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SECTION 01 11 00

SUMMARY OF WORK
08/15

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Utility Outage Requests

Utility Connection Requests

Excavation Permits

Burning Permits

1.2 WORK COVERED BY CONTRACT DOCUMENTS

1.2.1 Project Description :

Project # YZEU152020 – “Renovate Bathrooms Bldg 1020”. The work covered by this Statement of Work (SOW) consists of furnishing all plant, labor, tools, equipment, materials, accessories, and incidentals necessary to construct bathrooms in Bldg. 1020 as shown on the contract drawings and specifications.

Task List:

The work to be accomplished under this contract consists of furnishing all plant, labor, tools, equipment, materials, accessories, and incidentals necessary to perform the task list below (but not limited to) description and also shown on the contract drawings and specifications.

The objective of this project is to renovate a portion of an existing pre-engineered metal building to include restrooms and locker rooms.

Value Engineering Statement: *Contractors are encouraged to draw on their special 'know-how' and experience to propose changes that cut costs while maintaining or enhancing quality, value, and functional performance. You will be required to provide samples of any material(s) you propose as a better value substitute. Otherwise, the specific materials described in this document will be required.*

- See contract drawings and specifications for additional details:

Civil Work:

- Tie-in new building outlet to existing sanitary sewer.
- Repair trenching through existing concrete sidewalk and flexible paving.

Structural Work:

- Provide new metal c-channel columns and horizontal girt for new door opening in existing exterior wall.

Architectural Work:

- Interior demolition of CMU walls and washer/ dryer equipment.
- Exterior demolition of overhead sectional door and hollow metal doors and frames. Remove portion of exterior wall for new door opening.
- Infill exterior opening with masonry construction and provide new metal stud wall inside to insulate exterior walls. Infill interior opening with metal stud wall.

- Provide new interior metal stud partitions, acoustical grid ceilings, and gypsum board ceilings.
- Provide new wood and hollow metal doors, hollow metal frames, and door hardware.
- Provide new restroom and shower fixtures, accessories, toilet partitions, and built-in plastic laminate vanities with solid surface countertops.
- Provide solid plastic lockers and locker room benches.
- Provide interior finishes to include porcelain floor and wall tile, glass wall tile, sealed concrete, and paint.
- Provide interior signage.

Mechanical work:

- Remove existing exhaust hood.
- Provide new heat pump, ceiling concealed ducted horizontal high static air handling unit with wall-mounted wireless controller and exhaust fan.

Plumbing work:

- Provide new gas direct vent sealed combustion water heater and circulation pump.
- Provide new water distribution and sanitary piping.
- Provide new restroom and shower fixtures.

Electrical Work:

- Remove lights and electrical equipment in area of work; remove conduits and conductors back to point of supply.
- Provide new egress signage, lighting, receptacles, and fire alarm devices.
- Provide power for mechanical systems.

END OF SOW

1.2.2 Location

The work is located at the Oklahoma Air National Guard Base at Will Rogers World Airport, approximately as indicated. The exact location will be shown by the Contracting Officer.

1.3 CONTRACT DRAWINGS

Five sets of full size contract drawings, maps, and specifications will be furnished to the Contractor without charge. Reference publications will not be furnished. Immediately check furnished drawings and notify the Government of any discrepancies.

1.4 WORK RESCHEDULING

Normal duty hours for work are from 6:30 a.m. to 5:00 p.m., Monday through Thursday. Requests for additional work requires written approval from the Contracting Officer 7 days in advance of the proposed work period.

1.5 OCCUPANCY OF PREMISES

Building(s) will be occupied during performance of work under this Contract.

Before work is started, arrange with the Contracting Officer a sequence of procedure, means of access, space for storage of materials and equipment, and use of approaches, corridors, and stairways.

1.6 EXISTING WORK

In addition to "FAR 52.236-9, Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements":

a. Remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work which remain.

b. Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as approved by the Contracting Officer. At the completion of operations, existing work must be in a condition equal to or better than that which existed before new work started.

1.7 ON-SITE PERMITS

1.7.1 Utility Outage Requests and Utility Connection Requests

Schedule work to minimize outages. For utility outages and connections required during the execution of work that affect existing systems, schedule outside the regular working hours or on weekends, as approved by the Contracting Officer. Schedule utility outages and connections to minimize disruptions tothe Government. No additional payment will be provided for utility outages and connections required to be performed outside the regular work hours.

Submit requests for utility outages and connections in writing to the Contracting Officer for approval at least 7 calendar days in advance of the time required. In each request, state the system involved, area involved, approximate duration of outage, and the nature of work involved.

1.7.2 Borrow, Excavation, Welding, and Burning Permits

ACTIVITY	SUBMISSION DATE	SUBMISSION FORM
Burning Permits	prior to work each day	[[_____]]
Excavation Permits	7 calendar days prior to work	[[_____]]

Post permits at a conspicuous location in the construction area.

Burning of trash or rubbish is not permitted on project sit.

1.8 LOCATION OF UNDERGROUND UTILITIES

Obtain digging permits prior to start of excavation, and comply with Installation requirements for locating and marking underground utilities. Contact local utility locating service a minimum of 48 hours prior to excavating, to mark utilities, and within sufficient time required if work occurs on a Monday or after a Holiday. Verify existing utility locations indicated on contract drawings, within area of work.

Identify and mark all other utilities not managed and located by the local utility companies. Scan the construction site with Ground Penetrating Radar (GPR), electromagnetic, or sonic equipment, and mark the surface of the ground or paved surface where existing underground utilities are discovered. Verify the elevations of existing piping, utilities, and any type of underground obstruction not indicated, or specified to be removed, that is indicated or discovered during scanning, in locations to be traversed by piping, ducts, and other work to be conducted or installed. Verify elevations before installing new work closer than nearest manhole or other structure at which an adjustment in grade can be made.

1.8.1 Notification Prior to Excavation

Notify the Contracting Officer at least 15 days prior to starting excavation work.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

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SECTION 01 14 00

WORK RESTRICTIONS
11/11

PART 1 GENERAL

1.8 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

List of Contact Personnel; G

Personnel List; G

1.9 SPECIAL SCHEDULING REQUIREMENTS

1.9.1 The Contractor shall coordinate and submit a phasing plan for approval to the Base Contracting Officer before work is to start.

1.9.2 Have materials, equipment, and personnel required to perform the work at the site prior to the commencement of the work.

d. Permission to interrupt any Activity roads and/or utility service must be requested in writing a minimum of 7 calendar days prior to the desired date of interruption.

1.10 CONTRACTOR ACCESS AND USE OF PREMISES

• Activity Regulations

Ensure that Contractor personnel employed on the Activity become familiar with and obey Activity regulations including safety, fire, traffic and security regulations. Keep within the limits of the work and avenues of ingress and egress. Wear hard hats in designated areas. Do not enter any restricted areas unless required to do so and until cleared for such entry. Mark Contractor equipment for identification.

• Subcontractors and Personnel Contacts

Provide a list of contact personnel of the Contractor and subcontractors including addresses and telephone numbers for use in the event of an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

- Identification Badges and Installation Access Application

for and use of badges will be as directed and will be furnished wihtout charges if required. Obtain access to the installation by furnishing a list of a complete personnel list along with completed consent form with the person Name, SSN, Birthday and end of contract date. The form will allow Security to perform a background check in the NCIC/3 database. Immediately report instances of lost or stolen badges to the Contracting Officer.

- No Smoking Policy

Smoking is prohibited within and outside of all buildings on installation, except in designated smoking areas. This applies to existing buildings, buildings under construction and buildings under renovation. Discarding tobacco materials other than into designated tobacco receptacles is considered littering and is subject to fines. The Contracting Officer will identify designated smoking areas.

- Working Hours

Regular working hours shall be between 6:30 a.m. and 5:00 p.m., Monday through Thursday, excluding Government holidays.

- Work Outside Regular Hours

Work outside regular working hours requires Contracting Officer approval. Make application the Wednesday prior to such work to allow arrangements to be made by the Government for inspecting the work in progress, giving the specific dates, hours, location, type of work to be performed, contract number and project title. Based on the justification provided, the Contracting Officer may approve work outside regular hours. During periods of darkness, the different parts of the work must be lighted in a manner approved by the Contracting Officer. Make utility cutovers after normal working hours or on Fridays, Saturdays, Sundays, and Government holidays unless directed otherwise.

- Exclusionary Period

Contractor shall allow for a maximum of five calendar days where construction activity is prohibitive. Government will provide 24-hour notification in advance of restrictions. This period has not been considered in computing the time allowed for the performance of this contract.

- Occupied Building

The Contractor shall be working in an existing building which is partially occupied. Do not enter occupied areas without prior approval of the Contracting Officer.

The existing buildings and their contents must be kept secure at all times. Provide temporary closures as required to maintain security as directed by the Contracting Officer.

Provide dust covers or protective enclosures to protect existing work that remains and Government material located in the occupied areas of the building during the construction period.

Leave attached equipment in place, and protect it against damage, or temporarily disconnect, relocate, protect, and reinstall it at the completion of the work.

The Government will remove other Government property in the areas of the building scheduled to receive work.

- Utility Cutovers and Interruptions

1 Make utility cutovers and interruptions after normal working hours or on Saturdays, Sundays, and Government holidays. Conform to procedures required in the paragraph "Work Outside Regular Hours." Work shall be scheduled to hold outages to a minimum.

2 Ensure that new utility lines are complete, except for the connection, before interrupting existing service.

3 Interruption to water, sanitary sewer, storm sewer, telephone service, electric service, air conditioning, heating, fire alarm, and communications are considered utility cutovers pursuant to the paragraph entitled "Work Outside Regular Hours."

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

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SECTION 01 20 00.00 20 PRICE

AND PAYMENT PROCEDURES
11/11

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EP-1110-1-8	(2009) Construction Equipment Ownership and Operating Expense Schedule

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Schedule of Prices Report; G

1.3 Schedule of Prices REPORT

1.3.1 Data Required

This contract requires the use of a Schedule of Prices. The information required for the Schedule of Prices will be entered as an integral part of the Schedule. Within 20 calendar days of notice of award, prepare and deliver to the Contracting Officer an Schedule of Prices Report (construction contract) as directed by the Contracting Officer. Provide a detailed breakdown of the contract price, giving quantities for each of the various kinds of work. Costs shall be summarized and totals provided for each construction category.

1.3.2 Schedule Instructions

Payments will not be made until the Schedule of Prices Report from the cost-loaded Schedule has been submitted to and accepted by the Contracting Officer. Identify the cost for site work, and include incidental work to the 5 ft line. Identify costs for the building(s), and include work out to the 5 ft line. Work out to the 5 ft line shall include construction encompassed within a theoretical line 5 ft from the face of exterior walls and shall include attendant construction, such as pad mounted HVAC cooling equipment, cooling towers, and transformers placed beyond the 5 ft line.

1.3.3 Real Property Assets

The Government will provide the Draft DD Form 1354, Transfer and Acceptance of Military Real Property filled in with the appropriate Real Property Unique Identifiers (RPUID) and related construction Category Codes to summarize the designed real property assets that apply to this contract. The Contractor shall meet with the Contracting Officer and the Real Property Accounting Officer during the Pre Construction Meeting and the Project Closeout Meetings to modify and include any necessary changes to the DD Form 1354. The Contractor shall provide the Interim DD Form 1354 that uses the appropriate division of the RPUIDs/ Category Codes to represent the final constructed facility and include all associated cost. Coordinate the Contractor's Price and Payment structure with the structure of the RPUIDs/ Category Codes.

Divide detailed asset breakdown into the RPUIDs and related construction Category Codes and populate associated costs which represent all aspects of the work. Where assets diverge into multiple RPUID/ Category Codes, divide the asset and provide the proportion of the assets in each RPUID/ Category Code. Assets and related RPUID/ Category Codes may be modified by the Contracting Officer as necessary during course of the work. Coordinate identification and proportion of these assets with the Government Real Property Accounting Officer.

Cost data accumulated under this section are required in the preparation of DD Form 1354.

1.3.4 Schedule Requirements for HVAC TAB

The field work Section 23 05 93 TESTING, ADJUSTING AND BALANCING shall be broken down in the Schedule of Prices Report from the cost-loaded Schedule by separate line items which reflect measurable deliverables. Specific payment percentages for each line item shall be determined on a case by case basis for each contract. The line items shall be as follows:

a. Approval of Design Review Report: The TABS Agency is required to conduct a review of the project plans and specifications to identify any feature, or the lack thereof, that would preclude successful testing and balancing of the project HVAC systems. The resulting findings shall be submitted to the Government to allow correction of the design. The progress payment shall be issued after review and approval of the report.

b. Approval of the pre-field engineering report: The TABS Agency submits a report which outlines the scope of field work. The report shall contain details of what systems will be tested, procedures to be used, sample report forms for reporting test results and a quality control checklist of work items that must be completed before TABS field work commences.

c. Season I field work: Incremental payments are issued as the TABS field work progresses. The TABS Agency mobilizes to the project site and executes the field work as outlined in the pre-field engineering report. The HVAC water and air systems are balanced and operational data shall be collected for one seasonal condition (either summer or winter depending on project timing).

d. Approval of Season I report: On completion of the Season I field work, the data is compiled into a report and submitted to the Government. The report is reviewed, and approved, after ensuring compliance with the pre-field engineering report scope of work.

e. Completion of Season I field QA check: Contract QC and Government representatives meet the TABS Agency at the jobsite to retest portions of the systems reported in the Season I report. The purpose of these tests are to validate the accuracy and completeness of the previously submitted Season I report.

f. Approval of Season II report: The TABS Agency completes all Season II field work, which is normally comprised mainly of taking heat transfer temperature readings, in the season opposite of that under which Season I performance data was compiled. This data shall be compiled into a report and submitted to the Government. On completion of submittal review to ensure compliance with the pre-field engineering report scope, progress payment is issued. Progress payment is less than that issued for the Season I report since most of the water and air balancing work effort is completed under Season I.

1.4 CONTRACT MODIFICATIONS

In conjunction with the Contract Clause "DFARS 252.236-7000, Modification Proposals-Price Breakdown," and where actual ownership and operating costs of construction equipment cannot be determined from Contractor accounting records, equipment use rates shall be based upon the applicable provisions of the EP-1110-1-8.

1.5 CONTRACTOR'S INVOICE AND CONTRACT PERFORMANCE STATEMENT

1.5.1 Content of Invoice

Requests for payment will be processed in accordance with the Contract Clause FAR 52.232-27, Prompt Payment Construction Contracts and FAR 52.232-5, Payments Under Fixed-Price Construction Contracts. The requests for payment shall include the documents listed below.

a. The Contractor's invoice showing in summary form, the basis for arriving at the amount of the invoice. Invoice shall include certification by Quality Control (QC) Manager as required by the contract.

b. The Schedule of Prices Report from the cost-loaded Schedule, showing in detail: the estimated cost, percentage of completion, and value of completed performance.

c. Updated Project Schedule and reports required by the contract.

d. Contractor Safety Self Evaluation Checklist.

e. Other supporting documents as requested.

f. Updated copy of submittal register.

g. Invoices not completed in accordance with contract requirements will be returned to the Contractor for correction of the deficiencies.

1.5.2 Submission of Invoices

If NFAS Clause 5252.232-9301 is included in the contract, the documents

listed in paragraph "CONTENT OF INVOICE" shall be provided in their entirety as attachments in Wide Area Work Flow (WAWF) for each invoice submitted. The maximum size of each WAWF attachment is two megabytes, but there are no limits on the number of attachments. If a document cannot be attached in WAWF due to system or size restriction it shall be provided as instructed by the Contracting Officer.

1.5.3 Final Invoice

a. A final invoice shall be accompanied by the certification required by DFARS 252.247.7023 TRANSPORTATION OF SUPPLIES BY SEA, and the Contractor's Final Release. If the Contractor is incorporated, the Final Release shall contain the corporate seal. An officer of the corporation shall sign and the corporate secretary shall certify the Final Release.

Final invoices not accompanied by the Contractor's Final Release and required certification of Transportation of Supplies by Sea will be considered incomplete and will be returned to the Contractor.

1.6 PAYMENTS TO THE CONTRACTOR

Payments will be made on submission of itemized requests by the Contractor which comply with the requirements of this section, and will be subject to reduction for overpayments or increase for underpayments made on previous payments to the Contractor.

1.6.1 Obligation of Government Payments

The obligation of the Government to make payments required under the provisions of this contract will, at the discretion of the Contracting Officer, be subject to reductions and/or suspensions permitted under the FAR and agency regulations including the following in accordance with "FAR 32.503-6:

a. Reasonable deductions due to defects in material or workmanship;

b. Claims which the Government may have against the Contractor under or in connection with this contract;

c. Unless otherwise adjusted, repayment to the Government upon demand for overpayments made to the Contractor; and

d. Failure to provide up to date record drawings not current as stated in Contract Clause "FAC 5252.236-9310, Record Drawings."

1.6.2 Payment for Onsite and Offsite Materials

Progress payments may be made to the contractor for materials delivered on the site, for materials stored off construction sites, or materials that are in transit to the construction sites under the following conditions:

a. FAR 52.232-5(b) Payments Under Fixed Price Construction Contracts.

b. Materials delivered on the site but not installed, including completed preparatory work, and off-site materials to be considered for progress payment shall be major high cost, long lead, special order, or specialty items, not susceptible to deterioration or physical damage in storage or in transit to the construction site. Examples of materials acceptable for payment consideration include, but are not limited to, structural steel, non-magnetic steel, non-magnetic aggregate, equipment, machinery, large pipe and fittings, precast/ pre-stressed concrete products, plastic lumber (e.g., fender piles/curbs), and high-voltage electrical cable. Materials not acceptable for payment include consumable materials such as nails, fasteners, conduits, gypsum board, glass, insulation, and wall coverings.

c. Materials to be considered for progress payment prior to installation shall be specifically and separately identified in the Contractor's estimates of work submitted for the Contracting Officer's approval in accordance with Schedule of Prices Report requirement of this contract. Requests for progress payment consideration for such items shall be supported by documents establishing their value and that the title requirements of the clause at FAR 52.232-5 have been met.

d. Materials are adequately insured and protected from theft and exposure.

e. Provide a written consent from the surety company with each payment request for offsite materials.

f. Materials to be considered for progress payments prior to installation shall be stored either in Hawaii, Guam, Puerto Rico, or the Continental United States. Other locations are subject to written approval by the Contracting Officer.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

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SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS
08/15

PART 1 GENERAL

1.6 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

1.7 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1.5 MINIMUM INSURANCE REQUIREMENTS

Provide the minimum insurance coverage required by FAR 28.307-2 LIABILITY, during the entire period of performance under this contract. Provide other insurance coverage as required by Oklahoma State law.

1.7 SUPERVISION

1.7.1 Minimum Communication Requirements

Have at least one qualified superintendent, or competent alternate, capable of reading, writing, and conversing fluently in the English language, on the job-site at all times during the performance of contract work. In addition, if a Quality Control (QC) representative is required on the contract, then that individual must also have fluent English communication skills.

1.7.2 Superintendent Qualifications

The project superintendent must have a minimum of 10 years experience in construction with at least 5 of those years as a superintendent on projects similar in size and complexity. The individual must be familiar with the requirements of EM 385-1-1 and have experience in the areas of hazard identification and safety compliance. The individual must be capable of interpreting a critical path schedule and construction drawings.

The qualification requirements for the alternate superintendent are the same as for the project superintendent. The Contracting Officer may request proof of the superintendent's qualifications at any point in the project if the performance of the superintendent is in question.

1.7.2.1 Duties

The project superintendent is primarily responsible for managing and coordinating day-to-day production and schedule adherence on the project. The superintendent is required to attend partnering meetings, and quality control meetings. The superintendent or qualified alternative must be on-site at all times during the performance of this contract until the work is completed and accepted.

1.7.3 Non-Compliance Actions

The Project Superintendent is subject to removal by the Contracting Officer for non-compliance with requirements specified in the contract and for failure to manage the project to insure timely completion. Furthermore, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders is acceptable as the subject of claim for extension of time for excess costs or damages by the Contractor.

1.8 PRECONSTRUCTION

After award of the contract but prior to commencement of any work at the site, meet with the Contracting Officer to discuss and develop a mutual understanding relative to the administration of the value engineering and safety program, preparation of the schedule of prices or Schedule of Prices report, shop drawings, and other submittals, scheduling programming, prosecution of the work, and clear expectations of the "Interim DD Form 1354" Submittal. Major subcontractors who will engage in the work must also attend.

1.10 ELECTRONIC MAIL (E-MAIL) ADDRESS

Establish and maintain electronic mail (e-mail) capability along with the capability to open various electronic attachments as text files, pdf files, and other similar formats. Within 10 days after contract award, provide the Contracting Officer a single (only one) e-mail address for electronic communications from the Contracting Officer related to this contract including, but not limited to contract documents, invoice information, request for proposals, and other correspondence. The Contracting Officer may also use email to notify the Contractor of base access conditions when emergency conditions warrant, such as severe weather or terrorist threats. Multiple email addresses are not allowed.

It is the Contractor's responsibility to make timely distribution of all Contracting Officer initiated e-mail with its own organization including field office(s). Promptly notify the Contracting Officer, in writing, of any changes to this email address.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

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SECTION 01 33 00

SUBMITTAL PROCEDURES
05/11

PART 1 GENERAL

1.1 SUMMARY

The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections.

Units of weights and measures used on all submittals are to be the same as those used in the contract drawings.

Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

Contractor's Quality Control (CQC) System Manager and the Designer of Record, if applicable, to check and approve all items prior to submittal and stamp, sign, and date indicating action taken. Proposed deviations from the contract requirements are to be clearly identified. Include within submittals items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals.

Submittals requiring Government approval are to be scheduled and made prior to the acquisition of the material or equipment covered thereby. Pick up and dispose of samples not incorporated into the work in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

A submittal register showing items of equipment and materials for when submittals are required by the specifications is provided as "Appendix A - Submittal Register".

1.2 DEFINITIONS

1.2.1 Submittal Descriptions (SD)

Submittals requirements are specified in the technical sections. Submittals are identified by Submittal Description (SD) numbers and titles as follows:

SD-01 Preconstruction Submittals

Submittals which are required prior to start of construction (work). issuance of contract notice to proceed.or commencing work on site.or the start of the next major phase of the construction on a multi-phase contract, includes schedules, tabular list of data, or tabular list including location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.

Certificates of insurance

Surety bonds

List of proposed Subcontractors

List of proposed products

Construction progress schedule

Network Analysis Schedule (NAS)

Submittal register

Schedule of prices or Earned Value Report

Health and safety plan

Work plan

Quality Control(QC) plan

Environmental protection plan

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.

SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to a part of work.

Design submittals, design substantiation submittals and extensions of design submittals.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. Unless specified in another section, testing must have been within three years of date of contract award for the project.

Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports.

Daily logs and checklists.

Final acceptance test and operational test procedure.

SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier, installer or Subcontractor through Contractor. The document purpose is to further promote the orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.

Confined space entry permits.

Text of posted operating instructions.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and (MSDS)concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the

job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must be signed by an authorized official of a testing laboratory or agency and state the test results; and indicate whether the material, product, or system has passed or failed the test.

Factory test reports.

SD-10 Operation and Maintenance Data

Data that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel, including manufacturer's help and product line documentation necessary to maintain and install equipment. This data is needed by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

This data is intended to be incorporated in an operations and maintenance manual or control system.

SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

Submittals required for Guiding Principle Validation (GPV) or Third Party Certification (TPC).

Special requirements necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

1.2.2 Approving Authority

Office or designated person authorized to approve submittal.

1.2.3 Work

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce submittals, except those SD-01 Pre-Construction Submittals noted above, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with this section.

SD-01 Preconstruction Submittals

Submittal Register; G

1.4 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.4.1 Designer of Record Approved (DA)

Designer of Record (DOR) approval is required for extensions of design, critical materials, any deviations from the solicitation, the accepted proposal, or the completed design, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are considered to be "shop drawings." Contractor to provide the Government with the number of copies designated hereinafter of all DOR approved submittals. The Government may review any or all Designer of Record approved submittals for conformance to the Solicitation, Accepted Proposal and the completed design. The Government will review all submittals designated as deviating from the Solicitation or Accepted Proposal, as described below. Design submittals to be in accordance with Section 01 33 16 DESIGN AFTER AWARD. Generally, design submittals should be identified as SD-05 Design Data submittals.

1.4.2 Government Approved (G)

Government approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Government approval is required for any deviations from the Solicitation or Accepted Proposal and other items as designated by the Contracting Officer. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are considered to be "shop drawings."

1.4.3 Government Conformance Review of Design (CR)

The Government will review all intermediate and final design submittals for conformance with the technical requirements of the solicitation. Section 01 33 16 DESIGN AFTER AWARD covers the design submittal and review process in detail. Review will be only for conformance with the applicable codes, standards and contract requirements. Design data includes the design documents described in Section 01 33 16 DESIGN AFTER AWARD. Generally, design submittals should be identified as SD-05 Design Data submittals.

1.4.4 Designer of Record Approved/Government Conformance Review (DA/CR)

1.4.4.1 Deviations to the Accepted Design

Designer of Record approval and the Government's concurrence are required for any proposed deviation from the accepted design which still complies with the contract before the Contractor is authorized to proceed with material acquisition or installation. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are considered to be "shop drawings." If necessary to facilitate the project schedule, the Contractor and the DOR may discuss a submittal proposing a deviation with the Contracting Officer's Representative prior to officially submitting it to the Government. However, the Government reserves the right to review the submittal before providing an opinion, if deemed necessary. In any case, the Government will not formally agree to or provide a preliminary opinion on any deviation without the DOR's approval or recommended approval. The Government reserves the right to non-concur with any

deviation from the design, which may impact furniture, furnishings, equipment selections or operations decisions that were made, based on the reviewed and concurred design.

1.4.4.2 Substitutions

Unless prohibited or provided for otherwise elsewhere in the Contract, where the accepted contract proposal named products, systems, materials or equipment by manufacturer, brand name and/or by model number or other specific identification, and the Contractor desires to substitute manufacturer or model after award, submit a requested substitution for Government concurrence. Include substantiation, identifying information and the DOR's approval, as meeting the contract requirements and that it is equal in function, performance, quality and salient features to that in the accepted contract proposal. If the Contract otherwise prohibits substitutions of equal named products, systems, materials or equipment by manufacturer, brand name and/or by model number or other specific identification, the request is considered a "variation" to the contract. Variations are discussed below in paragraphs: "Designer of Record Approved/Government Approved" and "VARIATIONS."

1.4.5 Designer of Record Approved/Government Approved (DA/GA)

In addition to the above stated requirements for proposed deviations to the accepted design, both Designer of Record and Government Approval and, where applicable, a contract modification are required before the Contractor is authorized to proceed with material acquisition or installation for any proposed variation to the contract (the solicitation and/or the accepted proposal), which constitutes a change to the contract terms. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are considered to be "shop drawings." The Government reserves the right to accept or reject any such proposed deviation at its discretion.

1.4.6 For Information Only

Submittals not requiring Government approval will be for information only. For Design-build construction all submittals not requiring Designer of Record or Government approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

1.4.7 Sustainability Reporting Submittals (S)

Submittals for Guiding Principle Validation (GPV) or Third Party Certification (TPC) are indicated with an "S" designation. A full submittal for an item may be provided under another SD; however, for the "S" submittal, only provide that portion of the submittal that demonstrates compliance with the sustainable requirement. If the sustainable submittal does require Government Approval, it may be tagged under another SD with a "G."

Schedule submittals for these items throughout the course of construction as provided; do not wait until closeout.

1.5 FORWARDING SUBMITTALS REQUIRING GOVERNMENT APPROVAL

1.5.1 Submittals Required from the Contractor

As soon as practicable after award of contract, and before procurement of fabrication, forward to the Contrating Officer submittals required in the technical sections of this specification, including shop drawings, product data and samples. Forward one copy of the transmittal form for all submittals to the Resident Officer in Charge of Construction.

BCE will review and approve for the Contracting Officer those submittals reserved for Contracting Officer approval to verify submittals comply with the contract requirements.

1.5.1.1 O&M Data

The Architect-Engineer for this project BCE will review and approve for the Contracting Officer O&M Data to verify the submittals comply with the contract requirements; submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

In the event the Contractor fails to deliver O&M Data within the time limits specified, the Contracting Officer may withhold from progress payments 50 percent of the price of the item with which such O&M Data are applicable.

1.5.1.2 Overseas Shop Drawing Submittals

Send all submittals via overnight express mail service. All costs associated with the overnight express mail service shall be borne by the construction Contractor. Costs associated with the overnight express mail of submittals related to proposed submittal variances of resubmittals necessary as a result of noncompliant or incomplete Contractor submittals are the responsibility of the Contractor.

1.6 PREPARATION

1.6.1 Transmittal Form

Transmit each submittal, except sample installations and sample panels to office of approving authority. Transmit submittals with transmittal form prescribed by Contracting Administrator and standard for project. On the transmittal form identify Contractor, indicate date of submittal, and include information prescribed by transmittal form and required in paragraph IDENTIFYING SUBMITTALS of this section. Process transmittal forms to record actions regarding samples.

1.6.2 Identifying Submittals

When submittals are provided by a Subcontractor, the Prime Contractor is to prepare, review and stamp with Contractor's approval all specified submittals prior to submitting for Government approval.

Identify submittals, except sample installations and sample panels, with the following information permanently adhered to or noted on each separate component of each submittal and noted on transmittal form. Mark each copy of each submittal identically, with the following:

a. Project title and location.

b. Construction contract number.

c. Date of the drawings and revisions.

d. Name, address, and telephone number of subcontractor, supplier, manufacturer and any other subcontractor associated with the submittal.

e. Section number of the specification section by which submittal is required.

f. Submittal description (SD) number of each component of submittal.

g. When a resubmission, add alphabetic suffix on submittal description, for example, submittal 18 would become 18A, to indicate resubmission.

h. Product identification and location in project.

1.6.3 Format for SD-02 Shop Drawings

Shop drawings are not to be less than 8 1/2 by 11 inches nor more than 30 by 42 inches, except for full size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless other form is required. Drawings are to be suitable for reproduction and be of a quality to produce clear, distinct lines and letters with dark lines on a white background.

Present 8 1/2 by 11 inches sized shop drawings as part of the bound volume for submittals required by section. Present larger drawings in sets.

Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph IDENTIFYING SUBMITTALS.

Number drawings in a logical sequence. Contractors may use their own number system. Each drawing is to bear the number of the submittal in a uniform location adjacent to the title block. Place the Government contract number in the margin, immediately below the title block, for each drawing.

Dimension drawings, except diagrams and schematic drawings; prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

Include the nameplate data, size and capacity on drawings. Also include applicable federal, military, industry and technical society publication references.

Submit drawings PDF format.

1.6.4 Format of SD-03 Product Data and SD-08 Manufacturer's Instructions

Present product data submittals for each section as a complete, bound volume. Include table of contents, listing page and catalog item numbers for product data.

Indicate, by prominent notation, each product which is being submitted; indicate specification section number and paragraph number to which it pertains.

Supplement product data with material prepared for project to satisfy submittal requirements for which product data does not exist. Identify this material as developed specifically for project, with information and format as required for submission of SD-07 Certificates.

Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry and technical society publication references. Should manufacturer's data require supplemental information for clarification, submit as specified for SD-07 Certificates.

Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), and Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

Collect required data submittals for each specific material, product, unit of work, or system into a single submittal and marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically. Partial submittals will not be accepted for expedition of construction effort.

Submit manufacturer's instructions prior to installation.

1.6.5 Format of SD-04 Samples

Furnish samples in sizes below, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately same size as specified:

a. Sample of Equipment or Device: Full size.

b. Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.

c. Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.

d. Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.

e. Sample of Non-Solid Materials: Pint. Examples of non-solid materials are sand and paint.

f. Color Selection Samples: 2 by 4 inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.

g. Sample Panel: 4 by 4 feet.

h. Sample Installation: 100 square feet.

Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range. Mark each unit to describe its relation to the range of the variation.

Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples are to be in undamaged condition at time of use.

Recording of Sample Installation: Note and preserve the notation of area constituting sample installation but remove notation at final clean up of project.

When color, texture or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

1.6.6 Format of SD-05 Design Data and SD-07 Certificates

Provide design data and certificates on 8 1/2 by 11 inches paper. Provide a bound volume for submittals containing numerous pages.

1.6.7 Format of SD-06 Test Reports and SD-09 Manufacturer's Field Reports

Provide reports on 8 1/2 by 11 inches paper in a complete bound volume.

Indicate by prominent notation, each report in the submittal. Indicate specification number and paragraph number to which it pertains.

1.6.8 Format of SD-10 Operation and Maintenance Data (O&M)

Comply with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA for O&M Data format.

1.6.9 Format of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals

When submittal includes a document which is to be used in project or become part of project record, other than as a submittal, do not apply Contractor's approval stamp to document, but to a separate sheet accompanying document.

1.6.10 Source Drawings for Shop Drawings

The entire set of Source Drawing files (DWG) will not be provided to the Contractor. Only those requested by the Contractor to prepare shop drawings may be provided. Request the specific Drawing Number only for the preparation of Shop Drawings. These drawings may only be provided after award.

1.6.10.1 Terms and Conditions

Data contained on these electronic files must not be used for any purpose other than as a convenience in the preparation of construction data for the referenced project. Any other use or reuse shall be at the sole risk of the Contractor and without liability or legal exposure to the Government. The Contractor must make no claim and waives to the fullest extent

permitted by law, any claim or cause of action of any nature against the Government, its agents or sub consultants that may arise out of or in connection with the use of these electronic files. The Contractor must, to the fullest extent permitted by law, indemnify and hold the Government harmless against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

These electronic Source Drawing files are not construction documents. Differences may exist between the Source Drawing files and the corresponding construction documents. The Government makes no representation regarding the accuracy or completeness of the electronic Source Drawing files, nor does it make representation to the compatibility of these files with the Contractor hardware or software. In the event that a conflict arises between the signed and sealed construction documents prepared by the Government and the furnished Source Drawing files, the signed and sealed construction documents govern. The Contractor is responsible for determining if any conflict exists. Use of these Source Drawing files does not relieve the Contractor of duty to fully comply with the contract documents, including and without limitation, the need to check, confirm and coordinate the work of all contractors for the project. If the Contractor uses, duplicates or modifies these electronic Source Drawing files for use in producing construction data related to this contract, remove all previous indicia of ownership (seals, logos, signatures, initials and dates).

1.6.11 Electronic File Format

Provide submittals in electronic format, with the exception of material samples required for SD-04 Samples items. Compile the submittal file as a single, complete document, to include the Transmittal Form described within. Name the electronic submittal file specifically according to its contents, coordinate the file naming convention with the Contracting Officer. Electronic files must be of sufficient quality that all information is legible. Electronic format shall be in PDF, unless otherwise specified or directed by the Contracting Officer. Generate PDF files from original documents with bookmarks so that the text included in the PDF file is both searchable and can be copied. If documents are scanned, Optical Character Resolution (OCR) routines are required. Index and bookmark files exceeding 30 pages to allow efficient navigation of the file. When required, the electronic file must include a valid electronic signature, or scan of a signature.

Email electronic submittal documents fewer than 10MB to an email address as directed by the Contracting Officer. Provide electronic documents over 10MB on an optical disc, or through an electronic file sharing system such as the AMRDEC SAFE Web Application located at the following website: https://safe.amrdec.army.mil/safe/.

Provide hard copies of submittals when requested by the Contracting Officer. Up to 3 additional hard copies of any submittal may be requested at the discretion of the Contracting Officer, at no additional cost to the Government.

1.7 QUANTITY OF SUBMITTALS

1.7.1 Number of Copies of SD-02 Shop Drawings

Submit five copies of submittals of shop drawings requiring review and

approval only by QC organization and five copies of shop drawings requiring review and approval by Contracting Officer.

1.7.2 Number of Copies of SD-03 Product Data and SD-08 Manufacturer's Instructions

Submit in compliance with quantity requirements specified for shop drawings.

1.7.3 Number of Samples SD-04 Samples

a. Submit two samples, or two sets of samples showing range of variation, of each required item. One approved sample or set of samples will be retained by approving authority and one will be returned to Contractor.

b. Submit one sample panel or provide one sample installation where directed. Include components listed in technical section or as directed.

c. Submit one sample installation, where directed.

d. Submit one sample of non-solid materials.

1.7.4 Number of Copies SD-05 Design Data and SD-07 Certificates

Submit in compliance with quantity requirements specified for shop drawings.

1.7.5 Number of Copies SD-06 Test Reports and SD-09 Manufacturer's Field Reports

Submit in compliance with quantity and quality requirements specified for shop drawings other than field test results that will be submitted with QC reports.

1.7.6 Number of Copies of SD-10 Operation and Maintenance Data

Submit three copies of O&M Data to the Contracting Officer for review and approval.

1.7.7 Number of Copies of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals

Unless otherwise specified, submit three sets of administrative submittals.

1.8 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe. For design-build construction the Government will retain one cop y of information only submittals.

1.9 VARIATIONS

Variations from contract requirements require both Designer of Record (DOR) and Government approval pursuant to contract Clause FAR 52.236-21 and will be considered where advantageous to Government.

1.9.1 Considering Variations

Discussion with Contracting Officer prior to submission, after consulting with the DOR, will help ensure functional and quality requirements are met and minimize rejections and re-submittals. When contemplating a variation which results in lower cost, consider submission of the variation as a Value Engineering Change Proposal (VECP).

Specifically point out variations from contract requirements in transmittal letters. Failure to point out deviations may result in the Government requiring rejection and removal of such work at no additional cost to the Government.

1.9.2 Proposing Variations

When proposing variation, deliver written request to the Contracting Officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to Government, including the DOR's written analysis and approval. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

Check the column "variation" of ENG Form 4025 for submittals which include proposed deviations requested by the Contractor. Set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

1.9.3 Warranting that Variations are Compatible

When delivering a variation for approval, Contractor, including its Designer(s) of Record, warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.9.4 Review Schedule is Modified

In addition to normal submittal review period, a period of 10 working days will be allowed for consideration by the Government of submittals with variations.

1.10 SUBMITTAL REGISTER AND DATABASE

Prepare and maintain submittal register, as the work progresses. Use electronic submittal register program furnished by the Government or any other format. Do not change data which is output in columns (c), (d), (e), and (f) as delivered by Government; retain data which is output in columns (a), (g), (h), and (i) as approved. A submittal register showing items of equipment and materials for which submittals are required by the specifications is provided as an attachment. This list may not be all inclusive and additional submittals may be required. Maintain a submittal register for the project in accordance with Section 01 45 00.00 20 QUALITY

CONTROL (see RFP).

Column (c): Lists specification section in which submittal is required.

Column (d): Lists each submittal description (SD No. and type, e.g. SD-02 Shop Drawings) required in each specification section.

Column (e): Lists one principal paragraph in specification section where a material or product is specified. This listing is only to facilitate locating submitted requirements. Do not consider entries in column (e) as limiting project requirements.

Column (f): Indicate approving authority for each submittal.

The database and submittal management program will be furnished to Contractor on a Writable Compact Disk (CD-R), for operation on Windows based personal computer.

Thereafter, the Contractor is to track all submittals by maintaining a complete list, including completion of all data columns, including dates on which submittals are received and returned by the Government.

The Designer of Record develops a complete list of submittals during design and identify required submittals in the specifications, and use the list to prepare the Submittal Register. The list may not be all inclusive and additional submittals may be required by other parts of the contract. Complete the submittal register and submit it to the Contracting Officer for approval within 30 calendar days after Notice to Proceed. The approved submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the contract period. Coordinate the submit dates and need dates with dates in the Contractor prepared progress schedule. Submit monthly or until all submittals have been satisfactorily completed, updates to the submittal register showing the Contractor action codes and actual dates with Government action codes. Revise the submittal register when the progress schedule is revised and submit both for approval.

1.10.1 Use of Submittal Register

Submit submittal register as an electronic database, using submittals management program furnished to Contractor. Submit with QC plan and project schedule. Verify that all submittals required for project are listed and add missing submittals. Coordinate and complete the following fields on the register database submitted with the QC plan and the project schedule:

Column (a) Activity Number: Activity number from the project schedule.

Column (g) Contractor Submit Date: Scheduled date for approving authority to receive submittals.

Column (h) Contractor Approval Date: Date Contractor needs approval of submittal.

Column (i) Contractor Material: Date that Contractor needs material delivered to Contractor control.

1.10.2 Contractor Use of Submittal Register

Update the following fields with each submittal throughout contract.

Column (b) Transmittal Number: Contractor assigned list of consecutive numbers.

Column (j) Action Code (k): Date of action used to record Contractor's review when forwarding submittals to QC.

Column (l) List date of submittal transmission.

Column (q) List date approval received.

1.10.3 Approving Authority Use of Submittal Register

Update the following fields.

Column (b) Transmittal Number: Contractor assigned list of consecutive numbers.

Column (l) List date of submittal receipt.

Column (m) through (p) List Date related to review actions.

Column (q) List date returned to Contractor.

1.10.4 Action Codes

Entries for columns (j) and (o), are to be used are as follows (others may be prescribed by Transmittal Form):

1.10.4.1 Government Review Action Codes

"A" - "Approved as submitted"; "Completed"

"B" - "Approved, except as noted on drawings"; "Completed"

"C" - "Approved, except as noted on drawings; resubmission required"; "Resubmit"

"D" - "Returned by separate correspondence"; "Completed"

"E" - "Disapproved (See attached)"; "Resubmit"

"F" - "Receipt acknowledged"; "Completed"

"G" - "Other (Specify)"; "Resubmit"

"X" - "Receipt acknowledged, does not comply with contract requirements"; "Resubmit"

1.10.4.2 Contractor Action Codes

NR - Not Received

AN - Approved as noted

A - Approved

RR - Disapproved, Revise, and Resubmit

1.10.5 Copies Delivered to the Government

Deliver one copy of submittal register updated by Contractor to Government with each invoice request. Deliver in electronic format, unless a paper copy is requested by Contracting Officer.

1.11 SCHEDULING

Schedule and submit concurrently submittals covering component items forming a system or items that are interrelated. Include certifications to be submitted with the pertinent drawings at the same time. No delay damages or time extensions will be allowed for time lost in late submittals.

a. Coordinate scheduling, sequencing, preparing and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow for potential resubmittal of requirements.

b. Submittals called for by the contract documents will be listed on the register. If a submittal is called for but does not pertain to the contract work, the Contractor is to include the submittal in the register and annotate it "N/A" with a brief explanation. Approval by the Contracting Officer does not relieve the Contractor of supplying submittals required by the contract documents but which have been omitted from the register or marked "N/A."

c. Re-submit register and annotate monthly by the Contractor with actual submission and approval dates. When all items on the register have been fully approved, no further re-submittal is required.

d. Carefully control procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

e. Except as specified otherwise, allow review period, beginning with receipt by approving authority, that includes 20 working days for submittals for Contracting Officer approval. Period of review for submittals with Contracting Officer approval begins when Government receives submittal from QC organization.

f. For submittals requiring review by fire protection engineer, allow review period, beginning when Government receives submittal from QC organization, of 30 working days for return of submittal to the Contractor.

g. Period of review for each resubmittal is the same as for initial submittal.

At the Preconstruction conference, provide, for approval by the Contracting Officer, the following schedule of submittals:

a. A schedule of shop drawings and technical submittals required by the specifications and drawings. Indicate the specification or drawing reference requiring the submittal; the material, item, or process for which the submittal is required; the "SD" number and identifying title of the submittal; the Contractor's anticipated submission date and the approval need date.

b. A separate schedule of other submittals required under the contract but not listed in the specifications or drawings. Schedule will indicate the contract requirement reference; the type or title of the submittal; the Contractor's anticipated submission date and the approved need date (if approval is required).

1.11.1 Reviewing, Certifying, Approving Authority

The QC organization is responsible for reviewing and certifying that submittals are in compliance with contract requirements. Approving authority on submittals is QC Manager unless otherwise specified for specific submittal. At each "Submittal" paragraph in individual specification sections, a notation "G," following a submittal item, indicates Contracting Officer is approving authority for that submittal item. An "S" following a submittal item, indicates that the QC Manager is the approving authority, and that a copy of the approved submittal must be provided to the Designer of Record.

1.11.2 Constraints

Conform to provisions of this section, unless explicitly stated otherwise for submittals listed or specified in this contract.

Submit complete submittals for each definable feature of work. Submit at the same time components of definable feature interrelated as a system.

When acceptability of a submittal is dependent on conditions, items, or materials included in separate subsequent submittals, submittal will be returned without review.

Approval of a separate material, product, or component does not imply approval of assembly in which item functions.

1.11.3 QC Organization Responsibilities

a. Note date on which submittal was received from Contractor on each submittal.

b. Review each submittal; and check and coordinate each submittal with requirements of work and contract documents.

c. Review submittals for conformance with project design concepts and compliance with contract documents.

d. Act on submittals, determining appropriate action based on QC organization's review of submittal.

(1) When QC Manager is approving authority, take appropriate action on submittal from the possible actions defined in paragraph APPROVED SUBMITTALS.

(2) When Contracting Officer is approving authority or when variation has been proposed, forward submittal to Government with certifying statement or return submittal marked "not reviewed" or "revise and resubmit" as appropriate. The QC organization's review of submittal determines appropriate action.

e. Ensure that material is clearly legible.

f. Stamp each sheet of each submittal with QC certifying statement or approving statement, except that data submitted in bound volume or on one sheet printed on two sides may be stamped on the front of the first sheet only.

(1) When approving authority is Contracting Officer, QC organization will certify submittals forwarded to Contracting Officer with the following certifying statement:

"I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is that proposed to be incorporated with contract Number [_____], is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is submitted for Government approval.

Certified by Submittal Reviewer_____, Date _____
(Signature when applicable)

Certified by QC Manager_____, Date_____"
(Signature)

(2) When approving authority is QC Manager, QC Manager will use the following approval statement when returning submittals to Contractor as "Approved" or "Approved as Noted."

"I hereby certify that the (material) (equipment) (article) shown and marked in this submittal and proposed to be incorporated with contract Number [_____], is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is approved for use.

Certified by Submittal Reviewer_____, Date _____
(Signature when applicable)

Approved by QC Manager_____, Date_____"
(Signature)

g. Sign certifying statement or approval statement. The QC organization member designated in the approved QC plan is the person signing certifying statements. The use of original ink for signatures is required. Stamped signatures are not acceptable.

h. Update submittal register as submittal actions occur and maintain the submittal register at project site until final acceptance of all work by Contracting Officer.

i. Retain a copy of approved submittals at project site, including Contractor's copy of approved samples.

j. For "S" submittals, provide a copy of the approved submittal to the Designer of Record.

1.11.4 Government Reviewed Design

The Government will review design submittals for conformance with the technical requirements of the solicitation. Section 01 33 16 DESIGN AFTER AWARD covers the design submittal and review process in detail. Government review is required for deviation from the completed design. Review will be only for conformance with the contract requirements. Included are only

those construction submittals for which the Designer of Record design documents do not include enough detail to ascertain contract compliance. The Government may, but is not required, to review extensions of design such as structural steel or reinforcement shop drawings.

1.12 GOVERNMENT APPROVING AUTHORITY

When approving authority is Contracting Officer, the Government will:

a. Note date on which submittal was received from QC Manager.

b. Review submittals for approval within scheduling period specified and only for conformance with project design concepts and compliance with contract documents.

c. Identify returned submittals with one of the actions defined in paragraph REVIEW NOTATIONS and with markings appropriate for action indicated.

Upon completion of review of submittals requiring Government approval, stamp and date submittals. 1 copy of the submittal will be retained by the Contracting Officer and 1 copy of the submittal will be returned to the Contractor. If the Government performs a conformance review of other Designer of Record approved submittals, the submittals will be so identified and returned, as described above.

1.12.1 Review Notations

Contracting Officer review will be completed within 14 calendar days after date of submission. Submittals will be returned to the Contractor with the following notations:

a. Submittals marked "approved" or "accepted" authorize the Contractor to proceed with the work covered.

b. Submittals marked "approved as noted" "or approved, except as noted, resubmittal not required," authorize the Contractor to proceed with the work covered provided he takes no exception to the corrections.

c. Submittals marked "not approved" or "disapproved," or "revise and resubmit," indicate noncompliance with the contract requirements or design concept, or that submittal is incomplete. Resubmit with appropriate changes. No work shall proceed for this item until resubmittal is approved.

d. Submittals marked "not reviewed" will indicate submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.

1.13 DISAPPROVED OR REJECTED SUBMITTALS

Contractor shall make corrections required by the Contracting Officer. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications; notice as required under the Contract clause CHANGES, is to

be given to the Contracting Officer. Contractor is responsible for the dimensions and design of connection details and construction of work. Failure to point out deviations may result in the Government requiring rejection and removal of such work at the Contractor's expense.

If changes are necessary to submittals, make such revisions and submission of the submittals in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.14 APPROVED/ACCEPTED SUBMITTALS

The Contracting Officer's approval or acceptance of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing and other information are satisfactory. design, general method of construction, materials, detailing and other information appear to meet the Solicitation and Accepted Proposal.

Approval or acceptance will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work design, dimensions, all design extensions, such as the design of adequate connections and details, etc., and the satisfactory construction of all work.

After submittals have been approved or accepted by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.15 APPROVED SAMPLES

Approval of a sample is only for the characteristics or use named in such approval and is not be construed to change or modify any contract requirements. Before submitting samples, the Contractor to assure that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

Match the approved samples for materials and equipment incorporated in the work. If requested, approved samples, including those which may be damaged in testing, will be returned to the Contractor, at his expense, upon completion of the contract. Samples not approved will also be returned to the Contractor at its expense, if so requested.

Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make of that material. Government reserves the right to disapprove any material or equipment which previously has proved unsatisfactory in service.

Samples of various materials or equipment delivered on the site or in place may be taken by the Contracting Officer for testing. Samples failing to meet contract requirements will automatically void previous approvals. Contractor to replace such materials or equipment to meet contract requirements.

Approval of the Contractor's samples by the Contracting Officer does not

relieve the Contractor of his responsibilities under the contract.

1.16 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained. No payment for materials incorporated in the work will be made if all required Designer of Record or required Government approvals have not been obtained. No payment will be made for any materials incorporated into the work for any conformance review submittals or information only submittals found to contain errors or deviations from the Solicitation or Accepted Proposal.

1.17 PROGRESS SCHEDULE

1.17.1 Bar Chart

a. Submit the progress chart, for approval by the Contracting Officer, at the Preconstruction Conference in one reproducible and 4 copies.

b. Prepare the progress chart in the form of a bar chart utilizing form "Construction Progress Chart" or comparable format acceptable to the Contracting Officer.

c. Include no less than the following information on the progress chart:

(1) Break out by major headings for primary work activity.

(2) A line item break out under each major heading sufficient to track the progress of the work.

(3) A line item showing contract finalization task which includes punch list, clean-up and demolition, and final construction drawings.

(4) A materials bar and a separate labor bar for each line item. Both bars will show the scheduled percentage complete for any given date within the contract performance period. Labor bar will also show the number of men (man-load) expected to be working on any given date within the contract performance period.

(5) The estimated cost and percentage weight of total contract cost for each materials and labor bar on the chart.

(6) Separate line items for mobilization and drawing submittal and approval. (These items are to show no associated costs.)

d. Update the progress schedule in one reproduction and 4 copies every 30 calendar days throughout the contract performance period.

1.18 STATUS REPORT ON MATERIALS ORDERS

Within 14 calendar days after notice to proceed, submit, for approval by the Contracting Officer, an initial material status report on all materials orders. This report will be updated and re-submitted every 30 calendar days as the status on material orders changes.

Report to include list, in chronological order by need date, materials orders necessary for completion of the contract. The following information

will be required for each material order listed:

a. Material name, supplier, and invoice number.

b. Bar chart line item or CPM activity number affected by the order.

c. Delivery date needed to allow directly and indirectly related work to be completed within the contract performance period.

d. Current delivery date agreed on by supplier.

e. When item d exceeds item c, the effect that delayed delivery date will have on contract completion date.

f. When item d exceeds item c, a summary of efforts made by the Contractor to expedite the delayed delivery date to bring it in line with the needed delivery date, including efforts made to place the order (or subcontract) with other suppliers.

1.19 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements is to be similar to the following:

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
OANG - ASOS PARKING SHED

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)

SECTION 01 42 00

SOURCES FOR REFERENCE PUBLICATIONS
11/14

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization (e.g. ASTM B564 Standard Specification for Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided. Documents listed in the specifications with numbers which were not assigned by the standards producing organization should be ordered from the source by title rather than by number.

ALUMINUM ASSOCIATION (AA)
National Headquarters
1525 Wilson Boulevard, Suite 600
Arlington, VA 22209
Ph: 703-358-2960
E-Mail: info@aluminum.org
Internet: http://www.aluminum.org

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)
1827 Walden Office Square, Suite 550
Schaumburg, IL 60173-4268
Ph: 847-303-5664
Fax: 847-303-5774
E-mail: customerservice@aamanet.org
Internet: http://www.aamanet.org

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
444 North Capital Street, NW, Suite 249
Washington, DC 20001
Ph: 202-624-5800
Fax: 202-624-5806
E-Mail: info@aashto.org
Internet: http://www.aashto.org

AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)
38800 Country Club Drive
Farmington Hills, MI 48331-3439
Ph: 248-848-3700

Fax: 248-848-3701
E-mail: bkstore@concrete.org
Internet: http://www.concrete.org

AMERICAN HARDBOARD ASSOCIATION (AHA)
1210 West Northwest Highway
Palatine, IL 60067
Ph: 847-934-8800
Fax: 847-934-8803
E-mail: aha@hardboard.org
Internet: http://domensino.com/AHA/

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)
One East Wacker Drive, Suite 700
Chicago, IL 60601-1802
Ph: 312-670-2400
Fax: 312-670-5403
Bookstore: 800-644-2400
E-mail: aisc@ware-pak.com
Internet: http://www.aisc.org

AMERICAN IRON AND STEEL INSTITUTE (AISI)
25 Massachusetts Avenue, NW Suite 800
Washington, DC 20001
Ph: 202-452-7100
Internet: http://www.steel.org

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
1801 Alexander Bell Drive
Reston, VA 20191
Ph: 703-295-6300; 800-548-2723
E-mail: member@asce.org
Internet: http://www.asce.org

AMERICAN WATER WORKS ASSOCIATION (AWWA)
6666 West Quincy Avenue
Denver, CO 80235-3098
Ph: 303-794-7711
E-mail: distribution@awwa.org
Internet: http://www.awwa.org

AMERICAN WELDING SOCIETY (AWS)
13301 NW 47 Ave
Miami, FL 33054
Ph: 888-WELDING, 305-824-1177, 305-826-6192
Fax: 305-826-6195
E-mail: customer.service@awspubs.com
Internet: http://www.aws.org

ASTM INTERNATIONAL (ASTM)
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959
Ph: 877-909-2786
Internet: http://www.astm.org

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)
933 North Plum Grove Road
Schaumburg, IL 60173-4758

Ph: 847-517-1200
Fax: 847-517-1206
Internet: http://www.crsi.org/

GREEN SEAL (GS)
1001 Connecticut Avenue, NW
Suite 827
Washington, DC 20036-5525
Ph: 202-872-6400
Fax: 202-872-4324
Internet: http://www.greenseal.org

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
445 and 501 Hoes Lane
Piscataway, NJ 08854-4141
Ph: 732-981-0060 or 800-701-4333
Fax: 732-562-9667
E-mail: onlinesupport@ieee.org
Internet: http://www.ieee.org

INTERNATIONAL CODE COUNCIL (ICC)
500 New Jersey Avenue, NW
6th Floor, Washington, DC 20001
Ph: 800-786-4452 or 888-422-7233
E-mail: order@iccsafe.org
Internet: www.iccsafe.org

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)
3050 Old Centre Ave. Suite 102
Portage, MI 49024
Ph: 269-488-6382
Internet: http://www.netaworld.org

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)
1300 Sumner Avenue
Cleveland, OH 44115-2851
Ph: 216-241-7333
Fax: 216-241-0105
E-mail: mbma@mbma.com
Internet: http://www.mbma.com

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)
800 Roosevelt Road, Bldg C, Suite 312
Glen Ellyn, IL 60137
Ph: 630-942-6591
Fax: 630-790-3095
E-mail: wlewis7@cox.net(Wes Lewis,technical consultant)
Internet: http://www.naamm.org

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
1300 North 17th Street, Suite 900
Arlington, VA 22209
Ph: 703-841-3200
Internet: http://www.nema.org/

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
1 Batterymarch Park
Quincy, MA 02169-7471
Ph: 617-770-3000

Fax: 617-770-0700
Internet: http://www.nfpa.org

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)
100 Bureau Drive
Stop 1070
Gaithersburg, MD 20899-1070
Ph: 301-975-NIST (6478)
E-mail: inquiries@nist.gov
Internet: http://www.nist.gov

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)
10255 West Higgins Road, Suite 600
Rosemont, IL 60018-5607
Ph: 866-275-6722 (866-ASK-NRCA)
Fax: 847-299-1183
E-mail: info@nrca.net
Internet: http://www.nrca.net

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)
4201 Lafayette Center Drive
Chantilly, VA 20151-1219
Ph: 703-803-2980
Fax: 703-803-3732
Internet: http://www.smacna.org

SINGLE PLY ROOFING INDUSTRY (SPRI)
411 Waverley Oaks Road, Suite 331B
Waltham, MA 02452
Ph: 781-647-7026
Fax: 781-647-7222
E-mail: info@spri.org
Internet: http://www.spri.org

SOCIETY FOR PROTECTIVE COATINGS (SSPC)
40 24th Street, 6th Floor
Pittsburgh, PA 15222 Ph:
412-281-2331
Fax: 412-281-9992
E-mail: info@sspc.org
Internet: http://www.sspc.org

STEEL WINDOW INSTITUTE (SWI)
1300 Sumner Avenue
Cleveland, OH 44115-2851
Ph: 216-241-7333
Fax: 216-241-0105
E-mail: info@steelwindows.com
Internet: http://www.steelwindows.com

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)
1320 N. Courthouse Rd., Suite 200
Arlington, VA 22201
Ph: 703-907-7700
Fax: 703-907-7727
Internet: http://www.tiaonline.org

TURFGRASS PRODUCERS INTERNATIONAL (TPI)
2 East Main Street
East Dundee, IL 60118
Ph: 847-649-5555
Fax: 847-649-5678
E-mail: info@turfgrasssod.org
Internet: http://www.turfgrasssod.org

U.S. ARMY CORPS OF ENGINEERS (USACE)
CRD-C DOCUMENTS available on Internet:
http://www.wbdg.org/ccb/browse_cat.php?c=68
Order Other Documents from:
USACE Publications Depot
Attn: CEHEC-IM-PD
2803 52nd Avenue
Hyattsville, MD 20781-1102
Ph: 301-394-0081
Fax: 301-394-0084
E-mail: pubs-army@usace.army.mil
Internet: http://www.publications.usace.army.mil/
or
http://www.hnc.usace.army.mil/Missions/Engineering/TECHINFO.aspx

U.S. DEPARTMENT OF DEFENSE (DOD)
Order DOD Documents from:
Room 3A750-The Pentagon
1400 Defense Pentagon
Washington, DC 20301-1400
Ph: 703-571-3343
FAX: 215-697-1462
E-mail: customerservice@ntis.gov
Internet: http://www.ntis.gov
Obtain Military Specifications, Standards and Related Publications from:
Acquisition Streamlining and Standardization Information System (ASSIST)
Department of Defense Single Stock Point (DODSSP)
Document Automation and Production Service (DAPS)
Building 4/D
700 Robbins Avenue
Philadelphia, PA 19111-5094
Ph: 215-697-6396 - for account/password issues
Internet: http://assist.daps.dla.mil/online/start/; account registration required
Obtain Unified Facilities Criteria (UFC) from:
Whole Building Design Guide (WBDG)
National Institute of Building Sciences (NIBS)
1090 Vermont Avenue NW, Suite 700
Washington, CD 20005
Ph: 202-289-7800
Fax: 202-289-1092
Internet: http://www.wbdg.org/references/docs_refs.php

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, DC 20004
Ph: 202-272-0167
Internet: http://www2.epa.gov/libraries

--- Some EPA documents are available only from:
National Technical Information Service (NTIS)
5301 Shawnee Road
Alexandria, VA 22312
Ph: 703-605-6050 or 1-688-584-8332
Fax: 703-605-6900
E-mail: info@ntis.gov
Internet: http://www.ntis.gov

U.S. GENERAL SERVICES ADMINISTRATION (GSA)
General Services Administration
1275 First St. NE
Washington, DC 20417
Ph: 202-501-1231
Internet: http://www.gsaelibrary.gsa.gov/ElibMain/home.do
Obtain documents from:
Acquisition Streamlining and Standardization Information System (ASSIST)
Internet: https://assist.dla.mil/online/start/; account registration required

U. S. GREEN BUILDING COUNCIL (USGBC)
2101 L St NW, Suite 500
Washington, D.C. 20037
Ph: 800-795-1747
Internet: http://www.usgbc.org

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
8601 Adelphi Road
College Park, MD 20740-6001
Ph: 866-272-6272
Fax: 301-837-0483
Internet: http://www.archives.gov
Order documents from:
Superintendent of Documents
U.S.Government Printing Office (GPO)
710 North Capitol Street, NW
Washington, DC 20401
Ph: 202-512-1800
Fax: 202-512-2104
E-mail: contactcenter@gpo.gov
Internet: http://www.gpoaccess.gov

UNDERWRITERS LABORATORIES (UL)
2600 N.W. Lake Road
Camas, WA 98607-8542
Ph: 877-854-3577
E-mail: CEC.us@us.ul.com
Internet: http://www.ul.com/
UL Directories available through IHS at http://www.ihs.com

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

-- End of Section --

SECTION 01 78 00

CLOSEOUT SUBMITTALS
08/11

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E1971	(2005; R 2011) Stewardship for the Cleaning of Commercial and Institutional Buildings

GREEN SEAL (GS)

GS-37	(2012) Cleaning Products for Industrial and Institutional Use

U.S. ARMY CORPS OF ENGINEERS (USACE)

ERDC/ITL TR-12-1	(2012) CAD Drafting Standard
ERDC/ITL TR-12-6	(2012) A/E/C CAD Standard - Release 5.0

U.S. DEPARTMENT OF DEFENSE (DOD)

FC 1-300-09N	(2014) Navy and Marine Corps Design Procedures
UFC 1-300-08	(2009, with Change 2) Criteria for Transfer and Acceptance of DoD Real Property

1.2 DEFINITIONS

1.2.1 As-Built Drawings

As-built drawings are developed and maintained by the Contractor and depict actual conditions, including deviations from the Contract Documents. These deviations and additions may result from coordination required by, but not limited to: contract modifications; official responses to Contractor submitted Requests for Information; direction from the Contracting Officer; designs which are the responsibility of the Contractor, and differing site conditions. Maintain the as-builts throughout construction as red-lined hard copies on site. These files serve as the basis for the creation of the record drawings.

1.2.2 Record Drawings

The record drawings are the final compilation of actual conditions reflected in the as-built drawings.

1.3 SOURCE DRAWING FILES

Request the full set of electronic drawings, in the source format, for Record Drawing preparation, after award and at least 30 days prior to required use.

1.3.1 Terms and Conditions

Data contained on these electronic files must not be used for any purpose other than as a convenience in the preparation of construction drawings and data for the referenced project. Any other use or reuse shall be at the sole risk of the Contractor and without liability or legal exposure to the Government. The Contractor must make no claim and waives to the fullest extent permitted by law, any claim or cause of action of any nature against the Government, its agents or sub consultants that may arise out of or in connection with the use of these electronic files. The Contractor must, to the fullest extent permitted by law, indemnify and hold the Government harmless against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

These electronic CAD drawing files are not construction documents. Differences may exist between the CAD files and the corresponding construction documents. The Government makes no representation regarding the accuracy or completeness of the electronic CAD files, nor does it make representation to the compatibility of these files with the Contractor hardware or software. In the event that a conflict arises between the signed and sealed construction documents prepared by the Government and the furnished Source drawing files, the signed and sealed construction documents govern. The Contractor is responsible for determining if any conflict exists. Use of these Source Drawing files does not relieve the Contractor of duty to fully comply with the contract documents, including and without limitation, the need to check, confirm and coordinate the work of all contractors for the project. If the Contractor uses, duplicates or modifies these electronic source drawing files for use in producing construction drawings and data related to this contract, remove all previous indicia of ownership (seals, logos, signatures, initials and dates).

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.

SD-03 Product Data

Warranty Management Plan
Warranty Tags
Final Cleaning
Spare Parts Data

SD-08 Manufacturer's Instructions

Posted Instructions

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G

SD-11 Closeout Submittals

As-Built Drawings; G
Record Drawings; G
As-Built Record of Equipment and Materials
Final Approved Shop Drawings
Construction Contract Specifications
Certification of EPA Designated Items; G
Interim DD FORM 1354; G
Checklist for DD FORM 1354; G

1.5 SPARE PARTS DATA

Submit two copies of the Spare Parts Data list.

a. Indicate manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair. List those items that may be standard to the normal maintenance of the system.

1.6 WARRANTY MANAGEMENT

1.6.1 Warranty Management Plan

Develop a warranty management plan which contains information relevant to the clause Warranty of Construction. At least 30 days before the planned pre-warranty conference, submit one set of the warranty management plan. Include within the warranty management plan all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan must be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below must include due date and whether item has been submitted or was accomplished. Warranty information made available during the construction phase must be submitted to the Contracting Officer for approval prior to each monthly pay estimate. Assemble approved information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period will begin on the date of project acceptance and continue for the full product warranty period. A joint 4 month and 9 month warranty inspection will be conducted, measured from time of acceptance, by the Contractor, Contracting Officer and the Customer Representative. Include within the warranty management plan , but not limited to, the following:

a. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, subcontractors, manufacturers or suppliers involved.

b. Furnish with each warranty the name, address, and telephone number of each of the guarantor's representatives nearest to the project location.

c. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc.

d. A list for each warranted equipment, item, feature of construction or system indicating:

(1) Name of item.
(2) Model and serial numbers.
(3) Location where installed.
(4) Name and phone numbers of manufacturers or suppliers.
(5) Names, addresses and telephone numbers of sources of spare parts.
(6) Warranties and terms of warranty. Include one-year overall warranty of construction, including the starting date of warranty of construction. Items which have extended warranties must be indicated with separate warranty expiration dates.
(7) Cross-reference to warranty certificates as applicable.
(8) Starting point and duration of warranty period.
(9) Summary of maintenance procedures required to continue the warranty in force.
(10) Cross-reference to specific pertinent Operation and Maintenance manuals.
(11) Organization, names and phone numbers of persons to call for warranty service.
(12) Typical response time and repair time expected for various warranted equipment.

e. The plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.

f. Procedure and status of tagging of all equipment covered by extended warranties.

g. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

1.6.2 Performance Bond

The Performance Bond must remain effective throughout the construction period.

a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.

c. Following oral or written notification of required construction warranty repair work, respond in a timely manner. Written verification will follow oral instructions. Failure to respond will be cause for the Contracting Officer to proceed against the Contractor.

1.6.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section.

Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty will be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, be continuously available, and be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

1.6.4 Contractor's Response to Construction Warranty Service Requirements

Following oral or written notification by the Contracting Officer, respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. Submit a report on any warranty item that has been repaired during the warranty period. Include within the report the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframe specified, the Government will perform the work and back charge the construction warranty payment item established.

a. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

b. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

c. Third Priority Code 3. All other work to be initiated within 3 work days and work continuously to completion or relief.

d. The "Construction Warranty Service Priority List" is as follows:

Code 1-Doors
(1) Overhead doors not operational, causing a security, fire, or safety problem.
(2) Interior, exterior personnel doors or hardware, not functioning properly, causing a security, fire, or safety problem.

Code 3-Doors
(1) Overhead doors not operational.
(2) Interior/exterior personnel doors or hardware not functioning properly.

Code 1-Electrical
(1) Power failure (entire area or any building operational after 1600 hours).
(2) Security lights
(3) Smoke detectors

Code 2-Electrical
(1) Power failure (no power to a room or part of building).

(2) Receptacle and lights (in a room or part of building).

Code 3-Electrical
Street lights.

Code 1-Roof Leaks
Temporary repairs will be made where major damage to property is occurring.

Code 2-Roof Leaks
Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.

Code 3-All other work not listed above.

1.6.5 Warranty Tags

At the time of installation, tag each warranted item with a durable, oil and water resistant tag approved by the Contracting Officer. Attach each tag with a copper wire and spray with a silicone waterproof coating. Also, submit two record copies of the warranty tags showing the layout and design. The date of acceptance and the QC signature must remain blank until the project is accepted for beneficial occupancy. Show the following information on the tag.

Type of product/material	
Model number	
Serial number	
Contract number	
Warranty period from/to	
Inspector's signature	
Construction Contractor	
Address	
Telephone number	
Warranty contact	
Address	
Telephone number	
Warranty response time priority code	

WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.

PART 2 PRODUCTS

2.1 GOVERNMENT FURNISHED MATERIALS

The Government will provide an optical disc (CD or DVD) at the preconstruction conference that contains the following:

a. One set of "as-designed" electronic CAD files in the specified software and format revised to reflect all amendments and the final contract PDF drawings. The CAD files are provided to enable preparation of as-built or as-constructed drawings. If discrepancies exist between the CAD files and the contract PDF drawings, correct the CAD files to show the contract PDF drawings.

b. A submittal register data file in comma separated value (CSV) format for import into the Resident Management System (RMS).

2.2 SYSTEM DESCRIPTION

Prepare the CAD drawing files in AutoCAD Release 2013 format compatible with a Windows 7 operating system.

2.3 CERTIFICATION OF EPA DESIGNATED ITEMS

Submit the Certification of EPA Designated Items as required by FAR 52.223-9, "Certification and Estimate of Percentage of Recovered Material Content for EPA Designated Items". Include on the certification form the following information: project name, project number, Contractor name, license number, Contractor address, and certification. The certification will read as follows and be signed and dated by the Contractor. "I hereby certify the information provided herein is accurate and that the requisition/procurement of all materials listed on this form comply with current EPA standards for recycled/recovered materials content. The following exemptions may apply to the non-procurement of recycled/recovered content materials:

1) The product does not meet appropriate performance standards;
2) The product is not available within a reasonable time frame;
3) The product is not available competitively (from two or more sources);
4) The product is only available at an unreasonable price (compared with a comparable non-recycled content product)."

PART 3 EXECUTION

3.1 AS-BUILT DRAWINGS

Provide and maintain two black line print copies of the PDF contract drawings for As-Built Drawings. Provide and maintain As-Built Drawings in accordance with NFAS 5252.236-9310. Submit As-Built Drawings 30 days prior to Beneficial Occupancy Date(BOD).

3.1.1 Markup Guidelines

Make comments and markup the drawings complete without reference to letters, memos, or materials that are not part of the As-Built drawing. Show what was changed, how it was changed, where items(s) were relocated and change related details. These working as-built markup prints must be neat, legible and accurate as follows:

a. Use base colors of red, green, and blue. Color code for changes as follows:

(1) Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes.

(2) Deletions (Red) - Over-strike deleted graphic items (lines), lettering in notes and leaders.

(3) Additions (Green) - Added items, lettering in notes and leaders.

b. Provide a legend if colors other than the "base" colors of red, green, and blue are used.

c. Add and denote any additional equipment or material facilities, service lines, incorporated under As-Built Revisions if not already shown in legend.

d. Use frequent written explanations on markup drawings to describe changes. Do not totally rely on graphic means to convey the revision.

e. Use legible lettering and precise and clear digital values when marking prints. Clarify ambiguities concerning the nature and application of change involved.

f. Wherever a revision is made, also make changes to related section views, details, legend, profiles, plans and elevation views, schedules, notes and call out designations, and mark accordingly to avoid conflicting data on all other sheets.

g. For deletions, cross out all features, data and captions that relate to that revision.

h. For changes on small-scale drawings and in restricted areas, provide large-scale inserts, with leaders to the applicable location.

i. Indicate one of the following when attaching a print or sketch to a markup print:

1) Add an entire drawing to contract drawings

2) Change the contract drawing to show

3) Provided for reference only to further detail the initial design.

j. Incorporate all shop and fabrication drawings into the markup drawings.

3.1.2 As-Built Drawings Content

Revise As-Built Drawings in accordance with ERDC/ITL TR-12-1 and ERDC/ITL TR-12-6. Provide 2 sets of paper copies from PDF drawings to show the as-built conditions by red-line process during the execution of the project. Keep these working as-built markup drawings current on a weekly basis and at least one set available on the jobsite at all times. Changes

from the contract drawings which are made during construction or additional information which might be uncovered in the course of construction must be accurately and neatly recorded as they occur by means of details and notes. Submit the working as-built markup drawings for approval prior to submission of each monthly pay estimate. For failure to maintain the working and final record drawings as specified herein, the Contracting Officer will withhold 10 percent of the monthly progress payment until approval of updated drawings. Show on the as-built drawings, but not limited to, the following information:

a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show by offset dimensions to two permanently fixed surface features the end of each run including each change in direction on the record drawings. Locate valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Also record the average depth below the surface of each run.

b. The location and dimensions of any changes within the building structure.

c. Layout and schematic drawings of electrical circuits and piping.

d. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.

e. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to shop drawings, fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

f. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.

g. Changes or Revisions which result from the final inspection.

h. Where contract drawings or specifications present options, show only the option selected for construction on the working as-built markup drawings.

i. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, furnish a contour map of the final borrow pit/spoil area elevations.

j. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.

k. Changes in location of equipment and architectural features.

j. Modifications (include within change order price the cost to change working as-built markup drawings to reflect modifications) and compliance with FC 1-300-09N procedures.

l. Actual location of anchors, construction and control joints, etc., in concrete.

m. Unusual or uncharted obstructions that are encountered in the contract work area during construction.

n. Location, extent, thickness, and size of stone protection particularly where it will be normally submerged by water.

3.2 RECORD DRAWING FILES

If additional drawings are required, prepare them using the specified electronic file format applying the same graphic standards specified for original drawings. The title block and drawing border to be used for any new final record drawings must be identical to that used on the contract drawings. Accomplish additions and corrections to the contract drawings using CAD files. Provide all program files and hardware necessary to prepare final PDF record drawings. The Contracting Officer will review final PDF record drawings for accuracy and return them to the Contractor for required corrections, changes, additions, and deletions.

3.2.1 Rename the CAD Drawing files

Rename the CAD Drawing files using the contract number as the Project Code field,(e.g., W91238-15-C-10A-102.DWGDGN) as instructed in the Pre-Construction conference. Use only those renamed files for the Marked-up changes. Make all changes on the layer/level as the original item.

a. For AutoCAD files (DWG), enter all as-built delta changes and notations on the AS-BUILT layer.MicroStation files (DGN), enter all as-built delta changes and notations on:

- Level #63
- Level/Layer Name contains: ANNO-REVS
- Level/Layer Description: Revisions

c. When final revisions have been completed, show the wording "RECORD DRAWING AS-BUILTS" followed by the name of the Contractor in letters at least 3/16 inch high on the cover sheet drawing. Date RECORD DRAWING AS-BUILTS" drawing revisions in the revision block.

d. Within 1020 days after Government approval of all of the working record drawings for a phase of work, prepare the final CAD record drawings for that phase of work and submit PDF drawing files and two sets of prints for review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 710 days revise the CAD files accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 1020 days of substantial completion of all phases of work, submit the final record drawing package for the entire project. Submit one set of electronic CAD files, and one set of the approved working record PDF files on an optical disc with two sets of prints. The CAD files must be complete in all details and identical in form and function to the CAD drawing files supplied by the Government. Prepare AutoCAD files for transmittal using e-Transmit. Prepare MicroStation files for transmittal using the Packager (Archive). Make any transactions or adjustments necessary to accomplish this. The Government reserves the right to reject any drawing files it deems incompatible with the customer's CAD system. Paper prints, drawing files and storage media submitted will become the property of the

Government upon final approval. Failure to submit final record PDF drawing files, CAD files and marked prints as specified will be cause for withholding any payment due under this contract. Approval and acceptance of final record drawings must be accomplished before final payment is made.

3.3 RECORD DRAWINGS

Prepare and provide Record Drawings in accordance with FC 1-300-09N. Provide 2 copies of Record Drawings on two separate CDs or DVDs 30 days after BOD.

Prepare final record drawings after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (Foundations, Utilities, Structural Steel, etc., as appropriate for the project). Transfer the changes from the approved working as-built markup drawings to the original electronic CAD drawing files. Modify the as-built CAD drawing files to correctly show the features of the project as-built by bringing the working CAD drawing set into agreement with approved working as-built markup drawings, and adding such additional drawings as may be necessary. Refer to ERDC/ITL TR-12-1 Chapter 11 Drawing Revisions. Jointly review the working as-built markup drawings with printouts from working as-built CAD drawing PDF files for accuracy and completeness. Monthly review of working as-built CAD drawing PDF file printouts must cover all sheets revised since the previous review. These PDF drawing files are part of the permanent records of this project. Any drawings damaged or lost must be satisfactorily replaced at no expense to the Government.

a. Drawing revisions (include within change order price the cost to change working and final record drawings to reflect revisions) and compliance with the following procedures.

(1) Follow directions in the revision for posting descriptive changes.

(2) The revision delta size must be 5/16 inch unless the area where the delta is to be placed is crowded. Use a smaller size delta for crowded areas.

(3) Place a revision delta at the location of each deletion.

(4) For new details or sections which are added to a drawing, place a revision delta by the detail or section title.

(5) For minor changes, place a revision delta by the area changed on the drawing (each location).

(6) For major changes to a drawing, place a revision delta by the title of the affected plan, section, or detail at each location.

(7) For changes to schedules or drawings, place a revision delta either by the schedule heading or by the change in the schedule.

3.3.1 Final Record Drawing Package

Submit the final record PDF and CAD drawings package for the entire project within 20 days of substantial completion of all phases of work. Submit one set of ANSI D size PDF and CAD files on optical disc, read-only memory (ROM), two sets of ANSI D size prints and one set of the approved

working record drawings. The package must be complete in all details and identical in form and function to the contract drawing files supplied by the Government.

3.4 FINAL APPROVED SHOP DRAWINGS

Submit final approved project shop drawings 30 days after transfer of the completed facility.

3.5 CONSTRUCTION CONTRACT SPECIFICATIONS

Submit final PDF file record construction contract specifications, including revisions thereto, 30 days after transfer of the completed facility.

3.6 AS-BUILT RECORD OF EQUIPMENT AND MATERIALS

Furnish one copy of preliminary record of equipment and materials used on the project 15 days prior to final inspection. This preliminary submittal will be reviewed and returned 2 days after final inspection with Government comments. Submit Two sets of final record of equipment and materials 10 days after final inspection. Key the designations to the related area depicted on the contract drawings. List the following data:

RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA				
Description	Specification Section	Manufacturer and Catalog, Model, and Serial Number	Composition and Size	Where Used

3.7 OPERATION AND MAINTENANCE MANUALS

Provide project operation and maintenance manuals as specified in Section 01 78 23 OPERATION AND MAINTENANCE MANUALS DATA. Provide four electronic copies of the Operation and Maintenance Manual files and one hard copy of the Operation and Maintenance Manuals. Submit to the Contracting Officer for approval within 30 calendar days of the Beneficial Occupancy Date (BOD). Update and resubmit files for final approval at BOD.

3.8 CLEANUP

Provide final cleaning in accordance with ASTM E1971 and submit two copies of the listing of completed final clean-up items. Leave premises "broom clean." Comply with GS-37 for general purpose cleaning and bathroom cleaning. Use only nonhazardous cleaning materials, including natural cleaning materials, in the final cleanup. Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Clean debris from roofs, gutters, downspouts and drainage systems. Sweep paved areas. Remove waste and surplus materials, rubbish and construction

facilities from the site. Recycle, salvage, and return construction and demolition waste from project in accordance with Section 01 57 19.00 20 TEMPORARY ENVIRONMENTAL CONTROLS (see RFP), and 01 74 19 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT.

3.9 REAL PROPERTY RECORD

Near the completion of Project, but a minimum of 60 days prior to final acceptance of the work, complete, update draft DD FORM 1354 attached to this section, and submit an accounting of all installed property with Interim DD FORM 1354. Include any additional assets, improvements, and alterations from the Draft DD FORM 1354. Contact the Contracting Officer for any project specific information necessary to complete the DD FORM 1354. Refer to UFC 1-300-08 for instruction on completing the DD FORM 1354. For information purposes, a blank fillable PDF DD FORM 1354 may be obtained at the following:
http://www.dtic.mil/whs/directives/forms/eforms/dd1354.pdf

Submit the completed Checklist for DD FORM 1354 of Installed Building Equipment items. Attach this list to the updated DD FORM 1354.

-- End of Section --

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA
08/15

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E1971	(2005; R 2011) Stewardship for the Cleaning of Commercial and Institutional Buildings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-10 Operation and Maintenance Data

O&M Database ; G

Training Plan ; G

Training Outline ; G

Training Content ; G

1.3 OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) Data for the provided equipment, product, or system, defining the importance of system interactions, troubleshooting, and long-term preventive operation and maintenance. Compile, prepare, and aggregate O&M data to include clarifying and updating the original sequences of operation to as-built conditions. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01 33 00 SUBMITTAL PROCEDURES.

1.3.1 Package Quality

Documents must be fully legible. Operation and Maintenance data must be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions.

1.3.2 Package Content

Provide data package content in accordance with paragraph SCHEDULE OF

OPERATION AND MAINTENANCE DATA PACKAGES. Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission.

1.3.3 Changes to Submittals

Provide manufacturer-originated changes or revisions to submitted data if a component of an item is so affected subsequent to acceptance of the O&M Data. Submit changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data within 30 calendar days of the notification of this change requirement.

1.4 O&M DATABASE

Develop an editable, electronic spreadsheet based on the equipment in the Operation and Maintenance Manuals that contains the information required to start a preventive maintenance program. As a minimum, provide list of system equipment, location installed, warranty expiration date, manufacturer, model, and serial number.

1.5 OPERATION AND MAINTENANCE MANUAL FILE FORMAT

Assemble data packages into electronic Operation and Maintenance Manuals. Assemble each manual into a composite electronically indexed file using the most current version of Adobe Acrobat or similar software capable of producing PDF file format. Provide compact disks (CD) or data digital versatile disk (DVD) as appropriate, so that each one contains operation, maintenance and record files, project record documents, and training videos. Include a complete electronically linked operation and maintenance directory.

1.5.1 Organization

Bookmark Product and Drawing Information documents using the current version of CSI Masterformat numbering system, and arrange submittals using the specification sections as a structure. Use CSI Masterformat and UFGS numbers along with descriptive bookmarked titles that explain the content of the information that is being bookmarked.

1.5.2 CD or DVD Label and Disk Holder or Case

Provide the following information on the disk label and disk holder or case:

a. Building Number

b. Project Title

c. Activity and Location

d. Construction Contract Number

e. Prepared For: (Contracting Agency)

f. Prepared By: (Name, title, phone number and email address)

g. Include the disk content on the disk label

h. Date

i. Virus scanning program used

1.6 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

The following are a detailed description of the data package items listed in paragraph SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES.

1.6.1 Operating Instructions

Provide specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

1.6.1.1 Safety Precautions and Hazards

List personnel hazards and equipment or product safety precautions for operating conditions. List all residual hazards identified in the Activity Hazard Analysis provided under Section 01 35 26 GOVERNMENT SAFETY REQUIREMENTS (see RFP). Provide recommended safeguards for each identified hazard.

1.6.1.2 Operator Prestart

Provide procedures required to install, set up, and prepare each system for use.

1.6.1.3 Startup, Shutdown, and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

1.6.1.4 Normal Operations

Provide Control Diagrams with data to explain operation and control of systems and specific equipment. Provide narrative description of Normal Operating Procedures.

1.6.1.5 Emergency Operations

Provide Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Provide Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of utility systems including required valve positions, valve locations and zones or portions of systems controlled.

1.6.1.6 Operator Service Requirements

Provide instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gauge readings.

1.6.1.7 Environmental Conditions

Provide a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

1.6.1.8 Operating Log

Provide forms, sample logs, and instructions for maintaining necessary operating records.

1.6.2 Preventive Maintenance

Provide the following information for preventive and scheduled maintenance to minimize repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.6.2.1 Preventive Maintenance Plan, Schedule, and Procedures

Provide manufacturer's schedule for routine preventive maintenance, inspections, condition monitoring (predictive tests) and adjustments required to ensure proper and economical operation and to minimize repairs. Provide instructions stating when the systems should be retested. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

a. Define the anticipated time required to perform each of each test (work-hours), test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements within the schedule. Provide a remarks column for the testing validation procedure referencing operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Delineate procedures for preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize repairs.

b. Repair requirements must inform operators how to check out, troubleshoot, repair, and replace components of the system. Include electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of the system after acceptance.

1.6.2.2 Cleaning Recommendations

Provide environmentally preferable cleaning recommendations in accordance with ASTM E1971.

1.6.3 Repair

Provide manufacturer's recommended procedures and instructions for correcting problems and making repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.6.3.1 Wiring Diagrams and Control Diagrams

Provide point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number

electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

1.6.3.2 Repair Procedures

Provide instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

1.6.3.3 Removal and Replacement Instructions

Provide step-by-step procedures and a list of required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Use a combination of text and illustrations.

1.6.3.4 Spare Parts and Supply Lists

Provide lists of spare parts and supplies required for repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

1.6.3.5 Repair Work-Hours

Provide manufacturer's projection of repair work-hours including requirements by type of craft. Identify, and tabulate separately, repair that requires the equipment manufacturer to complete or to participate.

1.6.4 Real Property Equipment

Provide a list of installed equipment furnished under this contract. Include all information usually listed on manufacturer's name plate. In the "EQUIPMENT-IN-PLACE LIST" include, as applicable, the following for each piece of equipment installed: description of item, location (by room number), model number, serial number, capacity, name and address of manufacturer, name and address of equipment supplier, condition, spare parts list, manufacturer's catalog, and warranty. Submit the final list 30 days after transfer of the completed facility.

Key the designations to the related area depicted on the contract drawings. List the following data:

RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA				
Description	Specification Section	Manufacturer and Catalog, Model, and Serial Number	Composition and Size	Where Used
[_____]				

1.6.5 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

1.6.5.1 Product Submittal Data

Provide a copy of SD-03 Product Data submittals documented with the required approval.

1.6.5.2 Manufacturer's Instructions

Provide a copy of SD-08 Manufacturer's Instructions submittals documented with the required approval.

1.6.5.3 O&M Submittal Data

Provide a copy of SD-10 Operation and Maintenance Data submittals documented with the required approval.

1.6.5.4 Parts Identification

Provide identification and coverage for the parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing must show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Group the parts shown in the listings by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog.

1.6.5.5 Warranty Information

List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary componentsof the system. Provide copies of warranties required by Section 01 78 00 CLOSEOUT SUBMITTALS.

1.6.5.6 Extended Warranty Information

List all warranties for products, equipment, components, and sub-components whose duration exceeds one year. For each warranty listed, indicate the applicable specification section, duration, start date, end date, and the point of contact for warranty fulfillment. Also, list or reference the specific operation and maintenance procedures that must be performed to keep the warranty valid. Provide copies of warranties required by Section 01 78 00 CLOSEOUT SUBMITTALS.

1.6.5.7 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components. Provide final set points.

1.6.5.8 Testing and Performance Data

Include completed prefunctional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms. Provide final set points.

1.6.5.9 Field Test Reports

Provide a copy of Field Test Reports (SD-06) submittals documented with the required approval.

1.6.5.10 Contractor Information

Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

1.7 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Provide the O&M data packages specified in individual technical sections. The information required in each type of data package follows:

1.7.1 Data Package 1

a. Safety precautions and hazards

b. Cleaning recommendations

c. Maintenance and repair procedures

d. Warranty information

e. Extended warranty information

f. Contractor information

g. Spare parts and supply list

1.7.2 Data Package 2

a. Safety precautions and hazards

b. Normal operations

c. Environmental conditions

d. Lubrication data

e. Preventive maintenance plan, schedule, and procedures

f. Cleaning recommendations

g. Maintenance and repair procedures

h. Removal and replacement instructions

i. Spare parts and supply list

j. Parts identification

k. Warranty information

l. Extended warranty information

m. Contractor information

1.7.3 Data Package 3

a. Safety precautions and hazards

b. Operator prestart

c. Startup, shutdown, and post-shutdown procedures

d. Normal operations

e. Emergency operations

f. Environmental conditions

g. Operating log

h. Lubrication data

i. Preventive maintenance plan, schedule, and procedures

j. Cleaning recommendations

k. Troubleshooting guides and diagnostic techniques

l. Wiring diagrams and control diagrams

m. Maintenance and repair procedures

n. Removal and replacement instructions

o. Spare parts and supply list

p. Product submittal data

q. O&M submittal data

r. Parts identification

s. Warranty information

t. Extended warranty information

u. Testing equipment and special tool information

v. Testing and performance data

w. Contractor information

x. Field test reports

1.7.4 Data Package 4

a. Safety precautions and hazards

b. Operator prestart

c. Startup, shutdown, and post-shutdown procedures

d. Normal operations

e. Emergency operations

f. Operator service requirements

g. Environmental conditions

h. Operating log

i. Lubrication data

j. Preventive maintenance plan, schedule, and procedures

k. Cleaning recommendations

l. Troubleshooting guides and diagnostic techniques

m. Wiring diagrams and control diagrams

n. Repair procedures

o. Removal and replacement instructions

p. Spare parts and supply list

q. Repair work-hours

r. Product submittal data

s. O&M submittal data

t. Parts identification

u. Warranty information

v. Extended warranty information

w. Personnel training requirements

x. Testing equipment and special tool information

y. Testing and performance data

z. Contractor information

aa. Field test reports

1.7.5 Data Package 5

a. Safety precautions and hazards

b. Operator prestart

c. Start-up, shutdown, and post-shutdown procedures

d. Normal operations

e. Environmental conditions

f. Preventive maintenance plan, schedule, and procedures

g. Troubleshooting guides and diagnostic techniques

h. Wiring and control diagrams

i. Maintenance and repair procedures

j. Removal and replacement instructions

k. Spare parts and supply list

l. Product submittal data

m. Manufacturer's instructions

n. O&M submittal data

o. Parts identification

p. Testing equipment and special tool information

q. Warranty information

r. Extended warranty information

s. Testing and performance data

t. Contractor information

u. Field test reports

PART 2PRODUCTS

Not Used

PART 3 EXECUTION

3.1 TRAINING

Prior to acceptance of the facility by the Contracting Officer for Beneficial Occupancy, provide comprehensive training for the systems and equipment specified in the technical specifications. The training must be targeted for the building maintenance personnel, and applicable building occupants. Instructors must be well-versed in the particular systems that they are presenting. Address aspects of the Operation and Maintenance Manual submitted in accordance with Section 01 78 00 CLOSEOUT SUBMITTALS.

Training must include classroom or field lectures based on the system operating requirements. The location of classroom training requires approval by the Contracting Officer.

3.1.1 Training Plan

Submit a written training plan to the Contracting Officer for approval at least 60 calendar days prior to the scheduled training. Training plan must be approved by the Quality Control Manager (QC) prior to forwarding to the Contracting Officer. Also, coordinate the training schedule with the Contracting Officer. Include within the plan the following elements:

a. Equipment included in training

b. Intended audience

c. Location of training

d. Dates of training

e. Objectives

f. Outline of the information to be presented and subjects covered including description

g. Start and finish times and duration of training on each subject

h. Methods (e.g. classroom lecture, video, site walk-through, actual operational demonstrations, written handouts)

i. Instructor names and instructor qualifications for each subject

j. List of texts and other materials to be furnished by the Contractor that are required to support training

k. Description of proposed software to be used for video recording of training sessions.

3.1.2 Training Content

The core of this training must be based on manufacturer's recommendations and the operation and maintenance information. The QC is responsible for overseeing and approving the content and adequacy of the training. Spend 95 percent of the instruction time during the presentation on the OPERATION AND MAINTENANCE DATA. Include the following for each system training presentation:

a. Start-up, normal operation, shutdown, unoccupied operation, seasonal changeover, manual operation, controls set-up and programming, troubleshooting, and alarms.

b. Relevant health and safety issues.

c. Discussion of how the feature or system is environmentally responsive. Advise adjustments and optimizing methods for energy conservation.

d. Design intent.

e. Use of O&M Manual Files.

f. Review of control drawings and schematics.

g. Interactions with other systems.

h. Special maintenance and replacement sources.

i. Tenant interaction issues.

3.1.3 Training Outline

Provide the Operation and Maintenance Manual Files (Bookmarked PDF) and a written course outline listing the major and minor topics to be discussed by the instructor on each day of the course to each trainee in the course. Provide the course outline 14 calendar days prior to the training.

3.1.4 Unresolved Questions from Attendees

If, at the end of the training course, there are questions from attendees that remain unresolved, the instructor must send the answers, in writing, to the Contracting Officer for transmittal to the attendees, and the training video must be modified to include the appropriate clarifications.

-- End of Section --

SECTION 02050 - DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Utility lines, and other items to be demolished and/or abandoned are as shown.

1.2 SUBMITTALS

A. Quality Control Submittals:

1. Schedule of demolition, as part of and consistent with the progress schedule specified in Section 01310, PROGRESS/CRITICAL PATH SCHEDULES.

2. Copies of any authorizations and permits required to perform Work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 PREPARATION

A. Utilities:

1. Notify CONTRACTING OFFICER or appropriate utilities to turn off affected services before starting demolition or alterations.

2. Remove utility lines exposed by demolition excavation.

3. Remove electric, sanitary, water, and storm drainage adjacent to buildings to be demolished.

4. Excavate utility lines serving buildings to be demolished and provide a permanent leak-proof closure for water and gas lines.

3.2 DEMOLITION

A. Drawings define minimum required demolition. Unless otherwise shown, rough cuts or breaks may be made exceeding limits of demolition shown.

B. Core drill floor slabs, catch basins, and other concrete improvements to remain in place below ground, or break holes at structure's lowest point to allow water to freely migrate through.

C. Remove piping as shown and from any other areas that interfere with CONTRACTOR's work. Pipe, valves, and fittings adjacent to those to be removed may also be removed as salvage.

D. Cut off concealed or embedded conduit, boxes, or other materials a minimum of 6 inches below final finished surface.

E. Perform site cleanup daily before leaving the work site. Store equipment in a neat and orderly arrangement.

F. Abandonment of Buried Utility Piping Systems:

1. Plug pipelines at exposed excavations and at manholes or other utility structures with minimum 5-foot long concrete plug.

2. Manholes/wet wells/drainage structures:

a. Remove frames and covers/grates for salvage.

b. Remove structures shown on Drawings.

c. Backfill as described herein.

G. Demolition of utility poles, street signs and similar items:

1. Remove entire structure, including portions below ground.

2. Remove and separate items for salvage.

3. Backfill as described herein.

3.3 DISPOSAL

A. Dispose of debris and other nonsalvaged materials off base at location selected by CONTRACTOR.

3.4 BACKFILLING

A. Demolished Areas: Backfill to existing ground level or foundation level of new construction.

B. Backfill Material and Compaction:

1. Conform to Section 02220, FILL AND BACKFILL.

1. Do not use demolition debris as backfill material.

3.5 SALVAGE

A. Equipment and materials, including piping within the limits of demolition, unless otherwise specified, will become the property of the CONTRACTOR.

END OF SECTION

SECTION 02070 - SELECTIVE DEMOLITION

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section includes, but is not limited to, the following:

Demolition and removal of selected site elements including site pavements and slabs-on-grade.

Disconnecting, capping or sealing, and abandoning or removing existing site utilities.

Demolition and removal of dumpster screen walls, slab-on-grade footings, and associated elements.

Demolition and removal of fencing.

Relocation of existing site utilities, including light poles.

Demolition and removal of existing underground concrete rubble. Refer to Specification Section 02200.

Demolition and removal of other above and below grade improvements to accommodate new construction.

Demolition and removal of existing trench drain.

Patching and repairing.

Demolition and removal of curb and gutter.

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

Division 1 Section "Cutting and Repairing" for cutting and repairing procedures for selective demolition operations.
Division 2 Section "Site Clearing" for site clearing and removal of topsoil and vegetation.

Division 2 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.

Division 2 Section “Landscape Work” for relocation of trees.

DEFINITIONS

Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Government’s property.

Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition.

MATERIALS OWNERSHIP

Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Government’s property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option, unless otherwise indicated.

SUBMITTALS

Schedule indicating proposed sequence of operations for selective demolition work for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services as required.

Coordinate with adjacent facilities to permit continuing occupation of existing building and parking areas.

QUALITY ASSURANCE

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

JOB CONDITIONS

Occupancy: Conduct selective demolition work in manner that will minimize need for disruption of adjacent Government’s normal operations. Provide minimum of 72 hours advance notice to Contracting Officer’s Representative of demolition activities that will affect adjacent occupied facilities.

Condition of Structures: The Government assumes no responsibility for actual condition of items or structures to be demolished.

Conditions existing at time of inspection for bidding purposes will be maintained by Government insofar as practicable.

Partial Demolition and Removal: Items indicated to be removed but of salvageable value to Contractor may be removed as work progresses. Transport salvaged items from site as they are removed.

Storage or sale of removed items on site will not be permitted.

Protections: Provide temporary barricades and other forms of protection to protect from injury due to selective demolition work.

Conduct operations to prevent damage to adjacent buildings, structures, sidewalks, pavements, and other facilities and to prevent injury or damage to persons or property.

Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.

Remove protections at completion of work.

Damages: Promptly repair damages caused to adjacent facilities by demolition work.

Environmental Controls: Comply with governing regulations pertaining to environmental protection.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

EXAMINATION

Verify that utilities have been disconnected and capped.

Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

When unanticipated mechanical, electrical, or structural elements that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Architect.

UTILITY SERVICES

Maintain existing utilities to remain in service and protect them against damage during selective demolition operations.

Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Contracting Officer and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Government.

Provide not less than 72 hours' notice to Contracting Officer if shutdown of service is required during changeover.

Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services.

Where utility services are required to be removed, relocated, or abandoned, provide bypass connections to maintain continuity of service to other used or occupied buildings before proceeding with selective demolition.

PREPARATION

General: Provide interior and exterior shoring, bracing, or support to preserve stability and prevent movement, settlement, or collapse of areas to be demolished.

Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, acids, or other dangerous materials before proceeding with selective demolition operations.

Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Government. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective demolition area.

Erect temporary protection, such as walks and fences, as needed for protection.

Protect existing site improvements, appurtenances, and landscaping to remain.

DEMOLITION

General: Perform selective demolition work in a systematic manner. Use methods required to complete work within limitations of governing regulations and as follows:

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. To minimize disturbance of adjacent surfaces, use hand or small power tools designed for sawing or grinding, not hammering and chopping.

Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

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 portable fire-suppression devices during flame-cutting operations.

Maintain adequate ventilation when using cutting torches.

Remove decayed, vermin-infested, or unsuitable materials and promptly dispose of off-site.

Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.

Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.

Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain, using power-driven masonry saw or hand tools; do not use power-driven impact tools.

Break up and remove concrete slabs on grade, footings, and foundations, unless otherwise shown to remain.

Completely fill below-grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel, or sand, free of trash and debris, stones over 6 inches in diameter, roots, or other organic matter and thoroughly compact to specified criteria per Section 02200.

DISPOSAL OF DEMOLISHED MATERIALS

Remove from building site debris, rubbish, and other materials resulting from demolition operations, unless otherwise acceptable to Contracting Officer. Transport and legally dispose off site.

If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.
Burning of removed materials is not permitted on project site.

PATCHING AND REPAIRING

Promptly patch and repair damaged surfaces caused to adjacent construction by selective demolition operations.

Patching is specified in Division 1 Section "Cutting and Repairing."

Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

END OF SECTION 02070

SECTION 02080 – BASIC MATERIALS AND METHODS – PIPED UTILITIES

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Sleeves.
5. Identification devices.
6. Grout.
7. Piped utility demolition.
8. Equipment installation requirements common to equipment sections.
9. Concrete bases.
10. Metal supports and anchorages.

1.2 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

PART 2 – PRODUCTS

2.1 JOINING MATERIALS

A. Refer to individual Division 2 piping Sections for special joining materials not listed below.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

C. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

D. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

E. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

F. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

G. Brazing Filler Metals: AWS A5.8, BCuP Series, or BAg1, unless otherwise indicated.

H. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

I. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.

2. CPVC Piping: ASTM F 493.

3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

4. PVC to ABS Piping Transition: ASTM D 3138.

J. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

2.2 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solderjoint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig
(1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, fullface-or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035-or 2070-kPa) minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.3 SLEEVES

A. Mechanical sleeve seals for pipe penetrations are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

C. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

D. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.4 IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.

2. Location: Accessible and visible.

B Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

C. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressuresensitive vinyl type with permanent adhesive.

D. Plastic Duct Markers: Manufacturer's standard laminated plastic, in the following color codes:

1 Green: Cold-air supply.

2. Yellow: Hot-air supply.

3. Blue: Exhaust, outside, return, and mixed air.

4. Hazardous Material Exhausts: Use colors and designs recommended by ASME A13.1.

5. Terminology: Include direction of airflow; duct service such as supply, return, and exhaust; duct origin; duct destination; and design flow.

E. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils (0.08 mm) thick.

1 Width: 1-1/2 inches (40 mm) on pipes with OD, including insulation, less than 6 inches (150 mm); 2-1/2 inches (65 mm) for larger pipes.

2. Color: Comply with ASME A13.1, unless otherwise indicated.

F. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) sequenced numbers. Include 5/32-inch (4-mm) hole for fastener.

1 Material: 0.032-inch- (0.8-mm-) thick, polished brass or aluminum.

2. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

G. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resinlaminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.

2 Thickness: 1/16 inch (1.6 mm), for units up to 20 sq. in. (130 sq. cm) or 8 inches (200 mm) in length, and 1/8 inch (3 mm) for larger units.

3. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

H. Plastic Equipment Markers: Manufacturer's standard laminated plastic. Use colors and designs recommended by ASME A13.1.

1. Terminology: Match schedules as closely as possible. Include the following:

a. Name and plan number.

b Equipment service.

c. Design capacity.

d. Other design parameters such as pressure drop, entering and leaving conditions,

and speed.

2 Size: 2-1/2 by 4 inches (65 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.

2.5 GROUT

A Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

PART 3 – EXECUTION

3.1 PIPED UTILITY DEMOLITION

A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.

B. disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.

3. Equipment to Be Removed: Disconnect and cap services and remove equipment.

4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.

5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable,

remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 2 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

H. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

    a. PVC Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).

b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum board partitions.

K. Verify final equipment locations for roughing-in.

L. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 2 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.

3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

5. PVC Nonpressure Piping: Join according to ASTM D 2855.

6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.

2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.6 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Plastic markers, with application systems. Install on insulation segment if required for hot noninsulated piping.

2. Locate pipe markers on exposed piping according to the following:

a. Near each valve and control device.

b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.

c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.

d. At manholes and similar access points that permit view of concealed piping.

e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4 inch (6.4 mm) high for name of unit if viewing distance is less than 24 inches (610 mm), 1/2 inch (13 mm) high for distances up to 72 inches (1800 mm), and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.

2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.7 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.

3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.

6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

6. Use 3000-psi (20.7-Mpa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.7.1 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.8 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 02080

SECTION 02205 - EXCAVATION
PART 1 GENERAL

1.1 SUBMITTALS

A. Shop Drawings:

1. Excavation Plan, Detailing:

a. Methods and sequencing of excavation.

b. Proposed locations of stockpiled excavated material.

c. Proposed spoil disposal sites.

d. Anticipated difficulties and proposed resolutions.

1.2 QUALITY ASSURANCE

A. Provide adequate survey control to avoid unauthorized overexcavation.

1.3 WEATHER LIMITATIONS

A. Material excavated when frozen or when air temperature is less than 32 degrees F shall not be used as fill or backfill until material completely thaws.

B. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently for proper compaction.

1.4 SEQUENCING AND SCHEDULING

A. Demolition: Complete applicable Work specified in Section 02050, DEMOLITION, prior to excavating.

B. Clearing, Grubbing, and Stripping: Complete applicable Work specified in Section 02100, SITE PREPARATION, prior to excavating.

C. Dewatering: Conform to applicable requirements of Section 02140, DEWATERING, prior to initiating excavation.

PART 2 PRODUCTS (NOT USED) PART 3

EXECUTION

3.1 GENERAL

A. Excavate to lines, grades, and dimensions shown and as necessary to accomplish Work. Excavate to within tolerance of plus or minus 0.1-foot except where dimensions or grades are shown or specified as maximum or minimum. Allow for forms, working space, granular base, topsoil, and similar items, wherever applicable. Trim to neat lines where concrete is to be deposited against earth.

B. Overexcavation Beneath Finished Grade:

1. Column Footings: 2 feet below final grade, maximum.

2. Slab-on-Grade: 1 foot below final grade, maximum.

C. Backfill overexcavation as specified in Section 02220, FILL AND BACKFILL.

D. Remove or protect obstructions as shown and as specified in Section 01500, CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS, Article PROTECTION OF WORK AND PROPERTY.

3.2 UNCLASSIFIED EXCAVATION

A. Excavation is unclassified. Complete all excavation regardless of the type, nature, or condition of the materials encountered.

3.3 TRENCH WIDTH

A. Minimum Width of Trenches:

1. Single Pipes, Conduits, Direct-Buried Cables, and Duct Banks:

a. Less than 4-inch Outside Diameter or Width: 18 inches.

b. Greater than 4-inch Outside Diameter or Width: 18 inches greater than outside diameter or width of pipe, conduit, direct-buried cable, or duct bank.

2. Multiple Pipes, Conduits, Cables, or Duct Banks in Single Trench: 18 inches greater than aggregate width of pipes, conduits, cables, duct banks, plus space between.

3. Increase trench widths by thicknesses of sheeting.

B. Maximum Trench Width: Unlimited, unless otherwise shown or specified, or unless excess width will cause damage to existing facilities, adjacent property, or completed Work.

3.4 EMBANKMENT AND CUT SLOPES

A. Shape, trim, and finish cut slopes to conform with lines, grades, and cross-sections shown, with proper allowance for topsoil or slope protection, where shown.

B. Remove stones and rock that exceed 3-inch diameter and that are loose and may roll down slope. Remove exposed roots from cut slopes.

C. Round tops of cut slopes in soil to not less than a 6-foot radius, provided such rounding does not extend offsite or outside easements and right-of-ways, or adversely impacts existing facilities, adjacent property, or completed Work.

3.5 STOCKPILING EXCAVATED MATERIAL

A. Stockpile excavated material that is suitable for use as fill or backfill until material is needed.

B. Post signs indicating proposed use of material stockpiled. Post signs that are readable from all directions of approach to each stockpile. Signs should be clearly worded and readable by equipment operators from their normal seated position.

C. Confine stockpiles to within easements, rights-of-way, and approved work areas. Do not obstruct roads or streets.

D. Do not stockpile excavated material adjacent to trenches and other excavations unless excavation sideslopes and excavation support systems are designed, constructed, and maintained for stockpile loads.

E. Do not stockpile excavated materials near or over existing facilities, adjacent property, or completed Work, if weight of stockpiled material could induce excessive settlement.

3.6 DISPOSAL OF SPOIL

A. Dispose of excavated materials, which are unsuitable or exceed quantity needed for fill or backfill, off base.

B. Dispose of debris resulting from removal of underground facilities as specified in Section 02050, DEMOLITION, for demolition debris.

C. Dispose of debris resulting from removal of organic matter, trash, refuse, and junk as specified in Section 02100, SITE PREPARATION, for clearing and grubbing debris.

END OF SECTION

SECTION 02220 - FILL AND BACKFILL

PART 1 GENERAL

1.1 REFERENCES

A. The following is a list of standards which may be referenced in this section:

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

a. C117, Standard Test Method for Materials Finer Than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing.

b. C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

c. D75, Standard Practice for Sampling Aggregates.

d. D1557, Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-pound (4.54 kg) Rammer and 18-inch (457 mm) Drop.

e. D2922, Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods.

f. D4253, Standard Test Methods for Maximum Index Density of Soils Using a Vibratory Table.

g. D4254, Standard Test Methods for Minimum Index Density of Soils and Calculation of Relative Density.

1.2 DEFINITIONS

A. Relative Compaction:

1. Ratio, in percent, of as-compacted field dry density to laboratory maximum dry density as determined in accordance with ASTM D1557.

2. Apply corrections for oversize material to either as-compacted field dry density or maximum dry density, as determined by CONTRACTING OFFICER.

B. Optimum Moisture Content:

1. Determined in accordance with ASTM Standard specified to determine maximum dry density for relative compaction.

2. Determine field moisture content on basis of fraction passing 3/4-inch sieve.

B. Relative Density: Calculated in accordance with ASTM D4254 based on maximum index density determined in accordance with ASTM D4253 and minimum index density determined in accordance with ASTM D4254.

C. Prepared Ground Surface: Ground surface after completion of required demolition, clearing and grubbing, scalping of sod, stripping of topsoil, excavation to grade, and subgrade preparation.

D Completed Course: A course or layer that is ready for next layer or next phase of Work.

E. Lift: Loose (uncompacted) layer of material.

F. Geosynthetics: Geotextiles, geogrids, or geomembranes.

G. Well-Graded:

1. A mixture of particle sizes with no specific concentration or lack thereof of one or more sizes.

2. Does not define numerical value that must be placed on coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters.

3. Used to define material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

I. Influence Area: Area within planes sloped downward and outward at 60-degree angle from horizontal measured from:

1. 1-foot outside outermost edge at base of foundations or slabs.

2. 1-foot outside outermost edge at surface of roadways or shoulder.

3. 0.5-foot outside exterior at spring line of pipes or culverts.

J. Borrow Material: Material from required excavations.

K. Selected Backfill Material: Materials available onsite that CONTRACTING OFFICER determines to be suitable for specific use.

L. Imported Material: Materials obtained from sources off base, suitable for specified use.

M. Structural Fill: Fill materials as required under structures, pavements, and other facilities.

N. Embankment Material: Fill materials required to raise existing grade in areas other than under structures.

1.3 SUBMITTALS

A. Samples: Geotextile.

B. Quality Control Submittals:

1. Catalog and manufacturer's data sheets for compaction equipment.

2. Certified test results from independent testing agency.

1.4 QUALITY ASSURANCE

A. Notify CONTRACTING OFFICER when:

1. Structure or tank is ready for backfilling, and whenever backfilling operations are resumed after a period of inactivity.

2. Soft or loose subgrade materials are encountered wherever embankment or site fill is to be placed.

3. Fill material appears to be deviating from Specifications.

1.5 SEQUENCING AND SCHEDULING

A. Complete applicable Work specified in Sections 02050, DEMOLITION; 02100, SITE PREPARATION; 02205, EXCAVATION; and 02215, SUBGRADE PREPARATION, prior to placing fill or backfill.

B. Backfill against concrete structures only after concrete has attained compressive strength, specified in Section 03301, REINFORCED CONCRETE. Obtain CONTRACTING OFFICER's acceptance of concrete work and attained strength prior to placing backfill.

C. Do not place granular base, subbase, or surfacing until after subgrade has been prepared as specified in Section 02215, SUBGRADE PREPARATION.

PART 2 PRODUCTS

2.1 SOURCE QUALITY CONTROL

A. Gradation Tests:

1. As necessary to locate acceptable sources of imported material.

2. During production of imported material, test as follows:

   a. Granular Fill: 1 per 2,000 cubic yards, minimum 3.

   b. Sand: 1 per 2,000 cubic yards, minimum 3.

   c. Base Course: 1 per 2,000 cubic yards, minimum 3.

   d. Foundation Stabilization Rock: 1 per 2,000 cubic yards, minimum 3.

2.2 EARTHFILL

A. Excavated material from required excavations free from rocks larger than 3 inches, from roots and other organic matter, ashes, cinders, trash, debris, and other deleterious materials.

B. Provide imported material of equivalent quality, if required to accomplish Work.

2.3 GRANULAR FILL

A. 1-inch minus crushed gravel or crushed rock.

B. Free from dirt, clay balls, and organic material.

C. Well-Graded from coarse to fine and containing sufficient fines to bind material when compacted, but with maximum 8 percent by weight passing No. 2 sieve.

2.4 SAND

A. Free from clay, organic matter, or other deleterious material.

B. Gradation as determined in accordance with ASTM C117 and C136:

Sieve Size Percent Passing by Weight

1/4 inch 100

No. 4 95—100

No. 200 0—8

2.5 WATER FOR MOISTURE CONDITIONING

A. Free of hazardous or toxic contaminates, or contaminants deleterious to proper compaction.

2.6 BASE COURSE

A. As specified in Section 02236, BASE COURSES.

2.7 FOUNDATION STABILIZATION ROCK

A. Crushed rock or pit run rock.

B. Uniformly graded from coarse to fine.

C. Free from excessive dirt and other organic material.

D. Maximum 2-1/2 inches particle size.

2.8 GEOTEXTILE

A. As specified on the Plans.

PART 3 EXECUTION

3.1 GENERAL

A. Keep placement surfaces free of water, debris, and foreign material during placement and compaction of fill and backfill materials.

B. Place and spread fill and backfill materials in horizontal lifts of uniform thickness, in a manner that avoids segregation, and compact each lift to specified densities prior to placing succeeding lifts. Slope lifts only where necessary to conform to final grades or as necessary to keep placement surfaces drained of water.

C. During filling and backfilling, keep level of fill and backfill around each structure and buried tank even.

D. Do not place fill or backfill, if fill or backfill material is frozen, or if surface upon which fill or backfill is to be placed is frozen.

E. If pipe, conduit, duct bank, or cable is to be laid within fill or backfill:

1. Fill or backfill to an elevation 2 feet above top of item to be laid.

2. Excavate trench for installation of item.

3. Install bedding, if applicable, as specified in Section 02225, TRENCH BACKFILL.

3. Install item.

4. Backfill envelope zone and remaining trench, as specified in Section 02225,

TRENCH BACKFILL, before resuming filling or backfilling specified in this section.

F. Tolerances:

1. Final Lines and Grades: Within a tolerance of 0.1-foot unless dimensions or grades are shown or specified otherwise.

2. Grade to establish and maintain slopes and drainage as shown. Reverse slopes are not permitted.

G. Settlement: Correct and repair any subsequent damage to structures, pavements, curbs, slabs, piping, and other facilities, caused by settlement of fill or backfill material.

3.2 BACKFILL UNDER AND AROUND STRUCTURES

A. Under Facilities: Within influence area beneath structures, slabs, pavements, curbs, piping, conduits, duct banks, and other facilities, backfill with granular fill, unless otherwise shown. Place granular fill in lifts of 6-inch maximum thickness and compact each lift to minimum of 95 percent relative compaction as determined in accordance with ASTM D1557.

B. Other Areas: Backfill with granular fill to lines and grades shown, with proper allowance for topsoil thickness where shown. Place in lifts of 6-inch maximum thickness and compact each lift to minimum of 90 percent relative compaction as determined in accordance with ASTM D1557.

3.3 FILL

A. Outside Influence Areas Beneath Structures, Tanks, Pavements, Curbs, Slabs, Piping, and Other Facilities: Unless otherwise shown, place earthfill as follows:

1. Allow for 6-inch thickness of topsoil where required.

2. Maximum 8-inch thick lifts.

3. Place and compact fill across full width of embankment.

4. Compact to minimum 90 percent relative compaction as determined in accordance with ASTM D1557,

5. Dress completed embankment with allowance for topsoil, crest surfacing, and slope protection, where applicable.

6.

3.4 SITE TESTING

A. Gradation:

1. One sample from each 1,500 tons of finished product or more often as determined by CONTRACTING OFFICER, if variation in gradation is occurring, or if material appears to depart from Specifications.

2. If test results indicate material does not meet Specification requirements, terminate material placement until corrective measures are taken.

3. Remove material placed in Work that does not meet Specification requirements.

B. In-Place Density Tests: In accordance with ASTM D2922. During placement of materials, test as follows:

1. Granular Fill: 1 per acre, minimum 1 per lift.

2. Sand: 1 per acre, minimum 1 per lift.

3. Backfill Around Buried Tanks: Minimum 1 per lift.

4. Base Course: As specified in Section 02236, BASE COURSE.

3.5 REPLACING OVEREXCAVATED MATERIAL

A. Replace excavation carried below grade lines shown or established by CONTRACTING OFFICER as follows:

1. Beneath Footings: Granular fill.

2. Beneath Slabs-On-Grade: Granular fill.

3. Beneath Fill or Backfill: Same material as specified for overlying fill or backfill.

4. Trenches:

a. Unauthorized Overexcavation: Either trench stabilization material or granular pipe base material, as specified in Section 02225, TRENCH BACKFILL.

b. Authorized Overexcavation: Trench stabilization material, as specified in Section 02225, TRENCH BACKFILL.

4. Permanent Cut Slopes (Where Overlying Area is Not to Receive Fill or Backfill):

a. Flat to Moderate Steep Slopes (3:1, Horizontal Run:Vertical Rise or Flatter): Earthfill.

b. Steep Slopes (Steeper than 3:1):

1) Correct overexcavation by transitioning between overcut areas and designed slope adjoining areas, provided such cutting does not extend offsite or outside easements and right-of-ways, or adversely impacts existing facilities, adjacent property, or completed Work.

2) Backfilling overexcavated areas is prohibited unless, in CONTRACTING OFFICER's opinion, backfill will remain stable, and overexcavated material is replaced as compacted earth fill.

B. Place backfill for overexcavated areas in 6-inch loose lifts. Compact each lift to minimum of 95 percent relative compaction as determined in accordance with ASTM D1557.

3.6 GEOSYNTHETICS

A. Install in accordance with manufacturer's recommendations.

3.7 PLACING FILL OVER GEOSYNTHETICS

A. General:

1. Place fill over geosynthetics with sufficient care so as not to damage them.

2. Place fill by back dumping and spreading only.

3. Dump fill only on previously placed fill.

4. While operating equipment, avoid sharp turns, sudden starts or stops that could damage geosynthetics.

B. Hauling: Operate hauling equipment on minimum of 3 feet of fill.

C. Spreading:

1. Spreading equipment shall be track mounted, low ground pressure, D-6 or lighter.

2. Operate spreading equipment on minimum of 12 inches of fill over geosynthetics.

3. Spread fill in same direction as unseamed overlaps to avoid separation of seams and joints.

4. Never push fill downslope. Spread fill over sideslopes by pushing up from slope bottom. If access to bottom of slope is unavailable, progressively place fill, beginning at toe of slope and working upslope, with backhoe or dragline operated from top of slope. Limit distance material falls onto the geosynthetics to maximum of 2 feet.

5. Correct wrinkles in geotextiles in accordance with manufacturer's recommendations.
6. Maintain proper overlap of unseamed geosynthetics.

7. Avoid overstressing geosynthetics and seams.

D. Compaction: Compact fill only after uniformly spread to full thickness shown.

E. Geosynthetic Damage:

1. Mark punctures, tears, or other damage to geosynthetics, so repairs may be made.

2. Clear overlying fill as necessary to repair damage.

3. Repairs to geosynthetics shall be made by respective installers as specified in respective specification section for each geosynthetic.

END OF SECTION 02220

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

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

Division 2 Section "Exterior Portland Cement Concrete" for concrete paving and walks.

Division 2 Section “Exterior Portland Cement Concrete Pavement for Airfield Construction” for exterior apron and tow-way paving.

Division 2 Section "Auger Cast Piles” for auger cast piles.

Division 4 Section “Unit Masonry” for grout.

Division 9 Section “Reflective Chemically Resistant Urethane Floor Coating” for coating on Hangar Bay slab.

SUBMITTALS

General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, and others if requested by Architect.

Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams, and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures.

Samples of materials as requested by Contracting Officer, including names, sources, and descriptions.

Laboratory test reports for concrete materials and mix design test.

Material certificates in lieu of material laboratory test reports when permitted by Contracting Officer.

Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements.

QUALITY ASSURANCE

Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."

ACI 318, "Building Code Requirements for Reinforced Concrete."

Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."

Concrete Testing Service: Employ at Contractor's expense a testing agency acceptable to Contracting Officer to perform material evaluation tests and to design concrete mixes.

Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed Work, shall be done at Contractor's expense.

PROJECT CONDITIONS

Protection of Footings Against Freezing: Cover completed work at footing level with sufficient temporary or permanent cover as required to protect footings and adjacent subgrade against possibility of freezing, maintain cover for time period as necessary.

Protect adjacent finish materials against spatter during concrete placement.

PART 2 - PRODUCTS

FORM MATERIALS

Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints.

Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.
Forms for Exposed Columns and Supports: Metal or glass-fiber-reinforced plastic that will produce smooth surfaces without joint indications. Provide units with sufficient wall thickness to resist wet concrete loads without deformation.

Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 g/l

volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to the plane of the exposed concrete surface.

Provide ties that, when removed, will leave holes not larger than 1 inch in diameter in the concrete surface.

REINFORCING MATERIALS

Reinforcing Bars: ASTM A 615, Grade 60, deformed, including supplementary requirements S1. Refer to Structural Drawings.

Welded Wire Fabric: ASTM A 185, welded steel wire fabric.

Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.

For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

CONCRETE MATERIALS

Portland Cement: ASTM C 150, Type I or II.

Use one brand of cement throughout Project.

Fly Ash: Fly ash will not be permitted in concrete.

Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.

For exposed exterior surfaces, do not use fine or coarse aggregates that contain substances that cause spalling.

Aggregates shall be proportioned such that mix design shall contain a minimum of 50% coarse aggregates by gradation requirements set forth in ASTM C 33. Coarse aggregate shall meet No. 67 grading requirements.

Coarse aggregates shall pass the five-cycle magnesium sulphate accelerated soundness test with less than 18% loss.

Coarse aggregates shall have an absorption limit of 4% or less as determined by ASTM C127.

Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Architect.

Water: Potable.

Admixtures, General: Provide concrete admixtures that contain not more than 0.1 percent chloride ions. Concrete supplier shall certify that all admixtures, release agents, sealers and curing compounds are compatible with each other.

Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

Products: Subject to compliance with requirements, provide one of the following:

Darex AEA or Daravair, W.R. Grace & Co.
MB-VR, Master Builders, Inc.
Sika AER, Sika Corp.

Water-Reducing Admixture: ASTM C 494, Type A.

Products: Subject to compliance with requirements, provide one of the following:

WRDA Hycol, W.R. Grace & Co.
Pozzolith 344, Master Builders, Inc.
Plastocrete 161, Sika Corp.

High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.

Products: Subject to compliance with requirements, provide one of the following:

WRDA 19 or Daracem, W.R. Grace & Co.
Pozzolith 400, Master Builders, Inc.
Sikament 300 or Sikament 86, Sika Corp.

Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.

Products: Subject to compliance with requirements, provide one of the following:

Pozzolith 500, Master Builders, Inc.

Water-Reducing, Retarding Admixture: ASTM C 494, Type D.

Products: Subject to compliance with requirements, provide one of the following:

Daratard-17, W.R. Grace & Co.
Pozzolith 300, Master Builders, Inc.
Plastocrete 161 MR, Sika Corp.

RELATED MATERIALS

Reglets: Where sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 0.0217-inch-thick (26-gage) galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

Waterstops: Provide flat, dumbbell-type or centerbulb-type waterstops at construction joints and other joints as indicated. Size to suit joints.

Vapor Retarder: Provide vapor retarder that is resistant to deterioration when tested according to ASTM E 154, as follows:

Polyethylene sheet not less than 8 mils thick.

Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

Waterproof paper.

Polyethylene film.

Polyethylene-coated burlap.

Liquid Membrane-Forming Curing Compound: Liquid-type membrane-forming curing compound complying with ASTM C 309, Type I, Class A or B. Moisture loss not more than 0.55 kg/sq. meter when applied at 200 sq. ft./gal.

Products: Subject to compliance with requirements, provide one of the following:

RX Cure, Conspec Marketing & Mfg. Co.
Kurez Dre, Euclid Chemical Co.
L&M Cure R, L&M Construction Chemicals, Inc.

Underlayment Compound: Free-flowing, self-leveling, pumpable, cement-based compound for applications from 1 inch thick to feathered edges.

Products: Subject to compliance with requirements, provide one of the following:

Conflow, Conspec Marketing & Mfg. Co.

Level-Cure LCB, C-Cure Chemical Co., Inc.
Level-Cure SLU, C-Cure Chemical Co., Inc.
Thoro Underlayment Self-Leveling, Thoro System Products.

Bonding Agent: Polyvinyl acetate or acrylic base.

Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade, and class to suit Project requirements.

Products: Subject to compliance with requirements, provide one of the following:

Spec-Bond 100, Conspec Marketing & Mfg. Co.
Euco Epoxy System #452 or #620, Euclid Chemical Co.
Sikadur 32 Hi-Mod, Sika Corp.
Tyiopoxy, W.R. Grace.

Wear-Resistant Finish: Packaged dry combination of materials consisting of portland cement, silica quartz aggregate, and plasticizing admixture.

Products: Subject to compliance with requirements, provide one of the following.

Conshake 500, Conspec Marketing & Mfg. Co.

Expansion Joint Filler: Refer to Specification Section 07900.

Chemical Hardener: Colorless aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent, containing not less than 2 lbs. of fluosilicates per gal.

Products: Subject to compliance with requirements, provide one of the following:

Intraseal, Conspec Marketing & Mfg. Co.
Diamond Hard, Euclid Chemical Co.

PROPORTIONING AND DESIGNING MIXES

Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use an independent testing agency acceptable to Contracting Officer for preparing and reporting proposed mix designs.

Use of fly ash will not be permitted.

Submit written reports to Contracting Officer of each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Contracting Officer.

Design mixes to provide normal weight concrete with the following properties and as indicated on drawings and schedules:

Exterior Concrete: 4000-psi. Refer to Section 02520.

Interior Concrete: Refer to Structural Drawings and General Structural Notes.

Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

Ramps, slabs, and sloping surfaces: Not more than 4 inches.

Reinforced foundation systems: Not less than 3 inches and not more than 5 inches.

Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2-to-3-inch slump concrete.

Other concrete: Not less than 1 inch nor more than 4 inches.

Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work.

ADMIXTURES

Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:

Concrete structures and slabs exposed to freezing and thawing, deicer chemicals, or hydraulic pressure:

Minimum 4.0 percent, maximum 7.0 percent for 3/4-inch maximum aggregate.

Other concrete not exposed to freezing, thawing, or hydraulic pressure, or to receive a surface hardener: 2 to 4 percent air.

Use admixtures in strict compliance with manufacturer's directions.

CONCRETE MIXING

Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.

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

mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

GENERAL

Coordinate the installation of joint materials, vapor retarder, and other related materials with placement of forms and reinforcing steel.

Reinforcement shall be bundled and tagged with weatherproof tags, indicating location, size and length.

FORMS

General: Design, erect, support, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:

Provide Class A tolerances for concrete surfaces exposed to view.

Provide Class C tolerances for other concrete surfaces.

Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.

Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.

Provide temporary openings for clean-outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.

Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove

chips, wood, sawdust, dirt, or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

VAPOR RETARDER INSTALLATION

General: Place vapor retarder sheeting in position with longest dimension parallel with direction of pour.

Lap joints 6 inches and seal with manufacturer's recommended pressure-sensitive tape.

PLACING REINFORCEMENT

General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.

Avoiding cutting or puncturing vapor retarder during reinforcement placement and concreting operations. Repair damages before placing concrete.

Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

Install welded wire fabric in lengths as long as practicable. Overlap adjoining pieces a minimum of 2 wires plus 2” and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

Heating of reinforcement for bending or placement shall not be permitted. Welding or tack-welding of reinforcement shall not be permitted, unless specifically indicated.

JOINTS

Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Architect.
Provide keyways at least 1-1/2 inches deep in construction joints in walls and slabs and between walls and footings. Bulkheads designed and accepted for this purpose may be used for slabs.

Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise.

Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's printed instructions.

Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

Contraction (Control) Joints in Interior Slabs-on-Grade: Construct contraction joints in slabs-on-grade to form panels of patterns as shown and as directed. Use saw cuts 1/8 inch wide by one-fourth of slab depth or inserts 1/4 inch wide by one-fourth of slab depth, unless otherwise indicated.

Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate. Cutting shall be completed within 12 hours of placing concrete.

Location of control joints shall be reviewed and approved by Contracting Officer.

Joint fillers and sealants are specified in Division 7 Section "Joint Sealants."

Refer to Section 02520 for exterior joints in exterior pavement and walks.

INSTALLING EMBEDDED ITEMS

General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.

Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.

Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

PREPARING FORM SURFACES

General: Coat contact surfaces of forms with an approved, non-residual, low-VOC, form-coating compound before placing reinforcement.

Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.

Coat steel forms with a non-staining, rust-preventative material. Rust-stained steel formwork is not acceptable.

Clean forms of concrete matrix residue, repair and patch as required to return forms to an acceptable surface condition.

CONCRETE PLACEMENT

Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.

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

Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

Concrete shall not be subjected to a free fall exceeding 4' during any stage of transporting or placing; use tremies or trunks for any distance greater then 4'. Port holes may be used in lieu of above.

Avoid splashing of forms or reinforcing above the general level of the concrete which shall be maintained generally uniform with each pour becoming an integral part of the previous one.

Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.

Use square head mechanical vibrator or agitator for full compaction where practical; spade, settle or slightly shake reinforcing to insure flow of concrete around it.

Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate.

Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section.

Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.

Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

Maintain reinforcing in proper position during concrete placement.

Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.

Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.

Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Architect.

FINISHING FORMED SURFACES

Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to

concrete, such as waterproofing, dampproofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

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

MONOLITHIC SLAB FINISHES

Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified.

After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Finish surfaces to meet an overall tolerance of F(F) 30 (floor flatness) and F(L) 20 (floor levelness) and to meet a local tolerance of within any 500 square foot area F(F) 15 (floor flatness) and F (L) 10 (floor levelness) when measured in accordance with ASTM E1155.Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

Trowel Finish: Apply a trowel finish to monolithic slab surfaces exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or another thin film-finish coating system.

After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance. Finish surfaces to meet an overall tolerance of F (F) 20 (floor flatness) and F (L) 17 (floor levelness) and to meet a local tolerance within any 500 square foot area of F (F) 16 (floor flatness) and F (L) 10 (floor levelness) when measured in accordance with ASTM E1155. Grind smooth any surface defects that would telegraph through applied floor covering system.
Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom.

Non-slip Broom Finish: Apply a non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

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

Slab Flatness Testing: The Contractor shall employ an independent testing firm to measure the local tolerance in accordance with ASTM E-1155 for areas of no less than 500 square foot selected by the Contracting Officer.

If the above testing is out of tolerance, the Contracting Officer may require additional slab measurements as required to determine extent of defective slabs.

HANGAR BAY & CONCRETE SLAB TREATMENT

Apply liquid membrane forming curing compound per manufacturer's printed instructions, and compatible with reflective chemically resistant methane floor coating. Refer to Specification Section 09911.

EXPOSED CONCRETE SLAB TREATMENT

Where concrete is scheduled to receive no other finish, apply wear-resistant finish, chemical hardener finish and liquid membrane forming curing compound as follows:

Wear-Resistant Finish: Apply a wear-resistant finish to monolithic slab surface indicated.

Apply dry shake materials for the wear-resistant finish at a rate of 100 lb per 100 sq. ft., unless a greater amount is recommended by material manufacturer.

Cast a trial slab approximately 10 feet square to determine actual application rate, and finish, as acceptable to Architect.

Immediately following the first floating operation, uniformly distribute with mechanical spreader approximately two-thirds of the required weight of the dryshake material over the concrete surface, and embed by power floating. Follow floating operation with second shake application, uniformly distributing remainder of dry shake material with overlapping applications to ensure uniform color, and embed by power floating.

After broadcasting and floating, apply a trowel finish as specified.

Chemical-Hardener Finish: Apply proprietary chemical hardeners in accordance with manufacturer's printed instruction.

Liquid Membrane Forming Curing Compound: Apply liquid membrane forming curing compound and cure slab surfaces as recommended by Wear-Resistant and Chemical-Hardener Finish manufacturer.

Sequence and rate of application shall be per manufacturer's instructions.

MISCELLANEOUS CONCRETE ITEMS

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

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

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

CONCRETE CURING AND PROTECTION

General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing.

Curing Methods: Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.

Provide moisture curing by the following methods:

Keep concrete surface continuously wet by covering with water.

Use continuous water-fog spray.

Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4-inch lap over adjacent absorptive covers.

Provide moisture-retaining cover curing as follows:

Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

Apply curing compound on exposed interior slabs and on exterior slabs, walks, and curbs as follows:

Apply curing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping, and other flat surfaces, by applying the appropriate curing method.

Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

SHORES AND SUPPORTS

General: Comply with ACI 347 for shoring and reshoring.

Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to support work without excessive stress or deflection.

REMOVING FORMS

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

Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

Form-facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

All wood forms and supports shall be removed.

REUSING FORMS

Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Contracting Officer.

CONCRETE SURFACE REPAIRS

Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Contracting Officer.

Mix dry-pack mortar, consisting of one part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.

For surfaces exposed to view, blend white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

Repair concealed formed surfaces, where possible, containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.

Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.

Correct low areas in unformed surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Contracting Officer.

Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

Repair isolated random cracks and single holes 1 inch or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

Perform structural repairs with prior approval of Contracting Officer for method and procedure, using specified epoxy adhesive and mortar.

Repair methods not specified above may be used, subject to acceptance of Contracting Officer.

QUALITY CONTROL TESTING DURING CONSTRUCTION

General: The Contractor shall employ a testing agency to perform tests and to submit test reports.

Sampling and testing for quality control during concrete placement shall include the following:

Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

Air Content: ASTM C 173, volumetric method for light weight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.

Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.

Compression Test Specimen: ASTM C 31; one set of three standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for

laboratory-cured test specimens except when field-cured test specimens are required.

Compressive-Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd. of each concrete class placed in any one day; one specimen tested at 7 days, one specimen tested at 28 days, and one specimen retained in reserve for later testing if required.

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

Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.

Test results shall be reported in writing to Contracting Officer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

Additional Tests: The testing agency shall make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for all tests, including additional tests.

END OF SECTION 03300

SECTION 05120 - STRUCTURAL STEEL

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section includes structural steel.
Related Sections: The following Sections contain requirements that relate to this Section:

Division 5 Section "Steel Deck" for field installation of shear connections.

Division 5 Section "Metal Fabrications" for loose steel bearing plates, steel lintels, and miscellaneous steel framing.

REGULATIONS

All Work shall conform to applicable federal, state and city regulations.

All construction and furnishing of materials and equipment shall conform to OSHA regulations and requirements.

SUBMITTALS

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

Product Data for each type of product specified.

Shop Drawings detailing fabrication of structural steel components.

Include details of cuts, connections, splices, camber, holes, and other pertinent data.

Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.

Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted connections.

Include shop drawings signed and sealed by a qualified professional engineer responsible for their preparation.

Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.

Structural steel, including chemical and physical properties.

Bolts, nuts, and washers, including mechanical properties and chemical analysis.

Shear stud connectors.

Shop primers.

Non-shrink grout.

QUALITY ASSURANCE

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

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

Fabricator must participate in the AISC Quality Certification Program and also be designated an AISC Certified Plant as follows:

Category: Category II, complex steel building structure.

Comply with applicable provisions of the following specifications and documents:

AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."

AISC's "Specification for Allowable Stress Design of Single-Angle Members."

AISC's "Seismic Provisions for Structural Steel Buildings."

ASTM A 6 (ASTM A 6M) "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."

Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

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

Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel." For field welding operations, present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved within five years of Notice to Proceed.

Preinstallation Conference: Conduct conference at Project site

DELIVERY, STORAGE, AND HANDLING

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

Shipping Supports: All supports attached to structural steel members to provide support during shipping shall be of uniform size, installed securely, uniformly aligned, painted the same as specified for structural steel, and shall remain in place or shall be reviewed with Contracting Officer before removal.

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

Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.

Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

SEQUENCING

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

PART 2 - PRODUCTS

MATERIALS

Metal Surfaces, General: For fabrication of work that will be exposed to view, use only materials that are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and applying surface finishes.

Structural Steel Shapes, Plates, and Bars: As follows:

Carbon Steel: ASTM A 36.

High Strength Low-Alloy: ASTM A572 Grade 50 as indicated on plans.

Cold-Formed Structural Steel Tubing: ASTM A 500, Grade B, minimum 46,000 psi yield strength.

Steel Pipe: ASTM A 53, Grade B, minimum 35,000 psi yield strength.
Shear Connectors: ASTM A 108,Grade 1015 through 1020, headed stud type, cold finished carbon steel, AWS D1.1, Type B.

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

Unheaded Rods: ASTM A 36.

Headed Bolts: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); carbon-steel, hex-head bolts; and carbon-steel nuts.

Washers: ASTM A 36.
High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.
Finish: Plain, uncoated.

Welding Electrodes: Comply with AWS requirements.

E70XX electrodes shall be used for all welding.

Direct Tension Indicating Washers: ASTM F959 - 94 as indicated on plans.

PRIMER
Primer: SSPC-Paint 11, 13 or 25; red iron oxide, zinc oxide, raw linseed oil and alkyd primer.
GROUT
Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application, and a 30-minute working time.

FABRICATION

Design of Members and Connections: Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site.

Promptly notify Architect whenever design of members and connections for any portion of structure are not clearly indicated.

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

Camber structural steel members where indicated.

Mark and match-mark materials for field assembly.

Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.

Complete structural steel assemblies, including welding of units, before starting shop-priming operations.

Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

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

Plane thermally cut edges to be welded.

Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.

Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic and welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's printed instructions.

Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.

Reinforce openings as indicated on drawings.

Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.

Weld threaded nuts to framing and other specialty items as indicated to receive other work.

SHOP CONNECTIONS

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

Bolts: ASTM A 325 (ASTM A 325M) high-strength bolts, unless otherwise indicated.

Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.

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

Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.

SHOP PRIMING

Shop prime steel surfaces, except the following:

Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.

Surfaces to be field welded.

Galvanized surfaces.

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

SSPC-SP 3 "Power Tool Cleaning" and SSPC-SP2 "Hand Tool Cleaning" for surfaces not accessible to power tools.

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

Stripe paint corners, crevices, bolts, welds, and sharp edges.

Apply 2 coats of shop paint to inaccessible surfaces after assembly or erection.

SOURCE QUALITY CONTROL

Fabricator shall perform shop inspections and tests and shall prepare test reports.

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

Additional testing, at fabricator's expense, shall be performed to determine compliance of corrected Work with specified requirements.

Shop-bolted connections shall be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
In addition to visual inspection, shop-welded connections shall be inspected and tested by an independent certified testing agency according to AWS D1.1 and the inspection procedures listed below:

Ultrasonic Inspection: ASTM E 164. 100% of full penetration welds.

Liquid Penetrant Inspection: ASTM E168. 100% of fillet welds of truss members.

PART 3 - EXECUTION

EXAMINATION

Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry

bearing surfaces and locations of anchorages for compliance with requirements.

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

PREPARATION

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

ERECTION

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

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

Set base and bearing plates for structural members on wedges, shims, or other adjusting devices as required.

Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.

Comply with manufacturer's instructions for proprietary grout materials.

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

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

Level and plumb individual members of structure.

Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

Splice members only where shown on Structural Drawings or shown and approved on shop drawings.

Do not use thermal cutting during erection without prior approval by Architect/Engineer.

Finish sections thermally cut during erection equal to a sheared appearance.

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

FIELD CONNECTIONS

Install and tighten non-high-strength anchor bolts.

All bolts set in concrete shall be furnished with double nuts and set with template.

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

Bolts: ASTM A 325 (ASTM A 325M) high-strength bolts, unless otherwise indicated.
Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.

FIELD QUALITY CONTROL
Contractor shall engage an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports.

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

Testing agency shall report test results promptly in writing to Contractor, Architect, and Contracting Officer.

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

Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
Field-bolted connections shall be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
No less than 10% of bolted connections, nor less than two bolts selected at random in each bolted connection, shall be proof tested with an inspecting torque wrench.

In addition to visual inspection, field-welded connections shall be inspected and tested according to AWS D1.1 and the inspection procedures listed below:
Liquid Penetrant Inspection: ASTM E 165. 3% of total welds randomly selected by testing

agency. Additionally test 100% of fillet welds of truss members.

Ultrasonic Inspection: ASTM E 164. 100% of full penetration welds.

CLEANING

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

Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils.

END OF SECTION 05120

SECTION 06100 - ROUGH CARPENTRY

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Division 1 Specification Sections, apply to work of this Section.

SUMMARY

This Section includes the following:

Miscellaneous curbs.

Wood grounds, nailers and blocking.

Plywood panels.

DEFINITIONS

Rough carpentry includes carpentry work not specified as part of other Sections and which is generally not exposed, except as otherwise indicated.

SUBMITTALS

Wood Treatment Data: Submit chemical treatment manufacturer's instructions for handling, storing, installation and finishing of treated material.

Preservative Treatment: For each type specified, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained and conformance with applicable standards.

For water-borne treatment include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to project site.

For fire-retardant-treatment include certification by treating plant that treated material complies with specified standards and other requirements.

PRODUCT HANDLING

Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar

materials.

PROJECT CONDITIONS

Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow attachment of other work.

PART 2 - PRODUCTS

LUMBER, GENERAL

Lumber Standards: Manufacture lumber to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

Grade Stamps: Factory-mark each piece of lumber with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing and mill.

Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.

Provide dressed lumber, S4S, unless otherwise indicated.

Provide kiln-dried lumber with 15 percent (15%) maximum moisture content at time of dressing and shipment for sizes 2" or less in nominal thickness, unless otherwise indicated.

DIMENSION LUMBER

For light framing provide the following grade and species:

Construction grade, fir or yellow pine.

BOARDS

Exposed Boards: Where boards will be exposed in the finished work, provide the following:

Moisture content: 15 percent maximum, "MC-15"

Where transparent or natural finish or no finish is indicated, provide Redwood, Select Heart Grade (RIS).

Where painted finish is indicated, provide No. 1 Boards per SPIB rules, Select Merchantable Boards per WCLIB rules, or No. 2 Common Boards & Better per WWPA rules.

Concealed Boards: Where boards will be concealed by other work, provide lumber of 15 percent maximum moisture content and of following species and grade:

Redwood Construction Common per RIS rules, Southern Pine No. 2 Boards per SPIB rules, or any species graded Construction Boards per WCLIB or WWPA rules.

Board Sizes: Provide sizes indicated and as required.

MISCELLANEOUS LUMBER

Provide wood for support or attachment of other work including curbs, support bases, bucks, nailers, blocking, furring, grounds, stripping and similar members. Provide lumber of sizes indicated, worked into shapes shown, and as follows:

Provide same grade and species as dimension lumber.

CONSTRUCTION PANELS

Construction Panel Standards: Comply with PS 1 "U.S. Product Standard for Construction and Industrial Plywood" for plywood panels and, for products not manufactured under PS 1 provisions, with American Plywood Association (APA) "Performance Standard and Policies for Structural-Use Panels."

Trademark: Factory-mark each construction panel with APA trademark evidencing compliance with grade requirements.

Miscellaneous Exposed Plywood: A-C, Group 1, Exterior, not less than 3/4-inch nominal.

Miscellaneous Concealed Plywood: C-C Plugged Exterior, not less than 3/4 inch nominal.

Provide preservative treated plywood at roof edges and parapets.

Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant treated plywood panels with grade designation, APA C-D PLUGGED EXPOSURE 1, in thickness indicated, or, if not otherwise indicated, not less than 15/32".

MISCELLANEOUS MATERIALS

Fasteners and Anchorages: Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices. Provide gears and framing anchors of the size and type recommended by the manufacturer for each use including recommended nails.

Where rough carpentry work is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners and anchorages with a hot-dip zinc coating (ASTM A 153).

PRESERVATIVE WOOD TREATMENT BY PRESSURE PROCESS

General: Where lumber or plywood is indicated as "Trt-Wd" or "Treated," or is specified herein to be treated, comply with applicable requirements of AWPA Standards C2 (Lumber) and C9 (Plywood) and of AWPB Standards listed below. Mark each treated item with the AWPB Quality Mark Requirements.

Pressure-treat with water-borne preservatives to comply with AWPB LP-2 with a minimum retention of 0.25 pcf. After treatment, kiln-dry lumber and plywood to a maximum moisture content, respectively, of 19 percent (19%) and 15 percent (15%). Treat indicated items and the following:

Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, and gravel stop, wood bucks at window jambs and similar locations in exterior walls, and wood members in contact with concrete.

Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment and to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

FIRE-RETARDANT TREATMENT BY PRESSURE PROCESS

General: Where fire-retardant-treated wood is indicated, pressure impregnate lumber and plywood with fire-retardant chemicals to comply with AWPA C20 and C27, respectively, for treatment type indicated; identify "fire-retardant-treated wood" with appropriate classification marking of Underwriters Laboratories, Inc., U.S. Testing, Timber Products Inspection, Inc., or other testing and inspecting agency acceptable to authorities having jurisdiction.

Interior Type A: For interior locations use fire-retardant chemical formulation that produces treated lumber and plywood with the following properties under conditions present after installation:

No reduction takes place in bending strength, stiffness, and fastener holding capacities below values published by manufacturer of chemical formulation that are based on tests by a qualified independent testing laboratory of treated wood products identical to those indicated for this Project under elevated temperature and humidity conditions simulating installed conditions.

No other form of degradation occurs due to acid hydrolysis or other causes related to manufacture and treatment.

No corrosion of metal fasteners results from their contact with treated wood.

Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

All lumber and plywood used on the interior of the building for nailers, blocking, and furring of any nature

shall be fire-retardant treated.

Products: Subject to compliance with requirements, provide one of the following:

Interior Type A Fire-Retardant-Treated Wood:
"Dricon," Hickson Corporation.
"Pyro-Guard," Hoover Treated Wood Products.
"Flameproof LHC-HTT," Osmose Wood Preserving Co., Inc.

PART 3 - EXECUTION

INSTALLATION, GENERAL

Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.

Set carpentry work to required levels and lines, with members plumb and true to line and cut and fitted.

Fit rough carpentry to other construction; scribe and cope as required for accurate fit.

Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards.

Countersink nail heads on exposed carpentry work and fill holes.

Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

WOOD GROUNDS, NAILERS, BLOCKING AND SLEEPERS

Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.

Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated.

Comply with recommendations of National Forest Products Association (N.F.P.A.).

Anchor and nail as indicated and to comply with "National Design Specifications for Wood Construction" published by N.F.P.A.

END OF SECTION 06100

SECTION 06402 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

This section includes the following:

Laminate clad cabinets (plastic-covered casework).

Cabinet tops (countertops) and interior window sills.

Solid surfacing material for countertops and sinks.

Related Sections: The following sections contain requirements that relate to this section:

Division 6 Section "Rough Carpentry" for furring, blocking, and other carpentry work that is not exposed to view.

SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

Product data for each type of product and process specified in this section and incorporated into items of architectural woodwork during fabrication, finishing, and installation.

Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

Samples for initial selection purposes of the following in form of manufacturer's color charts consisting of actual units or sections of units showing full range of colors, textures, and patterns available for each type of material indicated.

Plastic laminate.
Solid surfacing materials.

Samples for verification purposes of the following:

Laminate clad panel products, 8-1/2 inches by 11 inches for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.

Solid surfacing materials, 6 inches square.

Product certificates signed by woodwork manufacturer certifying that products comply with specified requirements.

QUALITY ASSURANCE

Manufacturer Qualifications: Firm experienced in successfully producing architectural woodwork similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.

Single-Source Manufacturing and Installation Responsibility: Engage a qualified Manufacturer to assume undivided responsibility for woodwork specified in this section, including fabrication, finishing, and installation.

AWI Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI) except as otherwise indicated.

Hardware Coordination: Distribute copies of approved schedule for cabinet hardware specified in Division 8 Section "Finish Hardware" to manufacturer of architectural woodwork; coordinate cabinet shop drawings and fabrication with hardware requirements.

DELIVERY, STORAGE, AND HANDLING

Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

Do not deliver woodwork until painting, wet work, grinding, 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."

PROJECT CONDITIONS

Environmental Conditions: Obtain and comply with Woodwork Manufacturer'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 conditions have been attained and stabilized so that woodwork is within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.

Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.

PART 2 - PRODUCTS

HIGH PRESSURE DECORATIVE LAMINATE MANUFACTURERS

Manufacturer: Subject to compliance with requirements, provide high pressure decorative laminates of one of the following:

Formica Corp.
Nevamar Corp.
Ralph Wilson Plastics Co. (Wilsonart)

MATERIALS

General: Provide materials that comply with requirements of the AWI woodworking standard for each type of woodwork and quality grade indicated and, where the following products are part of woodwork, with requirements of the referenced product standards, that apply to product characteristics indicated:

Hardboard: ANSI/AHA A135.4

High Pressure Laminate: NEMA LD 3.

Medium Density Fiberboard: ANSI A208.2.

Particleboard: ANSI A208.1.

Softwood Plywood: PS 1.

Formaldehyde Emission Levels: Comply with formaldehyde emission requirements of each voluntary standard referenced below:

Particleboard: NPA 8.

Medium Density Fiberboard: NPA 9.

Hardwood Plywood: HPMA FE.

Solid Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with the material and performance requirements of ANSI Z124.3, Type 5 or Type 6, without a precoated finish.

Products: Subject to compliance with requirements, provide one of the following:

Corian; DuPont Polymers.
Surell; Formica Corp.
Fountainhead; Nevamar Corp.
Gibraltar; Ralph Wilson Plastics Co.

FABRICATION, GENERAL

Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber in relation to relative humidity conditions existing during time of fabrication and in installation areas.

Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

Corners of cabinets and edges of solid wood (lumber) members less than 1 inch in nominal thickness: 1/16 inch.

Edges of rails and similar members more than 1 inch in nominal thickness: 1/8 inch.

Complete fabrication, including assembly, finishing, and hardware application, before shipment to project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

Factory-cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges of cutouts with a water-resistant coating.

LAMINATE CLAD CABINETS (PLASTIC-COVERED CASEWORK)

QualityStandard: Comply with AWI Section 400 and its Division 400B "Laminate Clad Cabinets."

Grade: Custom.

Laminate Cladding: High pressure decorative laminate complying with the following requirements:

Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

Provide selections made by Contracting Officer from laminate manufacturer's full range of colors and finishes in the following categories:

Solid Colors.
Patterns.

Laminate Grade for Exposed Surfaces: Provide laminate cladding complying with the following requirements for type of surface and grade.

Horizontal Surfaces Other Than Tops: GP-50 (0.050-inch nominal thickness).

Postformed Surfaces: PF-42 (0.042-inch nominal thickness).

Vertical Surfaces: GP-28 (0.028-inch nominal thickness).

Edges: PVC tape, 3 mm minimum thickness matching laminate in color, pattern and finish.

Semiexposed Surfaces: Provide surface materials indicated below:

Woodwork manufacturer's standard low pressure laminate.

CABINET HARDWARE AND ACCESSORY MATERIALS

General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Finish Hardware."

Cabinet Hardware Schedule: Refer to schedule at end of this section for cabinet hardware required for architectural cabinets.

Hardware Standard: Comply with ANSI/BHMA A156.9 "American National Standard for Cabinet Hardware" for items indicated by reference to BHMA numbers or referenced to this standard.

Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for BHMA code number indicated.

Satin Chromium Plated, Brass or Bronze Base: BHMA 626.

For concealed hardware provide manufacturer's standard finish that complies with product class requirements of ANSI/BHMA A156.9.

ARCHITECTURAL CABINET TOPS (COUNTERTOPS) AND INTERIOR WINDOW SILLS

Quality Standard: Comply with AWI Section 400 and its Division 400C.

Type of Top: High pressure decorative laminate complying with the following:

Grade: Custom.

Laminate Cladding for Horizontal Surface: High pressure decorative laminate as follows:

Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

Provide selections made by Contracting Officer from manufacturer's full range of colors and finishes in the following categories:

Solid colors.
Patterns.

Grade: GP-50 (0.050-inch nominal thickness), except use PF-42 where required for post forming.

Edge Treatment: Same as laminate cladding on horizontal surfaces.

SOLID SURFACING MATERIAL COUNTERTOPS

Fabrication: Fabricate tops in one piece with shop-applied endsplashes, backsplashes, aprons, and edges, unless otherwise indicated. Comply with solid surfacing material manufacturer's recommendations for adhesives, sealers, fabrication, support and finishing.

Install undermount integral sink bowls in countertops in the shop. Minimum size shall be 16" x 13½" x 5½ deep.

Drill holes in countertops for plumbing fittings in the shop.

Intermediate Braces: As required for support and to match top.

Solid Surfacing Material Thickness: 3/4 inch.

Edge Treatment: Angled no-drip edge.

Color, Patterns, and Finishes: Provide materials and products that result in colors of solid surface material complying with the following requirements:

Provide Architect's selections from manufacturer's full range of colors and finishes.

FASTENERS AND ANCHORS

Screws: Select material, type, size and finish required for each use. Comply with FS FF-S-111 for applicable requirements.

For metal framing supports, provide screws as recommended by metal framing manufacturer.

Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

Anchors: Select material, type, size, and finish required by each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

PART 3 - EXECUTION

PREPARATION

Condition woodwork to average prevailing humidity conditions in installation areas before installing.Deliver inserts and similar anchoring devices to be built into substrates well in advance of time substrates are to be built.

Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

INSTALLATION

Quality Standard: Install woodwork to comply with AWI Section 1700 for same grade specified in Part 2 of this section for type of woodwork involved.

Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 8'0" for plumb and level (including tops) and with no variations in flushness of adjoining surfaces.

Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

Where trim is not shown, but reasonably implied or required, it shall conform to trim shown or detailed.

All surfaces shall be checked prior to installation. Unsuitable or defective wood shall be replaced and all surfaces corrected before proceeding.

Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fastener heads are required, use find finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.

Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.

Complete the installation of hardware and accessory items as indicated.

Tops: Anchor securely to base units and other support systems as indicated.

ADJUSTMENT AND CLEANING

Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
Clean, lubricate and adjust hardware.

Clean woodwork on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

PROTECTION

Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensures that woodwork is being without damage or deterioration at time of Substantial Completion.

HARDWARE SCHEDULE:

CLOSET AND UTILITY SHELVING HARDWARE:

Adjustable Shelf Standards and Related Supports: Provide standards and supports of type indicated which comply with ANSI/BHMA A156.9.

Horizontal Slotted Type: Surface or mortise mounted, 5/8" wide x 3/16" high x length indicated, BHMA No. B84071, nickel-plated steel. (Equal to "Knape & Vogt" #255 NP).

Support Type: Closed shelf rest, BHMA No. B84081, nickel-plated steel. (Equal to "Knape & Vogt" #256 NP, except use Knape & Vogt #256R at glass shelving.)

Vertical Slotted Type: Vertical slots spaced 2" on Center, 7/8" wide x 11/16" high x length indicated, BHMA No. B84102, Anochrome finish steel. Equal to “Knape & Vogt” #87 ANO).

Shelf Brackets: Size required to support shelving widths indicated, BHMA No. B84112., Anochrome finish steel. (Equal to “Knape &Vogt” #187 and with “Knape &Vogt” #211 shelf rests).

CABINET HARDWARE:

Drawers (Each to have):

1 pr. Drawer Slides 6020 x length as required (GRASS)
1 Pull 4484-US26D (STANLEY)

3/4" Thick Doors (Each to have):

1 pr. Hinges 3606 with necessary mounting plates for 95 degree opening angle (GRASS)
(Note: Provide 1-1/2 pair at doors 40" high or more.)

1 Pull 4484 - US26D (STANLEY)

Miscellaneous Items:

Cabinet Locks 15891 x 26D - cam as required (CORBIN). See drawings for locations.
Elbow Catch - 2 x MB26D (IVES). Furnish one with each pair of cabinet doors with one door leaf having a cabinet lock.

END OF SECTION 06402

SECTION 07901

JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes joint sealants for the following locations:

1. Exterior joints in vertical surfaces and nontraffic horizontal surfaces as indicated below:

    a. Control and expansion joints in cast-in-place concrete.
    b. Control and expansion joints in unit masonry.
    c. Joints between different materials listed above.
    d. Perimeter joints between materials listed above and frames of doors and windows.
    e. Control and expansion joints in ceiling and overhead surfaces.
    f. Other joints as indicated.

2. Exterior joints in horizontal traffic surfaces as indicated below:

    a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
    b. Joints between different materials listed above.
    c. Other joints as indicated.

3. Interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:

    a. Control and expansion joints on exposed interior surfaces of exterior walls.
    b. Perimeter joints of exterior openings where indicated.
    c. Tile control and expansion joints.
    d. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
    e. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
    f. Perimeter joints of toilet fixtures.

g. Other joints as indicated.

4. Interior joints in horizontal traffic surfaces as indicated below:

a. Control and expansion joints in cast-in-place concrete slabs.
b. Control and expansion joints in tile flooring.
c. Other joints as indicated.

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

1. Division 7 Section "Exterior Insulation and Finish Systems - Class PB" for sealing system joints.

2. Division 7 Section "Flashing and Sheet Metal" for sealing joints related to flashing and sheet metal for roofing.

3. Division 7 Section "Firestopping" for through-penetration firestopping systems.

4. Division 7 Section "Paving Joint Sealants" for sealing joints in portland cement concrete for pavements, walkways, and curbing.

5. Division 8 "Glass and Glazing" for sealants used in glazing.

6. Division 9 Section "Gypsum Drywall" for sealing concealed perimeter joints of gypsum board partitions to reduce sound transmission.

7. Division 9 Section "Acoustical Tile Ceiling" for sealing edge moldings at perimeter of acoustical ceilings.

8. Division 9 Section "Tile" for sealing tile joints.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.

B. Provide joint sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water resistant and cause no staining or deterioration of joint substrates.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data from manufacturers for each joint sealant product required. Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.

C. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.

D. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.

E. Qualification data complying with requirements specified in "Quality Assurance" article. Include list of completed projects with project names addresses, names of Architects and Owners, plus other information specified.

F. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

G. Product test reports for each type of joint sealants indicated, evidencing compliance with requirements specified.

H. Preconstruction field test reports indicating which products and joint preparation methods demonstrate acceptable adhesion to joint substrates.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.

B. Testing Laboratory Qualifications: To qualify for acceptance, an independent testing laboratory must demonstrate to Contracting Officer's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct satisfactorily the testing indicated without delaying progress of the Work.

C. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

D. Preconstruction Compatibility and Adhesion Testing: Submit to joint sealant manufacturers samples of materials that will contact or affect joint sealants for compatibility and adhesion testing as indicated below:

1. Use test methods standard with manufacturer to determine if priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates. Perform tests under normal environmental conditions that will exist during actual installation.

2. Submit not less than 9 pieces of each type of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.

3. Schedule sufficient time for testing and analysis of results to prevent delay in the progress of the Work.

4. Investigate materials failing compatibility or adhesion tests and obtain joint sealant manufacturer's written recommendations for corrective measures, including use of specially formulated primers.

5. Testing will not be required when joint sealant manufacturer is able to submit joint preparation data required above that are acceptable to Contracting Officer and are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

E. Product Testing: Provide comprehensive test data for each type of joint sealant based on tests conducted by a qualified independent testing laboratory on current product formulations within a 24-month period preceding date of Contractor's submittal of test results to Contracting Officer.

1. Test elastomeric sealants for compliance with requirements specified by reference to ASTM C 920. Include test results for hardness, stain resistance, adhesion and cohesion under cyclic movement (per ASTM C 719), low-temperature flexibility, modulus of elasticity at 100 percent strain, effects of heat aging, and effects of accelerated weathering.

2. Include test results performed on joint sealants after they have cured for 1 year.

F. Pre-Installation Conference: Conduct conference at Project site to comply with requirements of the Division 1 Section covering this activity.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.

2. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40 deg F (4.4 deg C).

3. When joint substrates are wet.

B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.8 SEQUENCING AND SCHEDULING

Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, 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.

B. Colors: Provide selections made by Contracting Officer from manufacturer's full range of standard colors for products of type indicated.

2.2 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing elastomeric sealants that comply with ASTM C 920 and other requirements indicated on each Elastomeric Joint Sealant Data Sheet at end of this Section, including those requirements referencing ASTM C 920 classifications for Type, Grade, Class, and Uses. Where additional movement capability is specified in Elastomeric Joint Sealant Data Sheet, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements of ASTM C 920 for Uses indicated.

B. Available Products: Subject to compliance with requirements, elastomeric sealants that may be incorporated in the Work include, but are not limited to, the products specified in each Elastomeric Sealant Data Sheet.

C. Products: Subject to compliance with requirements, provide one of the products specified in each Elastomeric Joint Sealant Data Sheet.

2.3 SOLVENT-RELEASE-CURING JOINT SEALANTS

A. Acrylic Sealant: Manufacturer's standard one-part, nonsag, solvent-release-curing acrylic terpolymer sealant complying with AAMA 808.3 or FS TT-S-00230 or both, with capability when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the following percentage change in joint width existing at time of application and remain adhered to joint substrates indicated for Project without failing cohesively:

1. 7-1/2 percent movement in both extension and compression for a total of 15 percent.
2. 12-1/2 percent movement in both extension and compression for a total of 25 percent.

B. Butyl Sealant: Manufacturer's standard one-part, nonsag, solvent-release-curing, polymerized butyl sealant complying with ASTM C 1085 and formulated with minimum of 75 percent solids to be nonstaining, paintable, and have a tack-free

time of 24 hours or less.

C. Pigmented Narrow Joint Sealant: Manufacturer's standard, solvent-release-curing, pigmented synthetic rubber sealant complying with AAMA 803.3 and formulated for sealing joints 3/16 inch or smaller in width.

D. Available Products: Subject to compliance with requirements, solvent-release-curing joint sealants that may be incorporated in the Work include, but are not limited to, the following:

E. Products: Subject to compliance with requirements, provide one of the following:

1. Acrylic Sealant:

a. "60+Unicrylic," Pecora Corp.
b. "PTI 738," Protective Treatments, Inc.
c. "PTI 767," Protective Treatments, Inc.
d. "Mono," Tremco, Inc.

2. Butyl Sealant:

a. "BC-158," Pecora Corp.
b. "PTI 757," Protective Treatments, Inc.
c. "Sonneborn Multi-Purpose Sealant," Sonneborn Building Products Div., ChemRex, Inc.
d. "Tremco Butyl Sealant," Tremco, Inc.

3. Pigmented Narrow Joint Sealant:

a. "PTI 200," Protective Treatments, Inc.

2.4 LATEX JOINT SEALANTS

A. General: Provide manufacturer's standard one-part, nonsag, mildew-resistant, paintable latex sealant of formulation indicated that is recommended for exposed applications on interior and protected exterior locations and that accommodates indicated percentage change in joint width existing at time of installation without failing either adhesively or cohesively.

B. Acrylic-Emulsion Sealant: Provide product complying with ASTM C 834 that accommodates joint movement of not more than 5 percent in both extension and compression for a total of 10 percent.

C. Silicone Emulsion Sealant: Provide product complying with ASTM C 834 and, except for weight loss measured per ASTM C 792, with ASTM C 920 that

accommodates joint movement of not more than 25 percent in both extension and compression for a total of 50 percent.

D. Available Products: Subject to compliance with requirements, latex joint sealants that may be incorporated in the Work include, but are not limited to, the following:

1. Acrylic-Emulsion Sealant:

a. "AC-20," Pecora Corp.
b. "Sonolac," Sonneborn Building Products Div., ChemRex, Inc.
c. "Tremco Acrylic Latex 834," Tremco, Inc.

2. Silicone-Emulsion Sealant: "Trade Mate Paintable Glazing Sealant," Dow Corning Corp.

2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following requirements:

1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E 90.

2. Product has flame spread and smoke developed ratings of less than 25 per ASTM E 84.

B. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.

C. Available Products: Subject to compliance with requirements, acoustical joint sealants that may be incorporated in the Work include, but are not limited to, the following:

1. Acoustical Sealant:

a. "SHEETROCK Acoustical Sealant," United States Gypsum Co.
b. "AC-20 FTR Acoustical and Insulation Sealant," Pecora Corp.

2. Acoustical Sealant for Concealed Joints:

a. "BA-98," Pecora Corp.
b. "Tremco Acoustical Sealant," Tremco, Inc.

2.6 TAPE SEALANTS

A. Tape Sealant: Manufacturer's standard, solvent-free, butyl-based tape sealant with a solids content of 100 percent formulated to be nonstaining, paintable, and nonmigrating in contact with nonporous surfaces with or without reinforcement thread to prevent stretch and packaged on rolls with a release paper on one side.

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

1. "Extru-Seal Tape," Pecora Corp.
2. "Shim-Seal Tape," Pecora Corp.
3. "PTI 606," Protective Treatments, Inc.
4. "Tremco 440 Tape," Tremco, Inc.
5. "MBT-35," Tremco, Inc.

2.7 PREFORMED FOAM SEALANTS

A. Preformed Foam Sealants: Manufacturer's standard preformed, precompressed, impregnated open-cell foam sealant manufactured from high-density urethane foam impregnated with a nondrying, water repellent agent; factory-produced in precompressed sizes and in roll or stick form to fit joint widths indicated and to develop a watertight and airtight seal when compressed to the degree specified by manufacturer; and complying with the following requirements:

1. Properties: Permanently elastic, mildew-resistant, nonmigratory, nonstaining, and compatible with joint substrates and other joint sealants.

2. Impregnating Agent: Manufacturer's standard.

3. Density: Manufacturer's standard.

4. Available Products: Subject to compliance with requirements, preformed foam sealants that may be incorporated in the Work include, but are not limited to, the following:

a. "Emseal," Emseal Corp.
b. "Emseal Greyflex," Emseal Corp.
c. "Wil-Seal 150," Wil-Seal Construction Foams Div., Illbruck.
d. "Wil-Seal 250," Wil-Seal Construction Foams Div., Illbruck.

2.8 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; 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.

B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Open-cell polyurethane foam.

2. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.

3. Proprietary, reticulated, closed-cell polymeric foam, nonoutgassing, with a density of 2.5 pcf and tensile strength of 35 psi per ASTM D 1623, and with water absorption less than 0.02 gms/cc per ASTM C 1083.

4. Any material indicated above.

C. Elastomeric Tubing Joint Fillers: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, capable of remaining resilient at temperatures down to -26 deg F (-32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

D. 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.

2.9 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

3. Remove laitance and form release agents from concrete.

4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

1. 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 that allow optimum sealant movement capability.

    a. Do not leave gaps between ends of joint fillers.
    b. Do not stretch, twist, puncture, or tear joint fillers.
    c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.

2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.

E. Installation of Sealants: Install sealants by proven 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 that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

F. 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 that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

1. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

2. Provide flush joint configuration, per Figure 5B in ASTM C 1193, where indicated. Use masking tape to protect adjacent surfaces of recessed tooled joints.

3. Provide recessed joint configuration, per Figure 5C in ASTM C 1193, of recess depth and at locations indicated.

G. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and to comply with sealant manufacturer's directions for installation methods, materials, and tools that produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's recommendations.

3.4 CLEANING

Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

Protect joint sealants 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 sealants immediately so that and installations with repaired areas are indistinguishable from original work.

END OF SECTION 07901

SECTION 08114

CUSTOM STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes custom-fabricated, commercial-quality steel doors and frames for doors and related openings, hollow metal panels, and louvers in these doors and frames.

B. Standard steel doors and frames are specified in Division 8 Section "Steel Doors and Frames."

C. Customized hollow metal work for other than doors, panels, and frames are specified an in Division 5 Section.

D. Building in of anchors and grouting of frames in masonry construction are specified in a Division 4 Section.

E. Door hardware installation is specified in Division 8 Section "Door Hardware".

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

1. Division 8 Section "Door Hardware" for door hardware installed in doors and frames.

2. Division 8 Section "Flush Wood Door" for solid-core wood doors installed in steel frames.

3. Division 9 Section "Painting" for field painting of doors and frames.

G. Products furnished but not installed under this Section include steel doors and frames.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product Data: Manufacturer's specifications for fabrication and installation, including data substantiating that products comply with requirements. Manufacturer's certificate stating that each assembly required to be fire rated but exceeding sizes of tested assemblies has been constructed to conform to design, materials, and details of construction equivalent to requirements for labeled units.

C. Shop Drawings: For fabrication and installation of custom steel doors and frames work. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections. Provide a schedule of doors and frames using same reference numbers for details and openings as those on the Contract Drawings.

D. Samples representing at least the minimum construction of doors and frames required for Project.

1. Doors showing vertical edge construction, top, and bottom construction; insulation, face stiffeners, hinge and other applied hardware reinforcement. Include louver section and glazing stops where applicable.

2. Frames showing profile, welded corner joint, welded hinge reinforcement, dust cover boxes, floor and wall anchors, and silencers. Include panel and louver sections and glazing stops where applicable.

1.4 QUALITY ASSURANCE

A. Provide custom steel doors and frames manufactured by a single firm specializing in the production of this type of work, unless otherwise acceptable to the Contracting Officer.

B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies whose fire resistance characteristics have been determined per ASTM E 152, and that are labeled and listed by UL, Warnock Hersey, or other testing and inspecting organization acceptable to authorities having jurisdiction.

C. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide manufacturer's certification that doors conform to all standard construction requirements of tested and labeled fire-rated door assemblies except for size.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palleted, wrapped, or crated to provide protection during transit and job storage.

B. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to the Architect; otherwise remove and replace damaged items as directed.

C. Store doors and frames at the building site under cover. Place units on minimum 4-inch-high wood blocking. Avoid the use of nonvented plastic or canvas shelters that could create a humidity chamber. If cardboard wrappers on doors become wet, remove cartons immediately. Provide 1/4-inch spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Custom Steel Doors and Frames:

    a. Allied Steel Products, Inc.
    b. American Steel Products Corp.
    c. Curries Mfg., Inc.
    d. Deronde Products.
    e. Impco Door Corporation.
    f. Karpen Steel Products, Inc.
    g. Overly Manufacturing Co.
    h. Pioneer Industries/Div. CORE Industries, Inc.
    i. Precision Metals, Inc.
    j. Security Metal Products, Inc.
    k. Superior Fireproof Door, Inc.

2.2 MATERIALS

A. Cold-Rolled Steel Sheets: Commercial-quality, level, carbon steel, complying with ASTM A 366.

B. Hot-Rolled Steel Sheets and Strips: Commercial-quality carbon steel, pickled and oiled, complying with ASTM A 569, free of scale, pitting, or surface defects.

C. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526 and ASTM A 525 with A60 or G60 coating designation, mill phosphatized.

D. Stainless Steel Sheets: Commercial-quality stainless steel, AISI Type 302/304, complying with ASTM A 167, exposed finish No. 4 polish.

E. Supports and Anchors: Fabricate of not less than 16-gage sheet metal. Galvanize after fabrication units to be built into exterior walls, complying with ASTM A 153, Class B.

F. Inserts, Bolts, and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.

G. Shop-Applied Paint: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as base for specified finish paints on steel surfaces.

2.3 DOORS

A. General: Provide flush design doors, 1-3/4 inches thick, seamless hollow construction, unless otherwise indicated.

1. For single-acting swing doors, bevel both vertical edges 1/8 inch in 2 inches. For double-acting swing doors, round vertical edges with 2-1/8-inch radius.

2. Unless otherwise required for acoustical or thermal doors, provide filler of fiberboard, mineral-wool board, or other insulating material solidly packed full door height to fill voids between inner core reinforcing members.

3. Reinforce doors with rigid tubular frame where stiles and rails are less than 8 inches wide. Form tubular frame with 16-gage steel, welded to outer sheets.

B. Painted Exterior Doors: Fabricate exterior doors of 2 outer, galvanized, stretcher-leveled steel sheets not less than 16 gage. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges, except

around glazed or louvered panel inserts. Provide weep-hole openings in the bottom of doors to permit escape of entrapped moisture.

1. Reinforce inside of doors with vertical galvanized sheet steel sections not less than 22 gage. Space vertical reinforcing 6 inches o.c. and extend full door height. Spot weld at not more than 5 inches o.c. to both face sheets. Continuous truss-form inner core of 28-gage galvanized sheet steel reinforcing may be provided as inner reinforcement, in lieu of above. Spot weld truss-form reinforcement 3 inches o.c. vertically and horizontally over entire surface of both sides.

2. Reinforce tops and bottoms of doors with 16-gage horizontal steel channels welded continuously to outer sheets. Close top and bottom edges to provide flush, waterproof weather seal, as integral part of door construction or by addition of inverted steel channels.

C. Painted Interior Doors: Fabricate interior doors of 2 outer, cold-rolled, stretcher-leveled steel sheets not less than 18 gage. Construct doors with smooth, flush surfaces, without visible joints or seams on exposed faces or stile edges, except around glazed or louvered panel inserts.

1. Reinforce inside of doors with vertical, hot-rolled, not less than 22-gage steel sections. Space vertical reinforcing 6 inches o.c. and extend full door height. Spot weld at not more than 5 inches o.c. to both face sheets. Continuous truss-form inner core of 28-gage sheet metal reinforcing may be provided as inner reinforcement in lieu of above. Spot weld truss-form reinforcement 3 inches o.c. vertically and horizontally over entire surface of both sides.

2. Reinforce tops and bottoms of doors with 18-gage, horizontal steel channels, welded continuously to outer sheets.

D. Finish Hardware Reinforcement: Minimum gages of steel reinforcing plates for the following hardware:

1. Hinges and Pivots: 7 gage thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.

2. Lock Face, Flush Bolts, Closers, and Concealed Holders: 12 gage.

3. All Other Surface-Mounted Hardware: 16 gage.

2.4 HOLLOW METAL PANELS

Provide hollow metal panels of same materials, construction, and finish as specified for

doors.

2.5 FRAMES

A. Fabricate frames of full-welded unit construction, with corners mitered, reinforced, continuously welded full depth and width of frame. Knock-down type frames are not acceptable.

1. Form frames of minimum 14-gage galvanized steel sheets for exterior, and either cold or hot-rolled sheet steel of the following minimum gages for interior:

a. Openings up to and including 4'-0" wide: 16 gage.
b. Openings over 4'-0" wide: 14 gage.

2. Form countertop of stainless steel sheets with #4 polish for openings indicated to receive stainless steel countertops. (Roll up Service Windows)

B. Finish Hardware Reinforcement: Minimum gages of steel reinforcing plates for the following hardware:

1. Hinges and Pivots: 7 gage thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.

2. Strikes, Flush Bolts, and Closers: 12 gage.

3. Surface-Mounted Hold-Open Arms and Panic Devices: 12 gage.

C. Mullions and Transom Bars: Provide closed or tubular mullions and transom bars where indicated. Fasten mullions and transom bars at crossings and to jambs by butt welding. Reinforce joints between frame members with concealed clip angles or sleeves of same metal and thickness as frame. Provide false head member to receive lower ceiling where frames extend to finish ceilings of different heights.

D. Head Reinforcing: Where installed in masonry, leave vertical mullions in frames open at top for grouting.

E. Jamb Anchors: Furnish jamb anchors as required to secure frames to adjacent construction, formed of not less than 18-gage galvanized steel.

1. Masonry Construction: Adjustable, flat, corrugated, or perforated, t-shaped to suit frame size, with leg not less than 2 inches wide by 10 inches long. Furnish at least 3 anchors per jamb up to 7'-6" height; 4 anchors up to 8'-0" jamb height; one additional anchor for each 24 inches or fraction thereof over 8'-0" height.

2. Metal Stud Partitions: Insert type with notched clip to engage metal stud, welded to back of frames. Provide at least 4 anchors for each jamb for frames up to 7'-6" in height; 5 anchors up to 8'-0" jamb height; one additional anchor each 24 inches or fraction thereof over 8'-0" height.

F. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, formed of not less than 14-gage galvanized steel sheet, as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with 2 holes to receive fasteners, welded to bottom of jambs and mullions.

2. Separate Topping Concrete Slabs: Adjustable type with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

G. Head Anchors: Provide 2 anchors at head of frames exceeding 42 inches wide for frames mounted in steel stud walls.

H. Head Strut Supports: Provide 3/8-inch by 2-inch vertical steel struts extending from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members in compliance with UL 63.

I. Structural Reinforcing Members: Provide as part of frame assembly, where indicated at mullions, transoms, or other locations that are to be built into frame.

J. Head Reinforcing: For frames over 4'-0" wide in masonry wall openings, provide continuous steel channel or angle stiffener, not less than 12 gage for full width of opening, welded to back of frame at head.

K. Spreader Bars: Provide removable spreader bar across bottom of frames, tack welded to jambs and mullions.

L. Rubber Door Silencers: Except on weatherstripped doors, drill stop in strike jamb to receive 3 silencers on single-door frames and drill head jamb stop to receive 4 silencers on double-door frames. Install plastic plugs to keep holes clear during construction.

M. Plaster Guards: Provide 26-gage steel plaster guards or dust cover boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

2.6 LOUVERS

A. Door Louvers: Fabricate louvers and mount flush into doors without overlapping moldings on surface of door facing sheets.

B. Provide internal support as recommended by louver manufacturer. Prime paint after fabrication, except stainless steel. Interior Louvers: Sightproof, stationary type, constructed of inverted Y-shaped blades formed of 20-gage cold-rolled steel, except 20-gage stainless steel for stainless steel doors.

C. Louvered Panels: Provide for installation in frames where indicated.

1. Exterior Louvers: Not less than 16-gage galvanized steel sheet. Fabricate units with stationary, weatherproof Z-shaped blades and U-shaped frames, not less than 1-3/8 inches thick. Space louver blades not more than 1-1/2 inches o.c. Assemble units by welding. Provide removable insect screens on interior side of frame, consisting of 14 by 18 bronze wire mesh in rigid, formed metal frame.

2. Interior Louvers: Not less than 18-gage cold-rolled steel sheet. Fabricate units with stationary, sightproof inverted V-shaped blades and U-shaped frames, not less than 1-3/8 inches thick. Space louver blades not more than 3 inches o.c. Assemble units by welding.

A. Provide stops and moldings around solid, glazed, and louvered panels where indicated.

B. Form fixed stops and moldings integral with frame, unless otherwise indicated.

C. Provide removable stops and moldings where indicated or required, formed of not less than 20-gage steel sheets matching steel of frames. Secure with countersunk flat or oval head machine screws spaced uniformly not more than 12 inches o.c. Form corners with butted hairline joints.

D. Coordinate width of rabbet between fixed and removable stops with type of glass or panel and type of installation indicated.

2.8 FABRICATION, GENERAL

A. Fabricate hollow metal units to be rigid, neat in appearance, and free from defects, warp, or buckle. Accurately form metal to required sizes and profiles. Wherever practicable, fit and assemble units in the manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure

proper assembly at the project site. Weld exposed joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

1. Interior Doors: Minimum 18-gage face sheets.

2. Exterior Doors: Minimum 16-gage face sheets.

B. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

C. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors and frames that have been fabricated as thermal insulating assemblies and tested in accordance with ASTM C 236 or C 976. Unless otherwise indicated, provide assemblies U-value rating of 0.68 to .19 Btu/(hr by sq ft by deg F).

D. Sound-Rated (Acoustical) Assemblies: Wherever shown or scheduled, provide door and frame assemblies that have been fabricated as sound-reducing type, tested in accordance with ASTM E 90, and classified in accordance with ASTM E 413. Unless otherwise indicated, provide acoustical assemblies with sound ratings of STC 33 or better.

E. Finish Hardware Preparation: As follows:

1. Prepare doors and frames to receive finish hardware, including cutouts, reinforcing, mortising, drilling, and tapping in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A 115 series specifications for door and frame preparation for hardware.

2. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.

3. Locate finish hardware as shown on final shop drawings, or if not shown, in accordance with "Recommended Locations for Builder's Hardware for Custom Steel Doors and Frames," published by Door and Hardware Institute.

F. Shop Painting: Clean, treat, and paint exposed surfaces of steel doors and frames, including galvanized surfaces, but excluding stainless steel surfaces.

1. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.

2. Apply pretreatment to cleaned metal surfaces, using cold phosphate solution (SSPC-PT2), hot phosphate solution (SSPC-PT4), or basic zinc

chromate-vinyl butyryl solution (SSPC-PT3).

3. Apply shop coat of prime paint within time limits recommended by pretreatment manufacturer. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Frames: Provide custom steel frames for doors, transoms, side lights, borrowed lights, and other openings, of size and profile as indicated.

1. Install frames and accessories in accordance with shop drawings, manufacturer's data, and as herein specified.

2. Setting Masonry Anchorage Devices: Provide masonry anchorage devices where required for securing frames to in-place concrete or masonry construction. Set anchorage devices opposite each anchor location, in accordance with details on final shop drawings and anchorage device manufacturer's instructions. Leave drilled holes rough, not reamed, and free from dust and debris.

3. Floor anchors may be set with powder-actuated fasteners instead of masonry anchorage devices and machine screws, if so indicated on final shop drawings.

4. Placing Frames: Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

   a. At in-place concrete or masonry construction, set frames and secure in place with machine screws and masonry anchorage devices.
   b. Place frames at fire-rated openings in accordance with NFPA Standard No. 80.
   c. Make field splices in frames as detailed on final shop drawings, welded and finished to match factory work.
   d. Remove spreader bars only after frames or bucks have been properly set and secured.

B. Door: Fit non-fire-rated doors accurately in their respective frames, with the following clearances:

1. Jambs and Head: 3/32 inch.

2. Meeting Edges, Pairs of Doors: 1/8 inch.

3. Bottom: 3/8 inch, where no threshold or carpet.

4. Bottom: 1/8 inch, at threshold or carpet.

C. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.

3.2 ADJUST AND CLEAN

A. Final Adjustments: Check and readjust operating hardware items just prior to final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames that are warped, bowed, or otherwise unacceptable.

B. Prime Coat Touch-Up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

C. Stainless Steel Touch-Up: Immediately after erection, smooth any abraded areas of stainless steel and polish to match undamaged finish.

END OF SECTION 08114

SECTION 08211

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SUMMARY:

A. Extent and location of each type of flush wood door is indicated on drawings and in schedules.

B. Types of doors required include the following: Solid core flush wood doors with wood veneer faces.

C. Shop-priming of flush wood doors is included in this section.

D. Factory-prefitting to frames and factory-premachining for hardware for wood doors is included in this section.

G. Metal door frames for flush wood doors are specified in another Division-8, Section 08111.

1.3 SUBMITTALS:

A. Product Data: Door manufacturer's technical data for each type of door, including details of core and edge construction, and factory-finishing specifications.

B. Shop Drawings: Submit shop drawings indicating location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, requirements for factory finishing and other pertinent data.

C. Samples: Submit samples, 1-0" square or as indicated, for the following: Doors for Transparent Finish: Door faces with solid wood edging representing typical range of color and grain for each species of veneer and solid lumber required.

1.4 QUALITY ASSURANCE:

A. Quality Standards: Comply with the following standards:

1. NWWDA Quality Standard: I.S.1 "Industry Standard for Wood Flush Doors", of National Wood Window and Door Association (NWWDA).

2. AWI Quality Standard: "Architectural Woodwork Quality Standards"; including Section 1300 "Architectural Flush Doors", of Architectural Woodwork Institute (AWI) for grade of door, core construction, finish and other requirements exceeding those of NWWDA quality standard.

B. NWWMA Quality Marking: Mark each wood door with NWWDA Wood Flush Door Certification Hallmark certifying compliance with applicable requirements of NWWDA I.S. 1 Series. For manufacturers not participating in NWWDA Hallmark Program, a certification of compliance may be substituted for marking of individual doors.

C. Fire-Rated Wood Doors: Provide wood doors which are identical in materials and construction to units tested in door and frame assemblies per ASTM E 152 and which are labeled and listed for ratings indicated by UL, Warnock Hersey or other testing and inspection agency acceptable to authorities having jurisdiction.

D. Sound Retardant Doors: Provide wood doors which are in sizes and thickness shown on drawings and schedules and which meet or exceed AWI Quality Standards for Type SR. The doors shall have an STC rating of 42 or better by tests conducted according to ASTM Standard E90-617. They shall also pass the standard ASTM E152-73 20-minute fire and hose stream test and bear a 20-minute fire-rated label.

E. Manufacturer: Obtain doors from a single manufacturer.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING:

A. Protect doors during transit, storage and handling to prevent damage, soiling and deterioration. Comply with requirements of referenced standards and recommendations of NWWDA pamphlet "How to Store, Handle, Finish, Install, and Maintain Wood Doors", as well as with manufacturer's instructions.

B. Identify each door with individual opening numbers which correlate with designation system used on shop drawings for door, frames, and hardware, using temporary, removable or concealed markings.

1.6 PROJECT CONDITIONS:

A. Conditioning: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during remainder of construction period to comply with the following requirements applicable to project's geographical location:

B. Referenced AWI quality standard including Section 100-S-3 "Moisture Content".

C. Referenced WIC quality standard including "Section 1 - General Information - Technical Bulletin".

1.7 WARRANTY:

A. General: Warranties shall be in addition to, and not a limitation of, other rights the Goverment may have under the Contract Documents.

B. Door Manufacturer's Warranty: Submit written agreement in door manufacturer's standard form signed by Manufacturer, Installer and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup or twist) or that show telegraphing of core construction in face veneers, or do not conform to tolerance limitations of referenced quality standards.

1. Warranty shall also include reinstallation which may be required due to repair or replacement of defective doors where defect was not apparent prior to hanging.

2. Warranty shall be in effect during following period of time after date of Substantial Completion.

3. Solid Core Interior Doors: 5 - Year, minimum.

C. Contractor's Responsibilities: Replace or refinish doors where Contractor's work contributed to rejection or to voiding of manufacturer's warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering doors which may be incorporated in the work include, but are not limited to, the following:

B. Manufacturer: Subject to compliance with requirements, provide products for Solid Core Doors with Wood Veneer Faces:

1. Algoma Hardwoods, Inc.
2. Buell Door Company.
3. Cal-Wood Door Div., Timberland Industries, Inc.
4. Chappell Door Company.
5. Doors, Incorporated.
6. Eggers Industries, Architectural Door Division.
7. Gay Doors, Inc.
8. Glen-Mar Door Mfg. Co.
9. Graham Manufacturing Corp.
10. Ipik Door Co., Inc.
11. Mohawk Flush Doors, Inc.
12. Weyerhauser Company.

2.2 INTERIOR FLUSH WOOD DOORS:

A. Solid Core Doors for Transparent Finish: Comply with the following requirements:

1. Faces: Red Oak.
2. AWI Grade: Premium.
3. Construction: PC-5 (Particleboard core, 5-ply).

B. Fire-Rated Solid Core Doors: Comply with the following requirements.

C. Faces and AWI Grade: Provide faces and grade to match non-rated doors in same area of building, unless otherwise indicated.

1. Construction: Manufacturer's standard core construction as required to provide fire-resistance and STC rating indicated.
2. Edge Construction: Provide manufacturer's standard laminated edge construction for improved screw-holding capability and split resistance as

compared to edges composed of a single layer of treated lumber.

2.3 FABRICATION:

Fabricate flush wood doors to produce doors complying with following requirements: In sizes indicated for job-site fitting.

2.4 SHOP PRIMING:

Transparent Finish: Shop seal faces and edges of doors.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine installed door frames prior to hanging door:

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.

2. Reject doors with defects.

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

3.2 INSTALLATION:

A. Hardware: For installation see Division-8 "Finish Hardware" section of these specifications.

B. Manufacturer's Instructions: Install wood doors to comply with manufacturer's instructions and of referenced AWI standard and as indicated. Install fire-rated doors in corresponding fire-rated frames in accordance with requirements of NFPA No. 80.

C. Field-Finished Doors: Refer to the following for finishing requirements: Division-9 section "Painting".

3.3 ADJUSTING AND PROTECTION:

A. Operation: Rehang or replace doors which do not swing or operate freely.

B. Finished Doors: Refinish or replace doors damaged during installation.

C. Protect doors as recommended by door manufacturer to ensure that wood doors will be without damage or deterioration at time of Substantial Completion.

END OF SECTION 08211

SECTION 08520

ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

Each window unit shall bear the AAMA Label warranting that the product complies with AAMA 101. Certified test reports attesting that the window units meet the requirements of AAMA 101 will be acceptable in lieu of product labeling.

1.3 SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

A. Manufacturer's Catalog Data for the following:

1. Windows
2. Hardware
3. Fasteners
4. Screens
5. Weatherstripping
6. Accessories

B. Manufacturer's Standard Color Charts

C. Drawings shall indicate elevations of windows, full-size sections, thicknesses and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, mullion details, method and materials for weatherstripping, method of attaching screens, material and method of attaching subframes, sills, trim, installation

details, and other related items.

D. Schedules: Submit schedule with drawings indicating location of each window unit.

E. Test Reports: Minimum condensation resistance factor: Submit test reports for each type of window attesting that identical windows have been tested and meet the requirements specified herein for conformance to AAMA 101, and minimum condensation resistance factor (CRF).

G. Samples: Submit one full-size window of each type proposed for use, complete with AAMA Label, glazing, hardware, anchors, and other accessories. Where screens or weatherstripping is required, fit sample windows with such items that are to be used. After approval, install each sample in the work, clearly identified, and record its location.

H. Operation and Maintenance Manuals: Submit Manufacturer's standard Operation and Maintenance Manuals.

1.4 DELIVERY AND STORAGE

Deliver windows to project site in an undamaged condition. Use care in handling and hoisting windows during transportation and at the jobsite. Store windows and components out of contact with the ground, under a weathertight covering, so as to prevent bending, warping, or otherwise damaging the windows. Damaged windows shall be repaired to an "as new" condition as approved by Contracting Officer. If windows can not be repaired, provide new units.

1.5 ROTECTION

Protect finished surfaces during shipping and handling using the manufacturer's standard method, except that no coatings or lacquers shall be applied to surfaces to which caulking and glazing compounds must adhere.

PART 2 - PRODUCTS

2.1 WINDOWS

A. Windows shall conform to AAMA 101 and the requirements specified herein. Provide windows of types, grades, performance classes, combinations and sizes indicated or specified. Design windows to accommodate hardware, glass, weatherstripping, screens, and accessories to be furnished. Each window shall be

a complete factory assembled unit with or without glass installed. Dimensions shown are minimum. Provide windows with insulating glass and thermal break necessary to achieve a minimum Condensation Resistance Factor (CRF) of 48 when tested in accordance with AAMA 1503.1.

1. Projected Windows: Type P-HC 50. Provide projected windows with concealed four bar friction hinges only.

2. Fixed Windows: Type F-HC 50.

3. Glass and Glazing: Materials are specified in Section 08800, "Glazing."

4. Caulking and Sealing: Are specified in Section 07901, "Joint Sealants."

5. Weatherstripping: AAMA 101.

6. Insect Screening, Metallic: FS RR-W-365, Type VII (aluminum alloy) 18 by 18 mesh.

2.2 FABRICATION

Window units shall conform to AAMA 101.

A Provisions for Glazing: Design windows and rabbets suitable for glass thickness shown or specified. Design sash for inside and outside double glazing and for securing glass with glazing channels.

B. Weatherstripping: Provide for ventilating sections of all windows to ensure a weather-tight seal meeting the infiltration requirements specified in AAMA 101. Provide easily replaceable factory-applied weatherstripping. Use molded vinyl, molded or molded-expanded neoprene or molded or expanded Ethylene Propylene Diene Terpolymer (EPDM) weatherstripping for compression contact surfaces. Use treated woven pile or wool, or polypropylene or nylon pile bonded to nylon fabric and metal or plastic backing strip weatherstripping for sliding surfaces. Do no use neoprene or polyvinylchloride weatherstripping where they will be exposed to direct sunlight.

C. Fasteners: Use fasteners as standard with the window manufacturer for windows, trim, and accessories. Self-tapping sheet-metal screws are not acceptable for material more than 1/16-inch thick.

D. Drips and Weep Holes: Provide continuous drips over heads of top ventilators. Where fixed windows adjoin ventilators, drips shall be continuous across tops of fixed windows. Provide drips and weep holes as required to return water to the outside.

E. Combination Windows: Windows used in combination shall be the same grade and performance class and shall be factory assembled. Where factory assembly of individual windows into larger units is limited by transportation considerations, prefabricate, match mark, transport, and field assemble.

F. Accessories: Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation and proper operation.

1. Hardware: AAMA 101. The item, type, and functional characteristics shall be the manufacturer's standard for the particular window type. Provide hardware of suitable design and of sufficient strength to perform the function for which it is used. Equip all operating ventilators with a lock or latching device which can be secured from the inside.

2. Fasteners: Provide concealed anchors of the type recommended by the window manufacturer for the specific type of construction. Anchors and fasteners shall be compatible with the window and the adjoining construction. Provide a minimum of three anchors for each jamb located approximately 6 inches from each end and at midpoint.

3. Finishes: Exposed aluminum surfaces shall be factory finished with an anodic coating. Color shall be as selected. All windows shall have the same finish.

4. Anodic Coating: Clean exposed aluminum surfaces and provide an anodized finish conforming to AA 45. Finish shall be architectural Class II (0.4 mil to 0.7 mil), designation AA-M10-C22-A32, integral color anodized.

5. Screens: AAMA 101. Provide one insect screen for each operable exterior sash or ventilator. Design screens to be rewirable, easily removable and to permit easy access to operating hardware.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Method of Installation: Install in accordance with the window manufacturer's printed instructions and details. Build in windows as the work progresses or install without forcing into prepared window openings. Set windows at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Protect ventilators and operating parts against accumulation of dirt and building materials

by keeping ventilators tightly closed and locked to frame. Bed screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes in mastic sealant of a type recommended by the window manufacturer. Install windows in a manner that will prevent entrance of water and wind. Fasten insect screens securely in place.

B. Dissimilar Materials: Where aluminum surfaces are in contact with, or fastened to masonry, concrete, wood, or dissimilar metals, except stainless steel or zinc, the aluminum surface shall be protected from dissimilar materials as recommended in the Appendix to AAMA 101. Surfaces in contact with sealants after installation shall not be coated with any type of protective material.

C. Anchors and Fastenings: Make provision for securing units to masonry and to other adjoining construction. Windows installed in masonry walls shall have head and jamb members designed to recess into masonry wall as indicated.

D. Adjustments After Installation: After installation of windows and completion of glazing and field painting, adjust all ventilators and hardware to operate smoothly and to provide weathertight sealing when ventilators are closed and locked. Lubricate hardware and operating parts as necessary.

3.2 CLEANING

Clean interior and exterior surfaces of window units of mortar, paint spattering spots, and other foreign matter to present a neat appearance, to prevent fouling of weathering surfaces and weather-stripping, and to prevent interference with the operation of hardware. Replace all stained, discolored, or abraded windows that cannot be restored to their original condition with new windows.

END OF SECTION 08520

SECTION 08800 - GLASS AND GLAZING

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

Extent of glass and glazing work is indicated on drawings and schedules.

Types of work in this section include glass and glazing for:

Windows.
Storefront construction.
Entrances and other doors.
Sidelights, borrowed lights and other openings.
Mirror glass.
Sealed insulating spandrel units.

SYSTEM DESCRIPTION

Provide glass and glazing that has been produced, fabricated and installed to withstand normal thermal movement, wind loading and impact loading (where applicable), without failure including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glass and glazing materials and other defects in the work.

Normal thermal movement is defined as that resulting from an ambient temperature range of 120 degrees F (67 degrees C) and from a consequent temperature range within glass and glass framing members of 180 degrees F (100 degrees C).

Deterioration of insulating glass is defined as failure of hermetic seal due to other causes than breakage which results in intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coating, if any, resulting from seal failure, and any other visual evidence of seal failure or performance.

Deterioration of coated glass is defined as the development of manufacturing defects including peeling, cracking or other indications of deterioration in coating due to normal conditions of use.

SUBMITTALS

Product Data: Submit manufacturer's technical data for each glazing material and fabricated glass product required, including installation and maintenance instructions. Samples: Submit, for verification purposes, 12" square samples of each type of glass indicated except for clear single pane units, and 12" long samples of each color required (except black) for each type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative of adjoining framing system in color.

Samples: Submit, for verification purposes, 12" square samples of each type of glass indicated except for clear single pane units, and 12" long samples of each color required for each type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative of adjoining framing system in color.

Certificate: Submit certificates from respective manufacturers attesting that glass and glazing materials furnished for project comply with requirements.

> Separate certification will not be required for glazing materials bearing manufacturer's permanent labels designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authorities having jurisdiction.

QUALITY ASSURANCE

Glazing Standards: Comply with recommendations of Flat Glass Marketing Association (FGMA) "Glazing Manual" and "Sealant Manual" except where more stringent requirements are indicated. Refer to those publications for definitions of glass and glazing terms not otherwise defined in this section or other referenced standards.

Safety Glazing Standard: Where safety glass is indicated or required by authorities having jurisdiction, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for category II materials.

Fire Resistance Rated Wire Glass: Provide wire glass products that are identical to those tested per ASTM E 163 (UL 9) and are labeled and listed by UL or other testing and inspecting agency acceptable to authorities having jurisdiction.

Insulating Glass Certification Program: Provide insulating glass units permanently marked either on spacers or at least one component pane of units with appropriate certification label of inspecting and testing organization indicated below:

> Insulating Glass Certification Council (IGCC).

> Associated Laboratories, Inc. (ALI).

Single Source Responsibility for Glass: To ensure consistent quality of appearance and performance,

provide materials produced by a single manufacturer or fabricator for each kind and condition of glass indicated and composed of primary glass obtained from a single source for each type and class required.

DELIVERY, STORAGE, AND HANDLING

Protect glass and glazing materials during delivery, storage and handling to comply with manufacturer's directions and as required to prevent edge damage to glass, and damage to glass and glazing materials from effects of moisture including condensation, of temperature changes, of direct exposure to sun, and from other causes.

PROJECT CONDITIONS

Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing material manufacturer or when joint substrates are wet due to rain, frost, condensation or other causes.

WARRANTY

General: Warranties shall be in addition to, and not a limitation of, other rights the Government may have under the Contract Documents.

Manufacturer's Special Project Warranty on Insulating Glass: Provide written warranty signed by manufacturer of insulating glass agreeing to furnish f.o.b. point of manufacture, freight allowed project site, within specified warranty period indicated below, replacements for those insulating glass units developing manufacturing defects. Manufacturing defects are defined as failure of hermetic seal of air space (beyond that due to glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coatings, if any, and other visual indications of seal failure or performance.

Warranty Period: Manufacturer's standard but not less than 10 years after date of substantial completion.

PART 2 - PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products of one of the following:

Manufacturers of Clear and Tinted Float Glass:

Ford Glass Division.
Guardian Industries Corp.
LOF Glass, Inc.

PPG Industries, Inc.
ITI Industries.

Manufacturers of Wire Glass:

Guardian Industries Corp.
Hordis Brothers, Inc.
Pilkington Sales (North America) Limited.

Manufacturers of Heat-Treated Glass:

Ford Glass Division.
Guardian Industries Corp.
LOF Glass, Inc.
PPG Industries, Inc.
ITI Industries.

Manufacturers of Insulating Glass:

Ford Glass Division.
Guardian Industries Corp.
PPG Industries, Inc.
ITI Industries.

GLASS PRODUCTS, GENERAL

Primary Glass Standard: Provide primary glass which complies with ASTM C 1036 requirements, including those indicated by reference to type, class, quality, and, if applicable, form, finish, mesh and pattern.

Heat-Treated Glass Standard: Provide heat-treated glass which complies with ASTM C 1048 requirements, including those indicated by reference to kind, condition, type, quality, class, and, if applicable, form, finish, and pattern.
Sizes: Fabricate glass to sizes required for glazing openings indicated, with edge clearances and tolerances complying with recommendations of glass manufacturer. Provide thicknesses indicated or, if not otherwise indicated, as recommended by glass manufacturer for application indicated.

PRIMARY GLASS PRODUCTS

Clear Float Glass: Type I (transparent glass, flat), Class 1 (clear), Quality q^3 (glazing select).

Tinted Float Glass: Type I (transparent glass, flat), Class 2 (tinted heat absorbing and light reducing), Quality q^3 (glazing select), and as follows:

Match color of exterior pane of insulating glass.

Refer to requirements for sealed insulating glass units for performance characteristics of assembled units composed of tinted glass, coated or uncoated, relative to visible light transmittance, U-values, shading coefficient and visible reflectance.

Wired Glass: Type II (patterned and wired glass, flat), Class 1 (translucent), Quality q^8 (glazing); complying with ANSI Z97.1; 1/4" thick; of form and mesh pattern indicated below.

Polished Wire Glass: Form 1 (wired, polished both sides), Mesh m2 (square).

Mirror Glass: 1/4" thick, Type I, Class 1, Quality q^2, conforming to FS DD-G-451, with silvering, copper coating, and protective organic coating complying with FS DD-M-411.

Provide mirror glass at locations shown on drawings. Edges shall be polished where no frames are indicated.

HEAT-TREATED GLASS PRODUCTS

Manufacturing Process: Manufacture heat-treated glass as follows:

By vertical (tong-held) or horizontal (roller hearth) process, at manufacturer's option, except provide horizontal process "tongless" or "free of tong marks."

Glass with visual distortions shall not be used and will not be accepted.

Uncoated Clear Heat-Treated Float Glass: Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Quality q^3 (glazing select), kind as indicated below.

Kind FT (fully tempered) where indicated.

Uncoated Tinted Heat-Treated Float Glass: Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 2 (tinted heat absorbing and light reducing), Quality q^3 (glazing select), with tint color and performance characteristics for 1/4" thick glass matching those indicated for non-heat-treated tinted float glass; kind as indicated below:

Kind FT (fully tempered).

SEALED INSULATING GLASS UNITS

General: Provide pre-assembled units consisting of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space and complying with ASTM E 774 for performance classification indicated as well as with other requirements specified for glass characteristics, air space, sealing system, sealant, spacer material, corner design and dessicant.

For properties of individual glass panes making up units, refer to product requirements specified elsewhere in this section applicable to types, classes, kinds and conditions of glass products indicated.

Provide heat-treated panes of kind and at locations indicted or, if not indicated, provide heat-strengthened panes where recommended by manufacturer for application indicated and tempered where indicated or where safety glass is designated or required.

Performance Classification per ASTM E 774: Class A.

Thickness of Each Pane: 1/4" unless otherwise indicated.

Air Space Thickness: ½".

Sealing System: Dual seal; primary and secondary sealant; manufacturer's standard materials.

Spacer Material: Aluminum.

Dessicant: Manufacturer's standard; either molecular sieve or silica gel or blend of both.

Corner Construction: Manufacturer's standard corner construction.

Uncoated Insulating Glass Units: Manufacturer's standard units complying with the following requirements:

Exterior Pane: Tinted float glass, bronze.

Kind FT (fully tempered).

Interior Pane of Glass: Clear float glass, except obscure glass at locations shown on drawings.

Kind FT (fully tempered).

Performance Characteristics: Visible light transmittance of 45 percent; summer U-value of .57 at ½" air space; winter U-value of .49 at ½" air space. Shading coefficient of 0.55 and outdoor reflectance of visible light of 8 percent.

SEALED INSULATING SPANDREL UNITS

Ceramic-Coated Heat-Treated Spandrel Glass: Condition B (spandrel glass, one surface ceramic coated), Type I (transparent glass, flat), Class 1 (clear), Quality q^3 (glazing select), with ceramic coating applied to second surface and third surface of insulating spandrel panels and complying with the following requirements:

Kind HS (heat strengthened).

Color: Match color of insulating glass; submit samples for Architect's selection and approval.

Fallout Resistance: Provide spandrel units identical to those passing fall out resistant test for spandrel glass specified in ASTM C1048.

Thickness of Each Panel: 1/4".

Air Space Thickness: 1/2".

Exterior Pane: Ceramic coating applied to second surface.

Interior Pane: Ceramic coating applied to third surface.

ELASTOMERIC GLAZING SEALANTS AND PREFORMED GLAZING TAPES

General: Provide products of type indicated and complying with the following requirements:

Compatibility: Select glazing sealants and tapes of proven compatibility with other materials with which they will come into contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.

Suitability: Comply with recommendations of sealant and glass manufacturers for selection of glazing sealants and tapes which have performance characteristics suitable for applications indicated and conditions at time of installation.
Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements, including those for Type, Grade, Class and Uses.

Colors: Provide color of exposed sealants as selected by Architect from manufacturer's standard colors.

One-Part Acid-Curing Silicone Glazing Sealant: Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to uses indicted, O.

One-Part Non-Acid-Curing Silicone Glazing Sealant: Type S, Grade NS, Class 25, Uses NT, G, A, and, as applicable to uses indicated, O; and complying with the following requirements for modulus and additional joint movement capability.

Medium Modulus: Tensile strength of not less than 45 nor more than 75 psi at 100 percent elongation when tested per ASTM D 412 after 14 days at 77^{o}F (20^{o} C) and 50 percent relative humidity.

Preformed Butyl-Polyisobutylene Glazing Tape: Provide manufacturer's standard solvent-free butyl-polyisobutylene formulation with a solids content of 100 percent; complying with AAMA A 804.1; in extruded tape form; non-staining and non-migrating in contact with nonporous surfaces; packaged on rolls with a release paper on one side; with or without continuous spacer rod as recommended by manufacturers of tape and glass for application indicated.

Products: Subject to compliance with requirements, provide one of the following:

One-Part Acid-Curing Silicone Glazing Sealant:

"Chem-Calk 1200"; Bostik Construction Products Div.
"Dow Corning 999"; Dow Corning Corp.
"SCS 1200"; General Electric Corp.
"863"; Pecora Corp.
"Proglaze"; Tremco, Inc.

One-Part Non-Acid Curing Medium-Modulus Silicone Glazing Sealant:

"Dow Corning 795"; Dow Corning Corp.
"Silpruf"; General Electric Corp.
"Gesil"; General Electric Corp.
"Spectrum 2"; Tremco, Inc.

Preformed Butyl-Polyisobutylene Glazing Tape Without Spacer Rod:

"Chem-Tape 40"; Bostick Construction Products Div.
"Extru-Seal"; Pecora Corp.
"Tremco 440 Tape"; Tremco Inc.

Preformed Butyl-Polyisobutylene Glazing Tape With Spacer Rod:

"Chem-Tape 60"; Bostik Construction Products Div.
"Shim-Seal"; Pecora Corp.
"Pre-shimmed Tremco 440 Tape"; Tremco Inc.

MISCELLANEOUS GLAZING MATERIALS

Compatibility: Provide materials with proven record of compatibility with surfaces contacted in installation.

Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.

Setting Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealants, 80 to 90 Shore A durometer hardness.

Spacers: Neoprene, EPDM or silicone blocks, or continuous extrusions, as required for compatibility with glazing sealant, of size, shape and hardness recommended by glass and sealant manufacturers for application indicated.

Edge Blocks: Neoprene, EPDM or silicone blocks as required for compatibility with glazing sealant, of size and hardness required to limit lateral movement (side-walking) of glass.

Compressible Filler Rods: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, flexible and resilient, with 5-10 psi compression strength for 25 percent deflection.

PART 3 - EXECUTION

EXAMINATION

Require Glazier to inspect work of glaze framing erector for compliance with manufacturing and installation tolerances, including those for size, squareness, offsets at corners; for presence and functioning of weep system; for existence of minimum required face or edge clearances; and for effective sealing of joinery. Obtain Glazier's written report listing conditions detrimental to performance of glazing work. Do not allow glazing work to proceed until unsatisfactory conditions have been corrected.

PREPARATION

Clean glazing channels and other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrates. Remove lacquer from metal surfaces where elastomeric sealants are indicated for use.

GLAZING, GENERAL

Comply with combined printed recommendations of glass manufacturers, of manufacturers of sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those of referenced glazing standards.

Glazing channel dimensions as indicated in details are intended to provide for necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by job conditions at time of installation.

Protect glass from edge damage during handling and installation; use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift

glass units within openings; do not raise or drift glass with a pry bar. Rotate glass with flares or bevels along one horizontal edge which would occur in vicinity of setting blocks so that these are located at top of opening. Remove from project and dispose of glass units with edge damage or other imperfections of kind that, when installed, weakens glass and impairs performance or appearance.

Apply primers to joint surfaces where required for adhesion of sealants.

GLAZING

Install setting blocks of proper size in sill rabbet, located one quarter of glass width from each corner, but with edge nearest corner not closer than 6" from corner, unless otherwise required. Set blocks in thin course of sealant which is acceptable for heel bead use.

Provide spacers inside and out, of correct size and spacing to preserve required face clearances, for glass sizes larger than 50 united inches (length plus height), except where gaskets or glazing tapes with continuous spacer rods are used for glazing. Provide 1/8" minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.

Provide edge blocking to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer.

Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.
Provide compressible filler rods or equivalent back-up material, as recommended by sealant and glass manufacturers, to prevent sealant from extruding into glass channel weep systems and from adhering to joints back surface as well as to control depth of sealant for optimum performance, unless otherwise indicated.

Force sealants into glazing channels to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.

Tool exposed surfaces of sealants to provide a substantial "wash" away from glass. Install pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.

Miter cut wedge-shaped gaskets at corners and install gaskets in manner recommended by gasket manufacturer to prevent pull away at corners; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

PROTECTION AND CLEANING

Protect exterior glass from breakage immediately upon installation by use of crossed streamers attached to framing and held away from glass. Do not apply markers to surfaces of glass. Remove nonpermanent labels and clean surfaces.

Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove immediately by method recommended by glass manufacturer.

Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less often than once a month, for build-up of dirt, scum, alkali deposits or staining. When examination reveals the presence of these forms of residue, remove by method recommended by glass manufacturer.

Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.

Wash glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Wash glass by method recommended by glass manufacturer.

END OF SECTION 08800

SECTION 09255 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section includes the following:

Non-load-bearing steel framing members for gypsum board assemblies.

Gypsum board assemblies attached to steel framing.

One hour fire-resistive ceiling assembly as scheduled.

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

Division 7 Section "Firestopping" for firestopping systems and fire-resistive-rated joint sealants.

DEFINITIONS

Gypsum Board Construction Terminology: Refer to ASTM C 11 USG Systems Folder SA-923, and GA-505 for definitions of terms related to gypsum board assemblies not defined in this Section or in other referenced standards.

SUBMITTALS

Product data for each type of product specified.

QUALITY ASSURANCE

Fire-Test-Response Characteristics: Where fire-rated gypsum board assemblies are indicated, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

Fire Resistance Ratings: As indicated by reference to GA File Numbers in GA-600 "Fire Resistance Design Manual" or to design designations in UL "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.

Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board

assemblies from a single manufacturer.

Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.

Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

DELIVERY, STORAGE, AND HANDLING

Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.

Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

PROJECT CONDITIONS

Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 and with gypsum board manufacturer's recommendations.

Room Temperatures: For non-adhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F (10 deg C) for 48 hours prior to application and continuously after until dry. Do not exceed 95 deg F (35 deg C) when using temporary heat sources.

Ventilation: Ventilate building spaces, as required, for drying joint treatment materials. Avoid drafts during hot dry weather to prevent finishing materials from drying too rapidly.

PART 2 - PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Steel Framing and Furring:

Dale Industries, Inc.
Dietrich Industries, Inc.
Gold Bond Building Products Div., National Gypsum Co.
Unimast Inc.
United States Gypsum Co.

Gypsum Board and Related Products:

Domtar Gypsum.
Georgia-Pacific Corp.
Gold Bond Building Products Div., National Gypsum Co.
United States Gypsum Co.

STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS

General: Provide components complying with ASTM C 754 for materials and sizes unless otherwise indicated.

Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.

Channels: Cold-rolled steel, 0.05980-inch-minimum thickness of base (uncoated) metal and 7/16-inch-wide flanges, and as follows:

Carrying Channels: 1-1/2 inch deep, 475 lb per 1000 feet, unless otherwise indicated.

Finish: Rust-inhibitive paint.

Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth of 7/8 inch, and minimum thickness of base (uncoated) metal as follows:

Thickness: 0.0179 inch, unless otherwise indicated.

STEEL FRAMING FOR WALLS AND PARTITIONS

General: Provide steel framing members complying with the following requirements:

Component Sizes and Spacings: As indicated but not less than that required to comply with ASTM C 754 under the following maximum deflection and lateral loading conditions:

Maximum Deflection: L/240 at 5 lb per sq. ft.

Protective Coating: Manufacturers standard corrosion-resistant coating.

Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 deg and doubled over to form 3/16-inch-wide minimum lip (return) and complying with the following requirements for minimum

thickness of base (uncoated) metal and for depth:

Thickness: 25 gage, unless otherwise indicated.

Depth: As indicated.

Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth and minimum thickness of base (uncoated) metal as follows:

Depth: 7/8 inch.
Thickness: 0.0179 inch, unless otherwise indicated.

Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

GYPSUM BOARD PRODUCTS

General: Provide gypsum board of types indicated in maximum lengths available to minimize end-to-end butt joints.

Thickness: Provide gypsum board in thicknesses indicated or, if not otherwise indicated, in 5/8 inch thicknesses to comply with ASTM C 840 for application system and support spacing indicated.

Gypsum Wallboard: ASTM C 36 and as follows:

Type: Type X

Edges: Tapered.

Thickness: 5/8 inch unless otherwise indicated.

TRIM ACCESSORIES

Accessories for Interior Installation: Corner beads, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:

Material: Formed metal, complying with the following requirement:

Sheet steel coated with zinc by hot-dip or electrolytic processes.

Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047:

Cornerbead on outside corners, unless otherwise indicated.

LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim unless otherwise indicated. Equal to USG # 200-B metal trim.

U-bead with face and back flanges; face flange formed to be left without application of joint compound. Use U-bead where indicated.

One-piece control joint formed with V-shaped slot, with removable strip covering slot opening.

JOINT TREATMENT MATERIALS

General: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

Joint Tape for Gypsum Board: Paper reinforcing tape, unless otherwise indicated.

Setting-Type Joint Compounds for Gypsum Board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.

Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.

For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer for this purpose.

For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by the gypsum board manufacturer for this purpose.

For topping compound, use sandable formulation.

Drying-Type Joint Compounds for Gypsum Board: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.

Ready-Mixed Formulation: Factory-mixed product.

Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.

Topping compound formulated for fill (second) and finish (third) coats.

ACOUSTICAL SEALANT

Latex Acoustical Sealant: Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834 and the following requirements:

Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E 90.

Acoustical Sealant for Concealed Joints: Manufacturer's standard non-drying, non-hardening, non-skinning, non-staining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.

Products: Subject to compliance with requirements, provide one of the following:

Acoustical Sealant:

AC-20 FTR Acoustical and Insulation Sealant, Pecora Corp.
SHEETROCK Acoustical Sealant, United States Gypsum Co.

Acoustical Sealant for Concealed Joints:

BA-98, Pecora Corp.
Tremco Acoustical Sealant, Tremco, Inc.

MISCELLANEOUS MATERIALS

General: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.

Steel drill screws complying with ASTM C 1002 for the following applications:

Fastening gypsum board to steel members less than 0.03 inch thick.

Fastening gypsum board to gypsum board.

Steel drill screws complying with ASTM C 954 for fastening gypsum board to steel members from 0.033 to 0.112 inch thick.

Sound Attenuation Blankets: Unfaced mineral-fiber blanket insulation produced by combining mineral fibers with thermosetting resins to comply with ASTM C 665 for Type I (blankets without membrane facing).

Thickness as indicated on drawings.

PART 3 - EXECUTION

EXAMINATION

Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

PREPARATION

Ceiling Anchorages: Coordinate installation of ceiling suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.

INSTALLING STEEL FRAMING, GENERAL

Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.

Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with "Gypsum Construction Handbook" published by United States Gypsum Co.

Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.

Where building structure abuts ceiling perimeter or penetrates ceiling.

Where partition framing and wall furring abut structure except at floor.

Provide slip- or cushioned-type joints to attain lateral support and avoid axial loading.

Do not bridge building expansion and control joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.

INSTALLING STEEL FRAMING FOR SUSPENDED AND FURRED CEILINGS

Suspend ceiling hangers from building structural members and as follows:

Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members,

SECTION 09255 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section includes the following:

Non-load-bearing steel framing members for gypsum board assemblies.

Gypsum board assemblies attached to steel framing.

One hour fire-resistive ceiling assembly as scheduled.

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

Division 7 Section "Firestopping" for firestopping systems and fire-resistive-rated joint sealants.

DEFINITIONS

Gypsum Board Construction Terminology: Refer to ASTM C 11 USG Systems Folder SA-923, and GA-505 for definitions of terms related to gypsum board assemblies not defined in this Section or in other referenced standards.

SUBMITTALS

Product data for each type of product specified.

QUALITY ASSURANCE

Fire-Test-Response Characteristics: Where fire-rated gypsum board assemblies are indicated, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

Fire Resistance Ratings: As indicated by reference to GA File Numbers in GA-600 "Fire Resistance Design Manual" or to design designations in UL "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.

Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board

assemblies from a single manufacturer.

Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.

Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

DELIVERY, STORAGE, AND HANDLING

Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.

Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

PROJECT CONDITIONS

Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 and with gypsum board manufacturer's recommendations.

Room Temperatures: For non-adhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F (10 deg C) for 48 hours prior to application and continuously after until dry. Do not exceed 95 deg F (35 deg C) when using temporary heat sources.

Ventilation: Ventilate building spaces, as required, for drying joint treatment materials. Avoid drafts during hot dry weather to prevent finishing materials from drying too rapidly.

PART 2 - PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Steel Framing and Furring:

Dale Industries, Inc.
Dietrich Industries, Inc.
Gold Bond Building Products Div., National Gypsum Co.
Unimast Inc.
United States Gypsum Co.

Gypsum Board and Related Products:

Domtar Gypsum.
Georgia-Pacific Corp.
Gold Bond Building Products Div., National Gypsum Co.
United States Gypsum Co.

STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS

General: Provide components complying with ASTM C 754 for materials and sizes unless otherwise indicated.

Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.

Channels: Cold-rolled steel, 0.05980-inch-minimum thickness of base (uncoated) metal and 7/16-inch-wide flanges, and as follows:

Carrying Channels: 1-1/2 inch deep, 475 lb per 1000 feet, unless otherwise indicated.

Finish: Rust-inhibitive paint.

Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth of 7/8 inch, and minimum thickness of base (uncoated) metal as follows:

Thickness: 0.0179 inch, unless otherwise indicated.

STEEL FRAMING FOR WALLS AND PARTITIONS

General: Provide steel framing members complying with the following requirements:

Component Sizes and Spacings: As indicated but not less than that required to comply with ASTM C 754 under the following maximum deflection and lateral loading conditions:

Maximum Deflection: L/240 at 5 lb per sq. ft.

Protective Coating: Manufacturers standard corrosion-resistant coating.

Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 deg and doubled over to form 3/16-inch-wide minimum lip (return) and complying with the following requirements for minimum

thickness of base (uncoated) metal and for depth:

Thickness: 25 gage, unless otherwise indicated.

Depth: As indicated.

Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth and minimum thickness of base (uncoated) metal as follows:

Depth: 7/8 inch.
Thickness: 0.0179 inch, unless otherwise indicated.

Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

GYPSUM BOARD PRODUCTS

General: Provide gypsum board of types indicated in maximum lengths available to minimize end-to-end butt joints.

Thickness: Provide gypsum board in thicknesses indicated or, if not otherwise indicated, in 5/8 inch thicknesses to comply with ASTM C 840 for application system and support spacing indicated.

Gypsum Wallboard: ASTM C 36 and as follows:

Type: Type X

Edges: Tapered.

Thickness: 5/8 inch unless otherwise indicated.

TRIM ACCESSORIES

Accessories for Interior Installation: Corner beads, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:

Material: Formed metal, complying with the following requirement:

Sheet steel coated with zinc by hot-dip or electrolytic processes.

Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047:

Cornerbead on outside corners, unless otherwise indicated.

LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim unless otherwise indicated. Equal to USG # 200-B metal trim.

U-bead with face and back flanges; face flange formed to be left without application of joint compound. Use U-bead where indicated.

One-piece control joint formed with V-shaped slot, with removable strip covering slot opening.

JOINT TREATMENT MATERIALS

General: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

Joint Tape for Gypsum Board: Paper reinforcing tape, unless otherwise indicated.

Setting-Type Joint Compounds for Gypsum Board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.

Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.

For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer for this purpose.

For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by the gypsum board manufacturer for this purpose.

For topping compound, use sandable formulation.

Drying-Type Joint Compounds for Gypsum Board: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.

Ready-Mixed Formulation: Factory-mixed product.

Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.

Topping compound formulated for fill (second) and finish (third) coats.

ACOUSTICAL SEALANT

Latex Acoustical Sealant: Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834 and the following requirements:

Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E 90.

Acoustical Sealant for Concealed Joints: Manufacturer's standard non-drying, non-hardening, non-skinning, non-staining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.

Products: Subject to compliance with requirements, provide one of the following:

Acoustical Sealant:

AC-20 FTR Acoustical and Insulation Sealant, Pecora Corp.
SHEETROCK Acoustical Sealant, United States Gypsum Co.

Acoustical Sealant for Concealed Joints:

BA-98, Pecora Corp.
Tremco Acoustical Sealant, Tremco, Inc.

MISCELLANEOUS MATERIALS

General: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.

Steel drill screws complying with ASTM C 1002 for the following applications:

Fastening gypsum board to steel members less than 0.03 inch thick.

Fastening gypsum board to gypsum board.

Steel drill screws complying with ASTM C 954 for fastening gypsum board to steel members from 0.033 to 0.112 inch thick.

Sound Attenuation Blankets: Unfaced mineral-fiber blanket insulation produced by combining mineral fibers with thermosetting resins to comply with ASTM C 665 for Type I (blankets without membrane facing).

Thickness as indicated on drawings.

PART 3 - EXECUTION

EXAMINATION

Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

PREPARATION

Ceiling Anchorages: Coordinate installation of ceiling suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.

INSTALLING STEEL FRAMING, GENERAL

Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.

Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with "Gypsum Construction Handbook" published by United States Gypsum Co.

Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.

Where building structure abuts ceiling perimeter or penetrates ceiling.

Where partition framing and wall furring abut structure except at floor.

Provide slip- or cushioned-type joints to attain lateral support and avoid axial loading.

Do not bridge building expansion and control joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.

INSTALLING STEEL FRAMING FOR SUSPENDED AND FURRED CEILINGS

Suspend ceiling hangers from building structural members and as follows:

Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members,

install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure as well as for type of hanger involved, and in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

Do not attach hangers to metal roof deck. Attach hangers to structural members.

Do not connect or suspend steel framing from ducts, pipes or conduit. Maintain minimum 2 inch clearance between hangers or braces and ducts, pipes or conduit.

Sway-brace suspended steel framing with hangers used for support.

Install suspended steel framing components in sizes and at spacings indicated but not less than that required by the referenced steel framing installation standard.

Wire Hangers: 0.1620-inch (8-gage) diameter, 4 feet o.c.

Carrying Channels (Main Runners): 1-1/2 inch, 4 feet o.c.

Rigid Furring Channels (Furring Members): 16 inches o.c.

Installation Tolerances: Install steel framing components for suspended ceilings so that cross-furring members or grid suspension members are level to within 1/8 inch in 12 feet as measured both lengthwise on each member and transversely between parallel members.

Wire-tie or clip furring members to main runners and to other structural supports as indicated.

INSTALLING STEEL FRAMING FOR WALLS AND PARTITIONS

Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction.

Where studs are installed directly against exterior walls, install asphalt felt strips between studs and wall.

Where top runners are installed directly against metal deck or structural members, provide deflection track.

install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

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Where top runners are installed directly against metal deck or structural members, provide deflection track.

Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch from the plane formed by the faces of adjacent framing.

Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Cut studs ½ inch short of full height. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

For fire-resistive-rated partitions requiring partitions to extend to the underside of floor/roof slabs and decks or other continuous solid structural surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed, to support gypsum board closures needed to make partitions continuous from floor to underside of solid structure.

Refer to Section 07270 for fire-stopping requirements.

Install steel studs and furring in sizes and at spacings indicated but not less than that required by the referenced steel framing installation standard to comply with maximum deflection and minimum loading requirements specified:

Single-Layer Construction: Space studs at 16 inches o.c.

Install steel studs so that flanges point in the same direction and so that leading edges or ends of each gypsum board can be attached to open (unsupported) edges of stud flanges first.

APPLYING AND FINISHING GYPSUM BOARD, GENERAL

Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840 and GA-216.

Install sound attenuation blankets where indicated prior to installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

Install ceiling board panels across framing to minimize the number of abutting end joints and avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

Install wall/partition board panels to minimize the number of abutting end joints or avoid them entirely. Stagger abutting end joints not less than one framing member in alternate courses of board. At stairwells and other high walls, install panels horizontally with end abutting joints over studs and staggered.

Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

Locate both edge or end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position adjoining panels so that tapered edges abut tapered edges, and field-cut edges abut field-cut edges and ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions. Avoid joints at corners of framed openings where possible.

Attach gypsum panels to steel studs so that the leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

Attach gypsum panels to framing provided at openings and cutouts.

Form control joints and expansion joints at locations indicated and to comply with manufacturer's recommended spacing, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.

Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chase walls that are braced internally.

Except where concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.

Fit gypsum panels tightly around ducts, pipes, and conduits.

Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4-to-1/2-inch-wide joints to install sealant.

Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors, as detailed. Provide 1/4-inch-to-1/2-inch-wide spaces at these locations and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

Where sound attenuation blankets are indicated, seal construction at perimeters, behind control and expansion joints, openings, and penetrations with a continuous bead of acoustical sealant including a bead at both faces of the partitions. Comply with ASTM C 919 and manufacturer's recommendations for location of edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.

GYPSUM BOARD APPLICATION METHODS

Single-Layer Application: Install gypsum wallboard panels as follows:

On ceilings, apply gypsum panels prior to wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.

On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated, and provide panel lengths that will minimize end joints.

Single-Layer Fastening Methods: Apply gypsum panels to supports as follows:

Fasten with screws.

INSTALLING TRIM ACCESSORIES

General: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.

Install corner beads at external corners.

Install edge trim where edge of gypsum panels would otherwise be exposed or semi-exposed. Provide edge trim type with face flange formed to receive joint compound except where other types are indicated.

Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.

Install L-bead where edge trims can only be installed after gypsum panels are installed.

Install U-bead where indicated.

Install control joints to comply with manufacturer's recommended spacing and according to ASTM C 840, and in locations approved by Contracting Officer for visual effect.

FINISHING GYPSUM BOARD ASSEMBLIES

General: Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim, and control joints; penetrations; fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration and levels of gypsum board finish indicated.

Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.

Apply joint tape over gypsum board joints except those with trim accessories having concealed face flanges not requiring taping to prevent cracks from developing in joint treatment at flange edges.

Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214.

Level 1 for ceiling plenum areas, concealed areas, and where indicated, unless a higher level of

finish is required for fire-resistive-rated assemblies and sound-rated assemblies.

Level 4 for gypsum board surfaces indicated to receive light-textured finishes, wallcoverings, and paints over light textures.

For level 4 gypsum board finish, embed tape in finishing compound plus two separate coats applied over joints, angles, fastener heads, and trim accessories using the following combination of joint compounds (not including prefill), and sand between coats and after last coat:

Embedding and First Coat: Setting-type joint compound.
Fill (Second) Coat: Setting-type joint compound.
Finish (Third) Coat: Ready-mixed, drying-type, all-purpose or topping compound.

Where level 1 gypsum board finish is indicated, apply joint compound specified for embedding coat.

CLEANING AND PROTECTION

Promptly remove any residual joint compound from adjacent surfaces.

Provide final protection and maintain conditions, in a manner suitable to Installer, that ensures gypsum board assemblies remain without damage or deterioration at time of Substantial Completion.

END OF SECTION 09255

09260 - METAL STUD AND GYPSUM BOARD SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Conditions of the Contract and Division 1 apply to this Section.

B. Provide labor, materials and equipment required to complete gypsum board system work
as indicated in the Contract Documents.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 06100 - Rough and Finish Carpentry

B. Section 07920 - Sealant and Caulking

C. Section 09500 - Acoustical Treatment

D. Section 09900 – Painting

E. Division 15000 - Mechanical Access Panels

F. Division 16000 - Electrical Access Panels

G. Division 16000 - Lighting

1.3 QUALITY ASSURANCE

A. Construction Tolerances

1. Do not exceed 1/8" in 8'-0" variation from plumb or level in any exposed line or surface, except at joints between units.

2. Do not exceed 1/16" variation between planes of abutting edges or ends.

B. Reference Standards

1. ASTM A525 Spec. for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

2. ASTM C36 Spec. for Gypsum Wallboard.

3. ASTM C475 Spec. for Joint Treatment Materials for Gypsum Wallboard Construction.

4. ASTM C514 Spec. for Nails of the Application of Gypsum Wallboard.

5. ASTM C557 Spec. for Adhesive for Fastening Gypsum Wallboard to Wood Framing.

6. ASTM C630 Spec. for Water-Resistant Gypsum Backing Board.

7. ASTM C645 Spec. for Non-Load (Axial) Bearing Steel Studs, Runners (Track) and Rigid Furring Channels for Screw Application of Gypsum Board.

8. ASTM C646 Spec. for Steel Drill Screws for the Application of Gypsum Board to Light-Gage Steel Studs.

9. ASTM C754 Spec. for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wallboard, Backing Board or Water-Resistant Backing Board.

10. ASTM C840 Spec. for Application and Finishing of Gypsum Board.

11. ASTM C894 Spec. for Type W Screws for the Application of Gypsum Board to Wood Framing.

12. ASTM E90 Laboratory Measurement of Airborne-Sound Transmission Loss of Building Partitions.

13. ASTM E119 Fire Tests of Building Construction and Materials.

14. ASTM E413 Classification for Determination of Sound Transmission Class.

15. ASTM C931 Spec. for Exterior Gypsum Soffit Board.

16. ASTM C1178 Spec. for Glass Mat Water-Resistant Gypsum Backing Board.

17. ANSI A108.9 Test Methods and Specifications for Cementitious Backer Units.

1.4 SUBMITTALS

A. Refer to Section 01300 for Submittal Requirements.

B. Texture/Finish Mock-Up

1. Provide a mock-up area, minimum 8'-0" wide x full height of wall for each texture used on this project. Sample area shall include as a minimum one continuous horizontal joint, one full height vertical joints, and if at a gypsum ceiling, continuous horizontal joint, one full height vertical joint, and if at a gypsum ceiling, continuous intersection with that ceiling to show texture change.

a. The mock-up may be part of the Work and may be incorporated into the finished work, when so approved by the Contracting Officer.

b. Revise as necessary to secure the Contracting Officer’s approval.

c. The mock-up areas, when approved by the Contracting Officer, will be used as datum points for comparison with the remainder of the finishing work of this Section for the purpose of acceptance or rejection of the work.

2. When making mock-up and throughout finishing of gypsum board, illuminate areas of installation using building's permanent lighting system and temporary additional lights as required; temporary alone will not be acceptable.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the project site with manufacturer's label intact and legible.

B. Stack wallboard so that long lengths are not over short lengths.

C. Store material inside under cover, stacked flat, off floor and away from sweating walls and other damp surfaces.

D. Store adhesives, joint finishing compounds, in dry area, provide protection against freezing at all times.

E. Metal products shall be stored and protected so as to prevent rusting.

F. All materials which are rusted, stained, or otherwise damaged during delivery or storage shall be removed from the site and replaced with acceptable material.

1.6 ENVIRONMENTAL CONDITIONS

A. Maintain a uniform room temperature between 55EF and 70EF one week prior to and during application and until completely dry and occupied. Provide adequate ventilation. Humidity level not to exceed 50% R.H.

B. Provide ventilation during and following adhesive and joint treatment application. Use temporary air circulators in enclosed areas lacking ventilation.

C. Under slow drying conditions, allow additional drying time between coats of joint treatment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Metal "Cee" Studs

1. Cold-formed, galvanized steel.

a. Screw type with perforated webs and knurled flanges.

b. 25 gauge by size indicated on drawings.

c. Provide top and bottom tracks, bridging, and bracing as required and recommended by manufacturer.

2. Provide minimum 20 gauge studs where "Durock" occurs.

B. Suspension and Furring Materials

1. Suspension main channels: 1-1/2" and 3/4" x 16 ga. cold rolled steel, galvanized "C" section. Minimum .475 lbs. per L.F.

2. Hat Furring Channels: Hat Shape sections 20 ga. galvanized steel, 1-3/8" x 7/8" deep, ASTM C645.

3. Provide 18 gauge tie wire and attachment clips as required and recommended by manufacturer. All galvanized finish.

4. Hanger Wire: Soft annealed galvanized mild steel wire - 12 gauge.

5. Resilient Furring Channels: USG RC-1 Semi-Hat Shape sections 20 ga. galvanized steel, 1-3/8" x 7/8" deep, ASTM A568.

C. Gypsum Board

1. Comply with ASTM C36 material specification unless specified otherwise. 48" wide x lengths long as possible or as required, thickness as shown on drawings. Tapered edges.

a. Gypsum Board Types:
- Type "X" at rated applications. USG Firecode "C" or equal.
- Type "WR" at moist applications. Comply with ASTM C-630.
- Regular at all other applications.

2. Gypsum Sheathing: USG 1/2" thick gypsum core with weather resistant paper all surfaces.

D. Tile Backer Board

1. U.S.G. "Durock" Tile Backer Board: Aggregated hydraulic cement board with coated woven glass fiber mesh in back and front surfaces.

2. Maximum length and width x thickness called for on drawings.

3. Glass fiber pressure sensitive tape.

E. Drywall Fasteners and Attachments

1. Provide screw fasteners of the type and size recommended by manufacturer for gypsum board applications. Type M for metal and Type W for wood attachment. Use coated screws at exterior applications. Use special fasteners provide by manufacturer for Durock applications.

2. Adhesives: Provide PL 400 at "wet" areas. Provide laminating adhesive as recommended by the manufacturer if so required.

F. Joint Treatment Materials

1. Joint Tapes: Plain or perforated complying with ASTM C475.

2. Joint Compound: Adhesive with or without fillers complying with ASTM C475.

3. Fiberglass joint tape as recommended by the manufacturer for specific applications.

G. Trim Accessories

1. Standard: Provide standard trim accessories of sizes and shape required for gypsum board applications as shown and required, fabricated from galvanized steel.

2. Provide extruded aluminum "F" shape window system sill, head and jamb trim as indicated on drawings; dark bronze finish.

H. Texturing Products

1. USG Spray Texture finish, non-asbestos unaggregated spray texture to produce an "Orange Peel" texture. Non washable unpainted.

I. Acoustic and Firesafing Insulation

1. U.S. Gypsum Company, "thermafiber" mineral fiber 3 PCF density unfaced insulation. Thickness as shown on drawings.

J. Miscellaneous

1. Fasteners: Drill in type TEC or Tapcon, Buildex, Rawl, or Phillips.

a. Do not use powder driven fasteners unless approved by Contracting Officer.

2. Acoustic Sealant: Tremco Acoustic Sealant or equal as approved by the Contracting Officer.

3. Isolation Gasket: Williams Gasket Company, "Everlastic", close cell neoprene stock, thickness 25% greater than joint dimension, width to suit joint conditions.

K. Flush Access Doors

1. JL Industries Model WB for wallboard or approved equal. Gypsum board shall be inset into door recess.

a. Door: 14 gal. "steel - prime painted".

b. Frame: 16 ga. steel - prime painted, 1" wide flange.

c. Hinges: Concealed - spring type to permit 175 degree opening.

d. Lock: Hex head operated concealed cam.

e. Anchors: As recommended by door manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Metal Stud/Furring Channel Installation

1. Install in strict accordance with USG Company Gypsum Construction Handbook and manufacturer's printed instructions.

2. Studs shall be placed vertically in runner track, spaced as called for on drawings but not greater than:

a. 16" o.c. for 1/2" gypsum board and tile backer board.

b. 24" o.c. for 5/8" gypsum board.

3. All studs located adjacent to door and frames, partition intersections and corners shall be anchored to runner flanges with metal lock fastener tool. Double studs at door frames and borrowed lights.

4. Where shown, extend metal studs to underside of structure for bracing. Studs extended to deck or structure shall have deep leg track and have space for 1/4" deflection.

5. Walls which are shown to extend above ceiling but not to deck shall have 45E stud braces at 6'-0" O.C. and at each door jamb.

6. Spot grout hollow metal door frame anchors while installing drywall.

7. At one sided "shaft" walls provide horizontal "V" type bracing at 48" o.c. vertically or clip brace metal studs back to masonry wall at 48" o.c. vertically.

8. Furring Channels: Attach furring channels to masonry walls and wood framing where shown. At "Z" shaped furring channels coordinate insulation with insulation trade. Space maximum 16" on center. Add additional furring channels around all openings and penetrations.

9. Resilient Furring Channels: Attach channels to studs where shown. Space maximum 24" o.c. mounting flange down.

B. Metal Framed Soffit System

1. Frame soffits/fascia with specified metal stud members; see drawings. Provide additional suspension members at soffit/fascia penetrations such as lights, diffusers, and access panels.

C. Ceiling System

1. Attach furring channels to wood framing at 16" o.c. maximum with wood screws.

2. Provide additional suspension channels and wires at ceiling penetrations such as lights and diffusers. Provide additional framing around ceiling access panels.

D. Gypsum Board/Tile Backer Board Installation

1. Manufacturer's Instructions: Unless shown or specified, install gypsum board, including accessories, in accordance with manufacturer's printed instructions.

2. Provide perimeter relief where non-load bearing drywall partitions abut ceilings, vertical elements, or dissimilar materials.

3. Where drywall partitions intersect concrete or masonry, provide control joints not less than 1/4" nor more than 3/8".

4. Gypsum board end joints made between framing members shall be backblocked. Do not back block Tile Backer Board, all joints shall be made over furring.

5. Begin fastening from center portion of sheet and work toward edges and ends. Space fasteners as recommended by manufacturer. Drive screws with power screwdriver.

6. Where partition types change and/or at partition intersections and at inside corners stagger each gypsum board layer and seal layers to each other.

7. Adhesive Application: Apply adhesive to back of drywall after cutting and fitting. Apply with notched trowel or spot per manufacturer's printed instructions. Laminate second layer over first if called for on drawings or required by job conditions.

E. Trim Accessories

1. Finish exposed drywall surfaces with joints, corners and exposed edges reinforced or trimmed as specified, and with all joints, fastener heads, trim accessories, flanges, and surfaces defects filled with joint compound in accordance with drywall manufacturer's recommendations for a smooth, flush surface.

a. Place drywall control joints as recommended by USG and directly opposite building control joints.

2. For protection of exposed wallboard edges around openings, provide metal casing bead "J" trim. Provide corner bead at all outside corners.

3. Where drywall abuts or intersects dissimilar construction, provide square edge semi-finishing casing bead, 1/4" joint and caulking in joint.

F. Shaft Wall Installation

1. Position steel runners at floor and ceiling with the short leg toward finish side of wall. Securely attach runners to structural supports with power driven fasteners at both ends and max. 24" o.c. With steel frame construction, install floor and ceiling runners and J-Runners or E-Studs on columns and beams before steel is fireproofed. Remove spray-fireproofing from runners and E-Studs before installing gypsum liner panels. If fireproofing is removed replace with Thermafiber Insulation packed in place.

2. Cut liner panels 1" less than floor-to-ceiling height and erect vertically between J-Runners. Where shaft walls exceed max. available panel height, position liner, panel and joints within upper and lower third points of wall. Stagger joints top and bottom in adjacent panels and reinforce end joints with horizontal C-H stud or 1" H-Spline. Screw attach studs to runners on walls over 16' high.

3. Use steel C-H studs 3/8" to not more than 1/2" less than floor-to-ceiling height, and install between liner panels with liner inserted in the groove. Install full-length steel E-Studs or J-Runners vertically at T-intersections, corners, door jambs, and columns. Install full-length E-Studs over gypsum liner panels both sides of closure

panels. Frame openings cut within a liner panel with J-Runner around perimeter. For openings, frame with vertical E-Stud or J-Runner at edges, horizontal J-Runners at head and sill and reinforcing as shown on the drawings. Suitably frame all openings to maintain structural support for wall.

4. Install floor-to-ceiling steel J-Runners or E-Studs each side of steel hinged door frames and ceiling runners with two (2) 3/8" Type S-12 Pan Head Screws. Attach strut-studs to jamb anchors with 1/2" Type S-12 screws. Over steel doors, install a cut-to-length section of J-Runner and attach to strut-studs with 3/8" Type S-12 Screws.

G. Finishing Gypsum Board: Tape and sand to feather all joints for smooth uniform surface. Final finish wipe joints with moist sponge.

H. Acoustic and Firesafing Insulation

1. Install between metal wall framing studs, soffits, etc. where shown on drawings, with friction fit. Stuff into all gaps. Tightly butt all end joints.

2. At fire rated walls install firesafing between top runner track and metal deck. Stuff firesafing into deck flutes full width of wall.

3. Lay on top of suspended acoustic ceiling. Do not hold tight to recessed light fixtures unless fixtures are rated to accept insulation covering. Do not cover fixtures unless approved by Contracting Officer.

I. Miscellaneous

1. Sealant: Install acoustic sealant at all acoustic rated partitions between tracks and structure at floor and deck. Seal around all penetrations through the wall including electrical outlets.

J. Make provisions to minimize spattering of compound on other work. Promptly remove compound from doors, frames, floors, and other surfaces.

3.2 ADJUST AND CLEAN

A. Clean premises of all litter, dirt and debris is created by work of this Section. Leave premises broom clean.

END OF SECTION

SECTION 09300 - TILE

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

Types of tile work in this section include the following:

Unglazed ceramic mosaic tile.

Glazed wall tile.

Shower pans.

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

Division 3 Section "Concrete Work" for monolithic slab finishes specified for tile substrates.

Division 4 Section “Unit Masonry” for concrete unit masonry substrate.

SUBMITTALS

Product data for each type of product specified.

Samples for initial selection purposes in form of manufacturer's actual tiles or sections of tile showing full range of colors, textures, and patterns available for each type and composition of tile indicated. Included samples of grout and accessories involving color selection.

Samples for verification purposes of each item listed below, prepared on samples of size and construction indicated, products involving color and texture variations, in sets showing full range of variations expected.

Each type and composition of tile and for each color and texture required, at least 12 inches square, mounted on plywood or hardboard backing and grouted.

Full-size units of each type of trim and accessory for each color required.

Metal edge strips in 6-inch lengths.

QUALITY ASSURANCE

Single-Source Responsibility for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

Single-Source Responsibility for Setting and Grouting Materials: Obtain ingredients of a uniform quality from one manufacturer for each cementitious and admixture component and from one source or producer for each aggregate.

Installer Qualifications: Engage an experienced Installer who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.

PRODUCT HANDLING

Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Prevent damage or contamination to materials by water, freezing, foreign matter or other causes.

PROJECT CONDITIONS

Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup. Maintain temperatures at not less than $50^{o}F$ ($10^{o}C$) in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS

Manufacturer: Subject to compliance with requirements, provide products by one of the following:

Unglazed Ceramic Mosaic Tile:

American Olean Tile Co., Div., National Gypsum Co.
Summitville Tiles, Inc.
United States Ceramic Tile Co.
Winburn Tile Manufacturing Co.

Glazed Wall Tile:

American Olean Tile Co., Div., National Gypsum Co.

Summitville Tiles, Inc.
United States Ceramic Tile Co.

Latex-Emulsion-Based Latex-Portland Cement Mortars and Grouts:

American Olean Tile Co., Inc.
Bostik Construction Products Div.
C-Cure Chemical Co.
DAP Inc. Div.; USG Corp.
L & M Mfg. Inc.
Laticrete International Inc.
Summitville Tiles, Inc.

PRODUCTS, GENERAL

ANSI Standard for Ceramic Tile: Comply with ANSI A137.1 "American National Standard Specifications for Ceramic Tile" for types and grades of tile indicated.

Furnish tile complying with "Standard Grade" requirements unless otherwise indicated.

ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.

Colors, Textures and Patterns: For tile and other products requiring selection of colors, surface textures or other appearance characteristics, provide products, including accent tile colors, as selected by Contracting Officer from manufacturer's standards.

Provide tile trim and accessories which match color and finish of adjoining flat tile.

TILE PRODUCTS

Unglazed Ceramic Mosaic Tile: Provide flat tile complying with the following requirements:

Type: Natural clay.
Wearing Surface: Without abrasive content.
Nominal Facial Dimensions: 2" x 2".
Nominal Thickness: 1/4".
Face: Plain with square edges.

Glazed Wall Tile: Provide flat tile complying with the following requirements:

Nominal Facial Dimension: 2" x 2".
Nominal Thickness: 5/16".
Face: Plain with cushion edges.

Trim Units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with following requirements:

Size: As indicated, coordinated with sizes and coursing of adjoining flat tile, where applicable.

Shapes: As follows, selected from manufacturer's standard shapes:

Base for Thinset Mortar Installations: Straight.

Wainscot Cap for Thinset Mortar Installations: Surface bullnose.

External Corners for Thinset Installations: Surface bullnose.

Internal Corners: Field-butted square corners, except use internal coved and cap angle pieces designed to member with stretcher shapes.

Special Shapes: Provide stop shapes and returns as required at door jambs where frames do not provide sufficient stop for the work.

Accessories for Glazed Wall Tile: Provide vitreous china accessories of type and size indicated and in color and finish to match adjoining glazed wall tile.

One soap holder for each shower equal to Willette Corp., No. 276 shower and tub soap dish, 8-1/2" w x 4-1/4" h x 3" d. Soap dish shall be fully recessed. Color as selected by Contracting Officer.

SETTING MATERIALS

Portland Cement Mortar Bed: Comply with ANSI A108.1. Provide mortar setting bed in shower areas as shown on drawings.

Thin-Set Portland Cement Mortar: Where thin-set portland cement mortar applications are indicated, use the following unless otherwise required.

Dry-set portland cement mortar, ANSI A118.1, factory sanded; or latex portland cement mortar, ANSI A 118.4.

Chemical-Resistant Epoxy Mortar: ANSI A118.3.

Provide product capable of resisting continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, as certified by mortar manufacturer for intended use.

Use chemical-resistant epoxy mortar at ceramic tile floors.

Trim Units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with following requirements:

Size: As indicated, coordinated with sizes and coursing of adjoining flat tile, where applicable.

Shapes: As follows, selected from manufacturer's standard shapes:

Base for Thinset Mortar Installations: Straight.

Wainscot Cap for Thinset Mortar Installations: Surface bullnose.

External Corners for Thinset Installations: Surface bullnose.

Internal Corners: Field-butted square corners, except use internal coved and cap angle pieces designed to member with stretcher shapes.

Special Shapes: Provide stop shapes and returns as required at door jambs where frames do not provide sufficient stop for the work.

Accessories for Glazed Wall Tile: Provide vitreous china accessories of type and size indicated and in color and finish to match adjoining glazed wall tile.

One soap holder for each shower equal to Willette Corp., No. 276 shower and tub soap dish, 8-1/2" w x 4-1/4" h x 3" d. Soap dish shall be fully recessed. Color as selected by Contracting Officer.

SETTING MATERIALS

Portland Cement Mortar Bed: Comply with ANSI A108.1. Provide mortar setting bed in shower areas as shown on drawings.

Thin-Set Portland Cement Mortar: Where thin-set portland cement mortar applications are indicated, use the following unless otherwise required.

Dry-set portland cement mortar, ANSI A118.1, factory sanded; or latex portland cement mortar, ANSI A 118.4.

Chemical-Resistant Epoxy Mortar: ANSI A118.3.

Provide product capable of resisting continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C) and 212 deg F (100 deg C), respectively, as certified by mortar manufacturer for intended use.

Use chemical-resistant epoxy mortar at ceramic tile floors.

SHOWER PAN

PVC Shower Pan Membranes: Provide 40 mil thick flexible PVC sheet shower pan membrane at shower area equal to COMPOSEAL shower pan as manufactured by Compotite Corp. All seams shall be lapped and sealed per manufacturer's recommendations. Provide complete with all components including preformed corner/curb protectors.

GROUTING MATERIALS

Latex-Portland Cement Grout: Proprietary preblended compound of portland cement, selected and graded aggregates, color pigments and chemical additives gaged with latex additive to comply with manufacturer's directions. Comply with ANSI A118.6.

Use latex additive in grout which is compatible with latex additive in latex-portland cement mortar.

Use latex-portland cement grout in wall joints.

Chemical-Resistant Epoxy Grout: ANSI A118.3.

Provide product compatible with epoxy mortar. Use at ceramic tile floor.

Grout Colors: Grout colors shall be as selected by Contracting Officer.

ELASTOMERIC SEALANTS

General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with requirements of Division 7 Section "Joint Sealers," including ASTM C 920 as referenced by Type, Grade, Class, and Uses.

Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

One-Part Mildew-Resistant Silicone Sealant: Type S; Grade NS; Class 25; Uses NT, G, A, and as applicable to nonporous joint substrate indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and temperature extremes.

Products: Subject to compliance with requirements, provide one of the following:

One-Part Mildew-Resistant Silicone Sealant:

"Dow Corning 786"; Dow Corning Corp.
"SCS 1702"; General Electric Co.

SHOWER PAN

PVC Shower Pan Membranes: Provide 40 mil thick flexible PVC sheet shower pan membrane at shower area equal to COMPOSEAL shower pan as manufactured by Compotite Corp. All seams shall be lapped and sealed per manufacturer's recommendations. Provide complete with all components including preformed corner/curb protectors.

GROUTING MATERIALS

Latex-Portland Cement Grout: Proprietary preblended compound of portland cement, selected and graded aggregates, color pigments and chemical additives gaged with latex additive to comply with manufacturer's directions. Comply with ANSI A118.6.

Use latex additive in grout which is compatible with latex additive in latex-portland cement mortar.

Use latex-portland cement grout in wall joints.

Chemical-Resistant Epoxy Grout: ANSI A118.3.

Provide product compatible with epoxy mortar. Use at ceramic tile floor.

Grout Colors: Grout colors shall be as selected by Contracting Officer.

ELASTOMERIC SEALANTS

General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with requirements of Division 7 Section "Joint Sealers," including ASTM C 920 as referenced by Type, Grade, Class, and Uses.

Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

One-Part Mildew-Resistant Silicone Sealant: Type S; Grade NS; Class 25; Uses NT, G, A, and as applicable to nonporous joint substrate indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and temperature extremes.

Products: Subject to compliance with requirements, provide one of the following:

One-Part Mildew-Resistant Silicone Sealant:

"Dow Corning 786"; Dow Corning Corp.
"SCS 1702"; General Electric Co.

"863 #345 White"; Pecora Corp.
"Proglaze White"; Tremco Corp.

Chemical-Resistant Sealants: For chemical-resistant floors, provide sealants compatible with chemical-resistant mortars and grouts, approved for use indicated by manufacturers of both mortar/grout and sealant and with chemical-resistant properties equivalent to mortar/grout.

MISCELLANEOUS MATERIALS

Metal Edge Strips: Zinc alloy or stainless steel strips, 1/8" wide at top edge with integral provision for anchorage to substrate, unless otherwise indicated.

Tile Cleaner: Product specifically acceptable to manufacturer of tile and grout manufacturer for application indicated and as recommended by National Tile Promotion Federation or Ceramic Tile Institute.

MIXING MORTARS AND GROUT

Mix mortars and grouts to comply with requirements of referenced standards and manufacturers including those for accurate proportioning of materials, water, or additive content; type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

EXAMINATION

Examine substrates and areas where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

Concrete floor shall be smooth and flat. Refer to Section 03310 for required tolerances and other specified self-leveling compounds. Verify acceptability of all self-leveling compounds with ceramic tile manufacturer.

Grind down all ridges and other irregularities.

Fill all cracks, holes, and depressions with leveling and patching compounds as recommended by ceramic tile manufacturer.

Check with the Contractor to insure that the effects of the concrete curing agent have been removed and that the proper finish to receive the tile work is on the floor.

Verify that substrates for setting tile are firm, dry, clean, and free from oil or waxy films and curing

compounds.

Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.

Do not proceed with installation until unsatisfactory conditions have been corrected.

PREPARATION

Blending: For tile exhibiting color variations within the ranges selected during sample submittals, verify that tile has been blended in factory and packaged accordingly so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

INSTALLATION, GENERAL

ANSI Tile Installation Standard: Comply with applicable parts of ANSI 108 series of tile installation standard included under "American National Standard Specifications for the Installation of Ceramic Tile."

TCA Installation Guidelines: TCA "Handbook for Ceramic Tile Installation"; comply with TCA installation methods indicated and as applicable to installation conditions shown.

Extend tile work into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions, except as otherwise shown. Terminate work neatly at obstructions, edges and corners without disrupting pattern or joint alignments.

Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures and other penetrations so that plates, collars, or covers overlap tile.

Jointing Pattern: Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tiles on base, walls, and trim are same size. Layout tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths.

Grout tile to comply with referenced installation standards, using grout materials indicated.

Mix and install proprietary components to comply with grout manufacturer's directions.

FLOOR INSTALLATION METHODS

Ceramic Mosaic Tile: Install tile to comply with requirements indicated below for setting bed methods, TCA installation methods related to types of subfloor construction, and grout types:

Portland Cement Mortar Bed: ANSI A108.1

Concrete Subfloors in Showers: TCA F112.

Grout: Chemical-resistant epoxy.

Chemical-Resistant Epoxy Mortar and Grout: ANSI A108.9.

Concrete Subfloors, Interior: TCA F131.

Grout: Chemical-resistant epoxy.

Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet or other flooring which finishes flush with top of tile.

WALL TILE INSTALLATION METHODS

Install types of tile designated for wall application to comply with requirements indicated below for setting bed methods, TCA installation methods related to subsurface wall conditions, and grout types:

Thin-Set Latex-Portland Cement Mortar (Interior): ANSI A108.5.

Masonry, Interior: TCA W202.

Grout: Latex-portland cement.

Install sealant at all joints at interior corners and door jambs.

CLEANING AND PROTECTION

Cleaning: Upon completion of placement and grouting, clean all tile surfaces so they are free of foreign matter.

Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but not sooner than 14 days after installation. Protect metal surfaces, cast iron and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.

Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, or otherwise defective tile work.

Protection: When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with Kraft paper or other heavy covering during construction period to prevent staining, damage and wear.

Prohibit foot and wheel traffic from using tiled floors for at least 7 days after grouting is completed.

Before final inspections, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 09300

09500- ACOUSTICAL TREATMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Conditions of the Contract and Division 1 apply to this Section.

B. Supply and install, complete in place; all acoustical treatment work as indicated on the drawings and as specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 09260 - Metal Stud and Gypsum Board Systems

B. Section 09900 - Painting

C. Division 15 - Mechanical

D. Division 16 - Electrical

1.3 QUALITY ASSURANCE

A. Acoustical treatment installer shall have a minimum of two (2) years experience on similar scope projects. Installer shall be approved by manufacturer.

B. Comply with all applicable requirements of the Acoustical Materials Association Bulletin AArchitectural Acoustical Materials@, and with all referenced ASTM standards.

C. Allowable Deflection: ASTM C-636, Mounting Type E-400, L/360 Maximum.

D. Out-of-Level Tolerance: Level within 1/8 inch in 12 feet.

E. Reference Standards

1. ASTM C 635, Spec. For Metal Suspension System for Acoustical Tile and Lay-In Panel Ceilings.

2. ASTM E 84, Test Method for Surface Burning Characteristics of Building Materials.

3. ASTM E 1264, Classification for Acoustical Ceiling Products.

1.4 PERFORMANCE REQUIREMENTS

A. Flame Spread: ASTM E 84; 25 or less

B. Smoke Development: 50 or less

1.5 SUBMITTALS

A. Refer to Section 01300 for Submittal Requirements.

B. Product Data: Manufacturers descriptive literature with technical data indicating materials, tests and installation and storage instructions.

C. Shop Drawings: Submit showing complete layout of all systems including attachments, intersections of members, and edge conditions.

D. Calculations: Submit calculations as evidence that main runners can support weight of ceiling, lighting fixtures, and air distribution units within allowable deflection.

E. Maintenance Data: Submit two (2) copies of the manufacturers recommendations regarding maintenance, care and cleaning of acoustical treatments.

F. Samples: Two (2) full size units of each acoustical treatment and three (3) 6" lengths of each suspension member.

G. Qualifications: Installer

H. Seismic Data

1.6 EXTRA MATERIALS

A. Leave with owner 2% of each type of acoustical treatment used.

B. Store in carton in area directed by Contracting Officer.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to jobsite in manufacturer=s original, unopened packaging and adequately protect against damage while stored in dry and heated location at the site.

B. Deliver materials to jobsite after all glazing has been completed and all exterior openings enclosed. All wet work, including concrete, drywall, plastering, etc. shall be completed and dried out.

C. Material shall be stored at jobsite a minimum of 24 hours prior to their installation.

D. Remove all damaged and unsuitable material from the jobsite immediately.

1.8 ENVIRONMENTAL CONDITIONS

A. Protect adjoining work surfaces before the work begins.

B. Do not install acoustical materials until permanent heating and cooling systems are operating and allowable temperature and humidity can be maintained.

C. Maintain 65EF and 50% maximum relative humidity 48 hours prior, during and after installation of materials.

D. Maintain minimum temperature of 55EF thereafter.

PART 2 - PRODUCTS

A. See the Architectural Finishes List bound into this specification for manufacturer, type, size, color and pattern of acoustical ceilings.

B. Suspension System

1. Type 1 Exposed Grid: Chicago Metallic Corporation, Intermediate Duty, Tempra 4000 Series, snap lock, double web steel with face cap.

a. Color: Standard White

b. 1" deep x nom. 1/2" face main tees

c. 1" deep x nom. 1/2" face cross tees

d. 3/4" x 3/4" perimeter angles

2. Type 2 Exposed Grid: Chicago Metallic Corporation Heavy Duty, 200 Series, snap lock, double weg steel with face cap.

a. Color: Standard White

b. 1" deep x nom. 1" wide face main and cross tees.

c. 3/4" x 3/4" perimeter angles.

3. Type 3 Concealed Grid: Chicago Metallic Corporation, 221 System

a. Color: Standard White

b. 1" deep x nom. 1" wide face main and cross tees.

c. 3/4" x 3/4" perimeter angles

C. Suspension Wire: Soft annealed galvanized mild steel wire - 12 gauge.

D. Suspension Channels: 1-1/2" cold or hot rolled steel channels/galvanized. Minimum .475 lbs per L. F.

E. Edge Moldings: metal wall angle with single flange exposed, pre-punched for wall attachments.

F. Screws: Type and size as required by conditions

G. Anchors: Provide drill-in anchors with eyelet to accept suspension wire. Builder, Hilti, Rawl Tec, or equal. Power driven fasteners not allowed.

H. Hold-Down Clips:

1. Vestibules

I. Tile Adhesive: ASTM D 1779, UL labeled with Class 0-25 flame spread rating.

J. Ceiling Light Baffles

1. CA Supply Co. Straight blade Aluminum Cross baffle, 1" deep blades on 1" enters. Butt ends of panels to have partial spacing to form full cells.

a. Length: 4' - 0"

b. Width: 11 3/4"

c. Finish: Clear Anodized Aluminum

K. AWP - 1: Acoustical Wall Panels

1. Conwed ARespond@ ACT 050, 1/2" thick, square edge, with fabric covering. Fabric covering shall be provided by panel manufacturer. Fabric will have two (2) coats of acrylic backing. Resin harden areas at fasteners. See Architectural Finishes List for fabric manufacturer and type.

2. Fasteners: Black phosphate coated coarse thread Adrywall@ screws 1 1/4" long and black finished shoulder Afinishing@ washers, diameter to be approved by Contracting Officer.

L. ATP - 1: Track Panels:

1. Conwed ARespond@ track panels, 1/2" thick, square edge, with fabric covering provided by
the panel manufacturer. See Architectural Finishes List for fabric manufacturer and type.

a. Return fabric minimum 1 - 1/2".

b. Surface Burning - ASTM E - 84, Class A.

c. High density mineral fiberboard.

M. Eggcrate Grilles: 1/2" cube injection molded, one piece translucent white acrylic.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine all subsurfaces to receive the work and report in writing to General Contractor, with copy to Contracting Officer, any detrimental conditions to the work. Failure to observe this injunction constitutes a waiver to any subsequent claims to the contrary and holds acoustical unit Contractor responsible for any corrections the Contracting Officer may require. Commencement of the work will be construed as acceptance of all subsurfaces.

B. Coordinate required surface corrections with contractor responsible for installation.

3.2 INSTALLATION

A Coordination

1. Prior to the beginning of ceiling work, the ceiling Contractor and other Contractors whose work is related to the ceiling installation shall identify all areas of potential interference between ceiling components and components from other trades. Ceiling Contractor shall coordinate layout requirements with Plumbing, Heating & Ventilation and Electrical Contractors.

2. All areas of the interference which arise following the beginning of ceiling construction shall be reported by the Contractor involved to the General Contractor as soon as the interference is observed. Such interference shall be resolved by the General Contractor with the assistance of the Contractors involved.

B. General

1. Install acoustical ceiling panels and suspension systems, including necessary hangers, grillage, spines, and other hardware supporting the acoustical materials in accordance with

ASTM C - 635 and C - 636.

2. Install suspension systems in accordance with Uniform Building Code Standard No. 47 - 18.

C. Layout

1. Install per manufacturers written instruction and recommendations.

2. Follow reflected ceiling plan on drawings.

3. Acoustical materials shall be installed in a true and even plane, in straight line design with courses laid out symmetrically about center lines of room or area with border units of greatest possible size.

4. Border units shown not be less than 1/2 unit in width.

5. Fissures of tile shall run in one direction within each room or area. Coordinate directions with [Architect/Engineer][Contracting Officer] prior to placing tile.

6. Provide additional hanger wires at light fixtures, diffusers, cubicle tracks, and other ceiling penetrations.

7. Neatly scribe and cut panels to fit tightly to all ceiling penetrations. At reveal edge panels, field or shop trim to conform to factory edge detail at all adjoining surfaces. Finish field cut reveal edges to match panel face surfaces.

8. Provide metal closure moulding at all vertical surfaces and junctures with other materials. Closures shall be neatly formed to provide neat tight closures against all surfaces, including bullnose masonry, and other similar curved or irregular surfaces.

D. Suspension System: Exposed Grid

1. Suspension system shall consist of main tees at 48 inch centers, supported by not less than

12 gauge wires at 48 inch centers maximum. Cross tees at 24 inch centers creating a 24 inch x 24 inch module.

E. Suspension System: Concealed Grid

1. Suspension system shall consist of main tees at 48 inch centers, supported by not less than 12 gauge wires at 48 inch centers maximum. Cross tees and /or access angles shall be spaced at 12 inch centers.

   a. System shall be complete with perimeter moulding, spring clips at perimeter edges, splines, spacer bars to stabilize system, and white vinyl slip-on trim mouldings at recessed light fixtures.

   b. Provide a minimum of 10% accessibility with upward access at locations to be determined in field. Each access panel shall be identified by use of pins with color coated heads. Minimum size of access panels shall be12 inches x 24 inches.

F. Attachment

1. Hanger connection to structure shall develop the full strength of the hanger.

2. Fastening of hangers to existing ceilings will not be permitted. Hangers shall be secured to the structural slab above the existing ceilings using drilled anchors of mechanically expanding design.

3. Method of hanger anchorage to concrete shall be drilled anchors, of a permanent, mechanically expanded type.

4. Hangers shall be attached to steel structure by attachment to steel beams, joists and/or metal deck. Attachment to metal deck shall be by dropping pigtail hangers through holes drilled in the deck or by running hanger through holes drilled in both vertical webs of a flute and tying properly.

5. Where duct work occurs, making it impossible to maintain spacing of hangers, provide additional hangers as required to support larger runners necessary for longer spans. Punching of ducts and extending hangers through ducts will not be permitted.

6. All wire hangers at suspended systems shall be hung vertically. Provide supplemental framing as required.

7. Mail runner shall be installed so that they are all level within 1/8 inch in 12 feet. Leveling shall be performed with the supporting hangers taut to prevent any subsequent downward movement when the ceiling loads are imposed. Local kinks or bends shall not be made in hanger wires as a means of leveling. Hanger wires shall be positively connected to prevent slippage.

8. Cross runners supported by either main runners or by other cross runners shall be installed as the required center distance with 1/32 inch. This tolerance shall be noncumulative beyond 12 feet. Intersecting runners shall form a right angle. Abutting sections of main

runner shall be jointed by means of a suitable connection such as splices, interlocking ends, tab locks, or pin locks.

G. Acoustical Wall and Tack Panels

1. Install on wall surface with specified mechanical fasteners at each corner formed by the wood strips; see drawings.

2. Stretch fabric over core and fully adhere to face with recommended adhesive. Wrap edged and return on back to hold fabric in place.

3. Install additional latex spray layer to back of fabric.

H. Ceiling Light Baffles:

1. Install light baffles in specified ceiling grid and edge moulding. Install in light cove. Ends of panels shall be connected without deviation or offset entire length.

3.3 ADJUST AND CLEAN

A. Clean soiled acoustical treatment after installation. Remove and replace damaged units.

B. Touch up paint may be used to repair minor surface and edge damage with Contracting Officer's approval.

C. Clean premises of all litter, dirt and debris created by work of this Section. Leave premises broom clean.

END OF SECTION

SECTION 09900 - PAINTING

PART 1 - GENERAL

SUMMARY

This Section includes surface preparation, painting and finishing of exposed interior and exterior items and surfaces.

Surface preparation, priming and finish coats specified in this section are in addition to shop-priming and surface treatment specified under other sections of work.

Paint exposed surfaces whether or not colors are designated in "schedules," except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Contracting Officer will select from Vision 2000 Standards.

Painting includes field painting interior and exterior exposed bare and covered pipes and ducts, hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

All items on the roof, whether aluminum or otherwise, are required to be painted.

Painting, unless otherwise indicated, is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts, and labels.

Prefinished items not to be painted, unless otherwise indicated, include the following factory-finished components:

Metal toilet partitions.
Finished mechanical and electrical equipment.
Light fixtures.

Concealed surfaces not to be painted, unless otherwise indicated, include wall or ceiling surfaces in the following generally inaccessible areas:

Furred areas.
Pipe spaces.
Duct shafts.

Finished metal surfaces not to be painted, unless otherwise indicated, include:

Anodized aluminum.
Stainless steel.
Chromium plate.
Copper.

Bronze.
Brass.

Operating parts not to be painted, unless otherwise indicated, include moving parts of operating equipment such as the following:

Valve and damper operators.
Linkages.
Sensing devices.
Motor and fan shafts.

Labels: Do not paint over Underwriter's Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

Related Sections: The following sections contain requirements that relate to this section:

Division 5 Sections for shop priming structural steel, joists and ferrous metal.

Division 8 Section "Standard Steel Doors and Frames" for shop priming steel doors and frames.

Division 9 Section “Special Coatings” for interior special coating applications.

DEFINITIONS

"Paint" includes coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

SUBMITTALS

Product Data: Manufacturer's technical information, label analysis and application instructions for each material proposed for use.

List each material and cross-reference the specific coating and finish system and application.

Identify each material by the manufacturer's catalog number and general classification.

Samples: For initial color selection in the form of manufacturer's color charts.

After color selection, the Contracting Officer will furnish a color schedule for surfaces to be coated.

Samples for verification purposes: Provide samples of each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate. Define each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.

Provide a list of material and application for each coat of each samples. Label each samples as to location and application.

QUALITY ASSURANCE

Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.

Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

Notify the Contracting Officer of problems anticipated using the materials specified.

Material Quality: Provide the manufacturer's best quality paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.

DELIVERY, STORAGE AND HANDLING

Deliver materials to job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and following information:

Product Name or title of material.
Product description (generic classification or binder type).
Federal Specification number, if applicable.
Manufacturer's stock number and date of manufacture.
Contents by volume, for major pigment and vehicle constituents.
Application instructions.
Color name and number.

Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45^{o}F (7^{o}C). Maintain containers used in storage in a clean condition, free of foreign materials and residue. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

JOB CONDITIONS

Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50^{o}F (10^{o}C) and 90^{o}F (32^{o}C), unless otherwise permitted by paint manufacturer's printed instructions.

Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45°F (7°C) and 95°F (35°C), unless otherwise permitted by paint manufacturer's printed instructions.

Do not apply paint in snow, rain, fog or mist; or when relative humidity exceeds 85 percent; or to damp or wet surfaces, unless otherwise permitted by paint manufacturer's printed instructions.

Painting may continue during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

All painting shall be done in favorable lighting conditions.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS

Manufacturer: Subject to compliance with requirements, provide products of one of the following:

The Glidden Company (Glidden).
Benjamin Moore and Co. (Moore).
PPG Industries, Pittsburgh Paints (Pittsburgh).
Pratt and Lambert (P & L).
The Sherwin-Williams Company (S-W).
Porter Paint Co. (Porter).

MATERIALS

Material Quality: Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.

Proprietary names used to designate colors or materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturers.

Federal Specifications establish minimum acceptable quality for paint materials. Provide written certification from paint manufacturer that materials provided meet or exceed these minimums. Manufacturer's products which comply with coating qualitative requirements of applicable Federal Specifications, yet differ in quantitative requirements, may be considered for use when acceptable to Contracting Officer. Furnish material data and manufacturer's certificate of performance to Contracting Officer for any proposed substitutions.

Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.

PART 3 - EXECUTION

COLORS AND FINISHES

Prior to beginning work, the Contracting Officer will furnish color selections for surfaces to be painted.

Use computer matching colors when preparing samples for review.

Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.

Paint Coordination: Provide finish coats which are compatible with prime paints used. Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information on characteristics of finish materials proposed for use, to ensure compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify Contracting Officer in writing of any anticipated problems using specified coating systems with substrates primed by others.

EXAMINATION:

Examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint. Do not begin paint application until unsatisfactory conditions have been corrected.

Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within any particular area.

Do not paint over dirt, rust, scale, grease, moisture, imperfections, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

PREPARATION

General Procedures: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.
Clean surfaces before applying paint or surface treatments. Remove oil and grease prior to cleaning. Schedule cleaning and painting so that dust and other contaminants from cleaning process will not fall on wet, newly painted surfaces.

Surface Preparation: Clean and prepare surfaces to be painted in accordance with the manufacturer's instructions for each particular substrate condition and as specified.

Provide barrier coats over incompatible primes or remove and re-prime. Notify Contracting Officer in

writing of problems anticipated with using specified finish-coat material with substrates primed by others.

Cementitious Materials: Prepare cementitious surfaces of concrete and concrete block to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.

Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.

Wood: Clean surfaces to be painted of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer before application of primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sandpaper smooth when dried.

Prime, stain, or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, and paneling.

Seal tops, bottoms, and cut-outs of unprimed wood doors with a heavy coat of varnish or equivalent sealer immediately upon delivery of job.

Ferrous Metals: Clean non-galvanized ferrous-metal surfaces, that have not been shop-coated; remove oil, grease, dirt, loose mill scale and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council.

Touch-up bare areas and shop-applied coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch-up with same primer as the shop coat.

Galvanized Surfaces: Clean galvanized surfaces with non-petroleum-based solvents so that the surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

Materials Preparation: Carefully mix and prepare paint materials in accordance with manufacturer's directions.

Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.

Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

Use only thinners approved by the paint manufacturer, and only within recommended limits.

Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

APPLICATION

Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

Provide finish coats that are compatible with primers used.

The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.

Apply additional coats when undercoats or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

The term "exposed surfaces" includes areas visible when permanent of built-in fixtures, grilles, and similar components are in place. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.

Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.

Heating and A/C grilles and registers including their cores shall be sprayed to match wall and ceiling color as directed.
Paint interior surfaces of ducts, where visible through registers or grille with a flat, non-specular black paint.

Paint both sides of access panels and removable or hinged covers to match exposed surfaces.

Paint all metal fire extinguisher cabinets located in a finished wall as directed by the Contracting Officer.

Finish doors on tops, bottoms, and side edges same as faces.

Sand lightly between each succeeding enamel coat.

Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.

Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.

Interior painted surfaces will be judged on final appearance only rather than the additional requirements of individual coat mil thickness.

Mechanical and Electrical Work: Painting mechanical and electrical work is limited to exposed items in equipment rooms and in occupied spaces and on the exterior of the building.

Mechanical items to be painted include but are not limited to:

Piping, pipe hangers, supports.
Heat exchangers.
Tanks.
Ductwork.
Insulation.
Supports.
Motors, mechanical equipment and supports.
Accessory items.

Electrical items to be painted include but are not limited to:

Exterior items such as transformers.
Electrical panel covers and boxes.
Conduit and fittings.
Switchgear.
Exposed electrical ducts, troughs, plug molds, etc.

Prime Coat: Before application of finish coats, apply a prime coat of material as recommended by the manufacturer to material that is required to be painted or finished and has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to assure a finish coat with no burn through or other defects due to insufficient sealing.

Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks, or other surface imperfections.

Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.

Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

FIELD QUALITY CONTROL

The Government reserves the right to invoke the following test procedure at any time and as often as the Government deems it necessary during the period when paint is being applied:

The Government may engage the services of an independent testing laboratory to sample the paint material being used. Samples of material delivered to the project will be taken, identified, sealed, and certified in the presence of the Contractor.

If test results show material being used does not comply with specified requirements, the Contractor may be directed to stop painting, remove non-complying paint, pay for testing, repaint surfaces coated with rejected paint, and remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.

CLEANING

Clean-up: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

Upon completion of painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping, using care not to scratch or damage adjacent finished surfaces.

PROTECTION

Protect work of other trades, whether to be painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Contracting Officer.

Provide "Wet Paint" signs to newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

At the completion of construction activities of other trades, touch-up and restore all damaged or defaced painted surfaces.

EXTERIOR PAINT SCHEDULE

General: Provide the following paint systems for the various substrates indicated.

Ferrous Metal: Primer is not required on shop-primed items.

High-Gloss Alkyd Enamel: 2 finish coats over primer.

Primer: Synthetic Rust-Inhibiting Primer. (DFT 1.3 mils minimum)
First Coat: High-Gloss Alkyd Enamel. (DFT 3.0 mils minimum)
Second Coat: High-Gloss Alkyd Enamel. (DFT 3.0 mils minimum)

Zinc-Coated Metal:

High-Gloss Alkyd Enamel: 2 finish coats over primer and preparatory coat.

Preparatory Coat: Phosphoric acid solution equal to GALVAPREP #5.

Primer: Galvanized Metal Primer. (DFT 1.2 mils minimum)
First Coat: High-Gloss Alkyd Enamel. (DFT 2.6 mils minimum)
Second Coat: High-Gloss Alkyd Enamel. (DFT 2.6 mils minimum)

Aluminum:

High-Gloss Alkyd Enamel: 2 finish coats over primer.

Primer: Alkyd-type Zinc Chromate Primer. (DFT 1.4 mils minimum)
First Coat: Alkyd High-Gloss Enamel. (DFT 2.6 mils minimum)
Second Coat: Alkyd High-Gloss Enamel. (DFT 2.6 mils minimum)

INTERIOR PAINT SCHEDULE

General: Provide the following paint systems for the various substrates as indicated:

Concrete and Concrete Masonry Units:

1st Coat: Surface Block Filler. (See note below) (DFT 5.0 mils minimum)
2nd Coat: Interior Low-Luster Satin Latex Wall Paint. (DFT 2.8 mils minimum)
3rd Coat: Interior Low-Luster Satin Latex Wall Paint. (DFT 2.8 mils minimum)

Apply filler coat at a rate to ensure complete coverage with pores filled to obtain a stipple finish with paint coatings.

Gypsum Drywall Systems:

1st Coat: - Interior Latex Base Primer Coat. (DFT 1.2 mils minimum)
2nd Coat: - Interior Low-Luster Satin Latex Wall Paint. (DFT 2.8 mils minimum)
3rd Coat: - Interior Low-Luster Stain Latex Wall Paint. (DFT 2.8 mils minimum)

Aluminum: (Only where indicated to be painted).

1st Coat: - Universal Metal Primer. (DFT 1.2 mils minimum)
2nd Coat: - Semi-Gloss Alkyd Enamel. (DFT 1.4 mils minimum)
3rd Coat: - Semi-Gloss Alkyd Enamel. (DFT 1.4 mils minimum)

Ferrous Metal:

1st Coat: - Synthetic Rust-Inhibiting Primer. (DFT 1.5 mils minimum)
2nd Coat: - Semi-Gloss Alkyd Enamel. (DFT 1.4 mils minimum)
3rd Coat: - Semi-Gloss Alkyd Enamel. (DFT 1.4 mils minimum)
First coat not required on items that are shop primed.

Zinc-Coated Metal:

1st Coat: - Phosphoric acid solution equal to Galvaprep #5.
2nd Coat: - Zinc Dust-Zinc Oxide Primer. (DFT 1.2 mils minimum)
3rd Coat: - Enamel Undercoat. (DFT 1.2 mils minimum)
4th Coat: - Semi-Gloss Alkyd Enamel. (DFT 1.4 mils minimum)

Opaque Woodwork:

1st Coat: - Interior Enamel Undercoat. (DFT 1.2 mils minimum)
2nd Coat: - Odorless Interior Semi-Gloss Enamel. (DFT 2.6 mils minimum)
3rd Coat: - Odorless Interior Semi-Gloss Enamel. (DFT 2.6 mils minimum)

Stained Woodwork:

Stained Varnish Satin Finish: 3 finish coats over stain plus filler on open-grain wood. Wipe filler before applying first varnish coat.

Stain Coat: Oil-type Interior Wood Stain. (Spreading rate as recommended by mfgr.)
First Coat: Sanding Sealer. (Spreading rate as recommended by mfgr.)
Filler Coat: Paste Wood Filler. (Spreading rate as recommended by mfgr.)
Second Coat: Oil Base Satin Varnish. (Spreading rate as recommended by mfgr.)
Third Coat: Oil Base Satin Varnish. (Spreading rate as recommended by mfgr.)

Exposed Structure, including but not limited to structural steel, girts, joists, girders, metal deck, and miscellaneous exposed steel:

Apply one (1) coat over shop primer equal to Porter Paints,
"Dry Fog White #36424". (DFT 1.5 mils minimum)

Walls, panels, glass & glazing shall be protected from overspray.

Cotton or Canvas Covering Over Insulation on Piping and Ductwork:

1st (size) Coat: - Interior Latex Emulsion. (Spreading rate as recommended by mfgr.)
2nd Coat: - Interior Latex Emulsion. (Spreading rate as recommended by mfgr.)
Add fungicidal agent to render fabric mildew-proof.

END OF SECTION 09900

SECTION 10155 - TOILET COMPARTMENTS

PART 1 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Division 1 Specification Sections, apply to this section.

SUMMARY

Types of toilet compartments include:

Metal with baked enamel finish.

Styles of toilet compartments include:

Floor-anchored, overhead braced.

Styles of screens include:

Wall-hung.

Toilet accessories, such as toilet paper holders and grab bars are specified elsewhere in Division 10.

SUBMITTALS

Product Data: Submit manufacturer's detailed technical data for materials, fabrication, and installation, including catalog cuts of anchors, hardware, fastenings, and accessories.

Shop Drawings: Submit shop drawings for fabrication and erection of partition assemblies not fully described by product drawings, templates and instructions for installation of anchorage devices built into other work.

Samples: Submit full range of color samples of each type of unit required. Submit 6 inch x 6 inch samples of each color and finish on same substrate to be used in work, for color verification after selections have been made.

QUALITY ASSURANCE

Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, to ensure proper fitting of work. Allow for adjustments within specified tolerances.

Coordination: Furnish inserts and anchorages which must be built into other work for installation of toilet

compartments and related items. Coordinate delivery with other work to avoid delay.

PART 2 - PRODUCTS

MANUFACTURERS

Manufacturer: Subject to compliance with requirements, provide products of one of the following:

Steel-Baked Enamel Finish:

All American Metal Corp.
American Sanitary Partition Corp.
AMPCO Products, Inc.
Global Steel Products Corp.
Metpar Steel Products Corp.
Sanymetal Products Co.

MATERIALS

General: Provide materials which have been selected for surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are not acceptable.

Steel Sheets for Baked Enamel Finish: ASTM A 591, Class C, galvanized-bonderized, of following minimum thicknesses:

Pilaster (overhead-braced): 20 gage
Pilasters (unbraced): 18 gage
Panels and Screens: 20 gage
Doors: 22 gage

Concealed Anchorage Reinforcement: Minimum 12-gage galvanized steel sheet.

Concealed Tapping Reinforcement: Minimum 14-gage galvanized steel sheet.

Core Material for Metal Partitions: Manufacturer's standard sound-deadening honeycomb of impregnated Kraft paper, in thickness to provide finished dimension of 1" minimum for doors, panels, and screens; 1-1/4" minimum for pilasters.

Pilaster Shoes and Caps: ASTM A 167, Type 302/304 stainless steel, not less than 3" high, 20-gage, finished to match hardware.

Stirrup Brackets: Manufacturer's standard design for attaching panels to walls and pilasters, either

chromium-plated non-ferrous cast alloy ("Zamac") or anodized aluminum.

Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories of chromium-plated non-ferrous cast alloy ("Zamac").

Overhead Bracing: Continuous extruded aluminum, antigrip profile, with clear anodized finish.

Anchorage and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, chromium-plated steel, or brass finished to match hardware, with theft-resistant type heads and nuts. For concealed anchors, use hot-dip galvanized cadmium-plated, or other rust-resistant protective-coated steel.

FABRICATION

General: Furnish standard doors, panels, screens, and pilasters fabricated for compartment system, unless otherwise indicated. Furnish units with cutouts, drilled holes, and internal reinforcement to receive partition-mounted hardware, accessories, and grab bars, as indicated.

Doors Dimensions: Unless otherwise indicated, furnish 24" wide in-swinging doors for ordinary toilet stalls and 32" wide (clear opening) doors at stalls equipped for use by handicapped. Door swing for handicap stalls shall be as indicated on drawings.

METAL TOILET PARTITIONS AND SCREENS

General: Pressure laminate seamless face sheets to core materials and seal edges with continuous interlocking strips or with lapped and formed edges. Weld edges and corners, with exposed welds ground smooth.

Overhead-Braced Partitions: Furnish galvanized steel supports and leveling bolts at pilasters, as recommended by manufacturer to suit floor conditions. Make provisions for setting and securing continuous extruded aluminum anti-grip overhead-bracing at top of each pilaster. Furnish shoe at each pilaster to conceal supports and leveling mechanism.

Wall-Hung Screens: Furnish 24" wide x 42" high panel units of same construction and finish as partition system panels.

Hardware: Furnish hardware for each compartment to comply with ANSI A 117.1 and ADA Accessibility Guidelines for Buildings and Facilities for handicapped accessibility and as follows:

Hinges: Cutout inset type, adjustable to hold door open at any angle up to 90 degrees. Provide gravity type, spring-action cam type, or concealed torsion rod type, to suit manufacturer's standards.

Latch and Keeper: Manufacturer's standard surface-mounted latch unit, designed for handicapped accessibility emergency access, with combination rubber-faced door strike and keeper.

Coat Hook: Manufacturer's standard unit, combination hook and rubber-tipped bumper, sized to prevent door hitting mounted accessories.

Door Pull: Manufacturer's standard unit for out-swing doors. Provide pulls on both faces of handicapped compartment doors.

FINISHES

Baked Enamel Finish:

Clean galvanized steel surfaces after fabrication and before application of enamel coating system, to remove processing compounds, oils, and other contaminants.

Prime metal with baked-on rust inhibitive primer.

Apply two coats of thermostating enamel finish, applied by electrostatic process, and baked in accordance with paint manufacturer's instructions.

Colors: Combination of manufacturer's standard colors as selected by Contracting Officer.

PART 3 - EXECUTION

INSTALLATION

General: Comply with manufacturer's recommended procedures and installation sequence. Install compartment units rigid, straight, plumb, and level. Provide clearances of not more than 1/2" between pilasters and panels, and not more than 1" between panels and walls. Secure panels to walls with not less than two stirrup brackets attached near top and bottom of panel. Locate wall brackets so that holes for wall anchorages occur in tile joints. Secure panels to pilasters with not less than two stirrup brackets located to align with stirrup brackets at wall. Secure panels in position with manufacturer's recommended anchoring devices.

Overhead-Braced Compartments: Secure pilasters to floor and level, plumb, and tighten installation with devices furnished. Secure overhead-brace to each pilaster with not less than two fasteners. Hang doors and adjust so that tops of doors are parallel with overhead-brace when doors are in closed position.

Screens: Attach with anchoring devices as recommended by manufacturer to suit supporting structure. Set units to provide support and to resist lateral impact.

ADJUST AND CLEAN

Hardware's Adjustment: Adjust and lubricate hardware for proper operation. Set hinges on in-swinging

doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors (and entrance swing doors) to return to fully closed position.

Clean exposed surfaces of partition systems using materials and methods recommended by manufacturer, and provide protection as necessary to prevent damage during remainder of construction period.

END OF SECTION 10155

SECTION 10425 - SIGNS

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section includes the following types of signs:

Panel signs.

Dimensional letters and numbers.

SUBMITTALS

General: Submit the following in accordance with Conditions of the Contract and Division 1 Specification Sections.

Product Data: Include manufacturer's construction details relative to materials, dimensions of individual components, profiles, and finishes for each type of sign required.

Shop Drawings: Provide shop drawings for fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, reinforcement, accessories, layout, and installation details.

Provide message list for each sign required, including large-scale details of wording and layout of lettering.

For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed.

Furnish full-size spacing templates for individually mounted dimensional letters and numbers.

Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.

Samples for initial selection of color, pattern, and texture:

Cast Acrylic Sheet and Plastic Laminate: Manufacturer's color charts consisting of actual sections of material including the full range of colors available for each material required.

Aluminum: Samples of each finish type and color, on 4-inch squares of sheet or plate, showing the full range of colors available.

Samples for verification of color, pattern, and texture selected, and compliance with requirements indicated:

Cast Acrylic Sheet and Plastic Laminate: Provide a sample panel not less than 8-1/2 inches by 11 inches for each material indicated. Include a panel for each color, texture, and pattern required. On each panel include a representative sample of the graphic image process required, showing graphic style, and colors and finishes of letters, numbers, and other graphic devices.

Aluminum: Samples of each finish type and color, on 4-inch squares of sheet or plate. Where finishes involve normal color and texture variations include sample sets showing the full range of variations expected.

QUALITY ASSURANCE

Single-Source Responsibility: For each separate type of sign required, obtain signs from one source from a single manufacturer.

PROJECT CONDITIONS

Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

PART 2 -PRODUCTS

MATERIALS

Cast Acrylic Sheet: Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested in accordance with ASTM D 790, a minimum allowable continuous service temperature of 176°F (80°C), and of the following general types:

Transparent Sheet: Where sheet material is indicated as "clear," provide colorless sheet in matte finish, with light transmittance of 92 percent, when tested in accordance with the requirements of ASTM D 1003.

White Translucent Sheet: Where sheet material is indicated as "white, provide white translucent sheet of density required to produce uniform brightness and minimum halation effects.

Opaque Sheet: Where sheet material is indicated as "opaque," provide colored opaque acrylic sheet in colors and finishes as selected from the manufacturer's standards.

Aluminum Sheet: Provide aluminum sheet of alloy and temper recommended by the aluminum producer or finisher for the type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B 209 for 5005-H15.

ABS Plastic: Provide high-impact thermoplastic composed of copolymers of acrylonitrile, butadiene, and styrene.

Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.

Colored Coatings for Acrylic Plastic Sheet: Use colored coatings, including inks and paints for copy and background colors, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are non-fading for the application intended.

PANEL SIGNS

Panel Signs for Exterior Room Identification: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally.

Framed Panel Signs for Interior Room Identification: Fabricate frames to profile indicated; comply with the following requirements for materials and corner conditions:

Material: Manufacturer's standard.

Corner Condition: Corners rounded to radius indicated.

Graphic Content and Style: Provide sign copy that complies with the requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices.

Raised Copy: Machine-cut copy characters from matte-finish opaque acrylic sheet and chemically weld onto the acrylic sheet forming sign panel face. Produce precisely formed characters with square cut edges free from burrs and cut marks.

Panel Material: Matte-finished opaque acrylic sheet.

Raised Copy Thickness: Not less than 1/32 inch.

Finish: Satin face, dark statuary matte edge.

Colors: As selected by Contracting Officer from full range of manufacturer's colors.

Pictograph Signage: Minimum 1/32" raised copy, symbol and braille. Braille shall be grade 2, flush with surface of sign.

Copy: As selected by Contracting Officer.

Sectional Signage: Minimum 1/32" raised copy and braille. Braille shall be grade 2, flush with surface of sign.

Copy: As selected by Contracting Officer.

Frames: Equal to JRS 640. Signs shall be held in frames with 1" magnetic stripping and steel plates.

Colors: As selected by Contracting Officer.

DIMENSIONAL LETTERS AND NUMBERS

Letters and Numbers: Form individual letters and numbers to produce characters with smooth, flat faces, sharp corners, and precisely formed lines and profiles, free from pits, scale, sand holes, or other defects. Comply with requirements indicated for finish, style, and size.

Letter Height: 48 inches.

Letter Style: Helvetica medium.

FINISHES

Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches as selected by the Architect from the manufacturer's standards.

Aluminum Finishes: Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

Baked-Enamel Finish: AA-M4xC12C42R1x (Mechanical Finish: Manufacturer’s standard, other nondirectional textured; Chemical Finish: Chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: as specified below). Apply baked enamel in compliance with paint manufacturer’s specifications for cleaning, conversion coating, and painting.

PART 3 - EXECUTION

INSTALLATION

General: Provide Room Identification Sign for each room at interior and exterior locations as indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.

Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.

Wall Mounted Panel Signs: Attach panel signs to wall surfaces using methods recommended by the manufacturer.

CLEANING AND PROTECTION

At completion of the installation, clean soiled sign surfaces in accordance with the manufacturer's instructions. Protect units from damage.

END OF SECTION 10425

SECTION 10522 - FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 - GENERAL

RELATED DOCUMENTS

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

SUMMARY

This Section includes the following:

Fire extinguishers

Fire extinguisher cabinets.

Mounting brackets.

SUBMITTALS

Product data for each type of product specified. For fire extinguisher cabinets include rough-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style, door construction, panel style, and materials.

Samples for initial selection purposes in form of manufacturer's color charts showing full range of colors available for those units with factory-applied color finishes.

QUALITY ASSURANCE

Single-Source Responsibility: Obtain fire extinguishers and cabinets from one source from a single manufacturer.

Coordination: Verify that fire extinguisher cabinets are sized to accommodate fire extinguishers of type and capacity indicated.

UL-Listed Products: Fire extinguishers shall be UL-listed and bear UL "Listing Mark" for type, rating, and classification of extinguisher.

PART 2 - PRODUCTS

MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by one of the following:
J.L. Industries.

Larsen's Manufacturing Co.
Modern Metal Products by Muckle.

FIRE EXTINGUISHERS

General: Provide fire extinguishers for each extinguisher cabinet and other locations indicated, in colors and finishes selected by Contracting Officer from manufacturer's standard, which comply with requirements of governing authorities.

Fill and service extinguishers to comply with requirements of governing authorities and manufacturer.

Multipurpose Dry Chemical Type: UL-rated 4-A:60-B:C, 10-pound nominal capacity, in enameled steel container.

MOUNTING BRACKETS

Provide brackets designed to prevent accidental dislodgement of extinguisher, of sizes required for type and capacity of extinguisher indicated, in plated finish.

Provide brackets for extinguishers not located in cabinets.

FIRE EXTINGUISHER CABINETS

General: Provide fire extinguisher cabinets, of suitable size for housing fire extinguishers of types and capacities indicated.

Construction: Manufacturer's standard enameled steel box, with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld all joints and grind smooth. Miter and weld perimeter door frames.

Cabinet Type: Suitable for mounting conditions indicated, of the following types:

Semi-recessed: Cabinet box (tub) partially recessed in walls of shallow depth.

Trim Style: Fabricate trim in one piece with corners mitered, welded, and ground smooth.

Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

Rolled-Edge Trim with 2-1/2 inch backbend depth.

Trim Metal: Of same metal and finish as door.

Door Material and Construction: Manufacturer's standard door construction, of material indicated, coordinated with cabinet types and trim styles selected.

Enameled Steel: Manufacturer's standard finish, hollow steel door construction with tubular stiles and rails.

Door Style: Manufacturer's standard design.

Duo-Panel: Acrylic, clear 1/4-inch thick, vertical.

Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide door pull, exposed or concealed and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

Identify fire extinguisher in cabinet with FIRE EXTINGUISHER lettering applied to door. Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location.

Application Process: Silk screen.

Identify bracket-mounted extinguishers with FIRE EXTINGUISHER in red letter decals applied to wall surface. Use letter size, style, and location as selected by Contracting Officer.

FINISHES FOR FIRE EXTINGUISHER CABINETS, GENERAL

Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

Protect mechanical finishes on exposed surfaces from damage by application of strippable, temporary protective covering prior to shipment.

STEEL FIRE EXTINGUISHER CABINET FINISHES

Surface Preparation: Solvent-clean surfaces in compliance with SSPS-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel in compliance with SSPC-SP 5 (White Metal Blast Cleaning) or SSPC-SP8 (Pickling).

Baked Enamel Finish: Immediately after cleaning and pretreatment, apply manufacturer's standard 2-coat baked enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's instructions for application and baking to achieve a minimum dry film thickness of 2.0 mils.

Color and Gloss: As selected by Contracting Officer from manufacturer's standard choices for color and gloss.

Paint the following:

Exterior and interior of cabinet.

PART 3 - EXECUTION

INSTALLATION

Follow manufacturer's printed instructions for installation.

Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.

Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.

Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.

Where exact location of surface-mounted cabinets and bracket-mounted fire extinguishers is not indicated, locate as directed by Contracting Officer.

END OF SECTION 10522

SECTION 10800 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

RELATED DOCUMENTS

Drawing and general provisions of Contract, including General and Division 1 Specification Sections, apply to this section.

SUMMARY

This section includes toilet and bath accessory items as scheduled.

Toilet compartments and related accessories are specified in Section 10155.

SUBMITTALS

Product Data for each toilet accessory item specified, including details of construction relative to materials, dimensions, gages, profiles, method of mounting, specified options, and finishes.

Schedule indicating types, quantities, sizes, and installation locations (by room) for each toilet accessory item to be provided for project.

Setting Drawings: Where cutouts are required in other work, provide templates, substrate preparation instructions, and directions for preparing cutouts and for installation of anchorage devices.

QUALITY ASSURANCE

Inserts and Anchorages: Furnish accessory manufacturers' standard inserts and anchoring devices that must be set in concrete or built into masonry; coordinate delivery with other work to avoid delay.

Single-Source Responsibility: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise acceptable to Contracting Officer.

PROJECT CONDITIONS

Coordination: Coordinate accessory locations, installation, and sequencing with other work to avoid interference with and ensure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide toilet accessories by one of the following:

American Specialties, Inc.
Bobrick Washroom Equipment, Inc.
Bradley Corporation.
McKinney/Parker.

MATERIALS, GENERAL

Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 22-gage (.034 inch) minimum thickness, unless otherwise indicated.

Brass: Leaded and unleaded, flat products, ASTM B 19; rods, shapes, forgings, and flat products with finished edges, ASTM B 16, castings, ASTM B-30.

Sheet Steel: Cold-rolled, commercial quality ASTM A 366, 20-gage (.040 inch) minimum, unless otherwise indicated. Surface preparation and metal pretreatment as required for applied finish.

Galvanized Steel Sheet: ASTM A 527, G60.

Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.

Mirror Glass: Nominal 6.0 mm (0.23 inch) thick, conforming to ASTM C 1036, Type I, Class I, Quality q2, and with silvering, electro-plated copper coating, and protective organic coating.

Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.

Fasteners: Screws, bolts, and other devices of same material as accessory unit or of galvanized steel where concealed.

FABRICATION

General: No names or labels are permitted on exposed faces of toilet and bath accessory units. On either interior surface not exposed to view or on back surface, provide identification of each accessory item by either a printed, waterproof label or a stamped nameplate indicating manufacturer's name and product model number.

Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.

Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all welded construction, without mitered corners. Hang doors or access panels with full-length stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed.

Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing, and re-supply. Provide minimum of six keys to Contracting Officer.

PART 3 - EXECUTION

INSTALLATION

Install toilet accessory units in accordance with manufacturer's instructions, using fasteners appropriate to substrate and recommended by manufacturer of unit. Install units plumb and level, firmly anchored in locations and at heights indicated.

ADJUSTING AND CLEANING

Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.

Clean and polish all exposed surfaces in strict accordance with manufacturer's recommendations after removing temporary labels and protective coatings.

TOILET ACCESSORY SCHEDULE

A. Toilet tissue dispenser shall be equal to ASI, Model 0715, surface mounted double roll toilet tissue dispenser fabricated of heavy gage satin chrome plated steel.

B. Recessed paper towel dispenser and waste receptacle equal to ASI, Model 0469.

C. Mirror, Re: Specification Section 08800.

D. All purpose Lav-basin soap dispenser equal to ASI, Model 0330.

E. Shower curtain rod shall be equal to American Specialties, Inc., Model 1206, 1" diameter stainless steel tubing with satin finish. Provide rods complete with stainless steel flanges equal to ASI, Model 1209.

F. Shower curtain shall be equal to American Specialties, Inc., Model 1200, 100% 8 ounce sanforized white duck, bleached and mildew resistant with rustproof chrome plated nylon reinforced grommets. Curtain shall be 12" wider than the opening. Provide curtain complete with chrome finish shower curtain hooks. Field verify curtain heights.

G. Recessed ceramic tile soap dish. Refer to Spec. Section 09300.

H. Double robe hook shall be equal to Bobrick Washroom Equipment, Inc. Model B-672, polished

stainless steel.

I. Surface mounted napkin disposal shall be equal to ASI, Model 0852. Furnish with disposable wet-strength paper liner.

J. Surface mounted vertical soap dispenser shall be equal to ASI, Model 0343, satin finish, with all purpose liquid soap valve and refill window.

K. Surface mounted paper towel dispenser - petite shall be equal to ASI, Model 0215, satin finish stainless steel.

END OF SECTION 10800

SECTION 15010 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Division 1 Specification Sections, apply to this and the other sections of Division 15.

1.2 SUMMARY

A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:

Submittals.
Coordination drawings.
Record documents.
Maintenance manuals.
Rough-ins.
Mechanical installations.
Cutting and patching.

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

1. Division 15 Section "ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT," for factory-installed motors, controllers, accessories, and connections.

2. Division 15 Section "BASIC MECHANICAL MATERIALS AND METHODS," for materials and methods common to the remainder of Division 15, plus general related specifications including:

Access to mechanical installations.

Excavation for mechanical installations within the building boundaries, and from building to utilities connections.

1.3 EXAMINATION OF SITE

A. Visit the site, inspect the existing conditions and check the drawings and specifications so as to be fully informed of the requirements for completion of the work.

B. Lack of such information shall not justify an extra to the contract price.

1.4 SCOPE

A. The Mechanical Work shall include labor, materials, and equipment to install systems and place in proper working order, as shown on plans and hereinafter specified. The installation shall include all labor, materials, tools, transportation, equipment, services and facilities, required for the complete, proper and substantial installation of all mechanical work shown on the plans, and/or outlined in these specifications. The installation shall include all materials, appliances, and apparatus not specifically mentioned herein or noted on the drawings but which are necessary to make a complete working installation of all mechanical systems.

B. By bidding, this contractor acknowledges his understanding of the work to be done and agrees to install complete and workable systems.

1.5 CODES

A. Execute work in compliance with all applicable Federal, State and Municipal laws, codes, ordinances, and local customs regarding the trade to perform the work.

B. Codes shall govern in case of any direct conflict between codes and plans and specifications; except when plans and specifications require higher standards than those required by code. Variance from the plan and specifications made to comply with code must be approved by the Architect and Base CEEE. If approved they shall be made with no increased cost to the Government.

C. In addition, the following published Standards and Regulations shall be adhered to as applicable to the work involved.

Latest issue of the Local, State, and National Plumbing Codes
Latest issue of the ASHRAE Guide
Latest issue of the SMACNA Handbook
Applicable NFPA Pamphlets
Applicable ANSI Standards

American Society of Mechanical Engineers Boiler Code
American Society of Mechanical Engineers Unfired
Pressure Vessel Code
American Standards Association Code for Mechanical
Occupational Safety and Health Act
Current Editions of Uniform Building Code, Uniform Mechanical Code,
Uniform Plumbing Code
Latest issue of the State Air Pollution Control Regulations
Rules of the State Boiler Inspection Department
Americans with Disabilities Act of 1990

1.6 DEFINITIONS

A. It shall be understood that the drawings and specifications complement one another and items specified shall also meet the criteria set forth on the drawings.

B. Where any device or item is referred to in the singular sense (such as "the unit"), such reference applies to as many devices as are required to complete the installation as shown on the drawings.

C. The term "work" shall mean all obligations imposed upon the Contractor by the Contract Documents.

1.7 ABBREVIATIONS

ADA	Americans with Disabilities Act of 1990
AGA	American Gas Association
AISI	American Iron and Steel Institute
AMCA	Air Moving and Conditioning Association, Inc.
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigeration & Air-Conditioning Engineers, Inc.
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
BPVC	Boiler and Pressure Vessel Code of ASME
CISPI	Cast Iron Soil Pipe Institute
NFPA	National Fire Protection Association
SMACNA	Sheet Metal and Air-Conditioning Contractors National Association, Inc.
UL	Underwriters' Laboratories, Inc.
ETL	ETL Testing Laboratories, Inc.
OSHA	Occupational Safety and Health Administration
NBI	National Boiler Inspection Code

1.8 PERMITS

A. Obtain and pay for all licenses and permits, fees, inspection and certificates required for the execution of this work.

B. Pay fees and charges for connection to outside services and use of property.

C. Deliver permits and certificates to the Architect for transmittal to the Government.

1.9 RESPONSIBILITY

A. This contractor will be held responsible for any and all damage to any part of the building or to the work of other contractors, as may be caused through his operation.

B. The operation and maintenance of the Mechanical Plant during construction shall be the responsibility of this contractor until the acceptance of the building by the Government.

C. The General Contractor shall pay for all fuel cost for operation of the plant.

D. This Contractor shall make all provisions for entry of equipment, installed under this Contract, to the installed location. This Contractor shall provide openings in existing construction if necessary. This Contractor shall do all repair necessary to restore the building to the original condition. During the period of entry of equipment and removal of trash, no disruption of the Government's normal business shall occur.

1.10 WORKMANSHIP AND COORDINATION

A. Make installation substantially as shown on the plans.

B. Pipe and duct routing and equipment location shown on the drawings are schematic in nature. Make alterations in location of apparatus or piping as may be required to conform to building construction without extra charge.

C. Equipment service clearances, per equipment manufacturers specifications, shall be maintained from general construction. No pipe or ductwork shall be installed within these clearances. No piping, coils, or ductwork shall be installed above electrical panels, starters or switchgear, or in elevator equipment rooms.

D. Cooperate with other contractors in their installation of work.

E. The duct work shall take precedence over all pipe work except where it is necessary to maintain an even grade on the piping.

F. Use only experienced mechanics.

1.11 MATERIALS

A. Material and equipment shall be new, of best quality and design and free from defects. A manufacturer's nameplate affixed in a conspicuous place will be required on each major component of equipment stating manufacturer's name, address and catalog number.

1.12 EXCAVATION AND BACKFILLING

A. All work shall be in accordance with Section "EARTHWORK".

B. Do all excavation required for water, gas, sewer, drainage, etc.

C. Contractor shall do all shoring and bracing necessary per OSHA requirements to perform the work and as required for safety.

D. Backfill and tamp the earth around pipes and bring to required level. Compact to percentage amount specified in Section "EARTHWORK"

E. Fill carefully to prevent future settlement.

F. Backfill trenches under concrete floor, drive, or walks, with sand, crushed rock, or gravel in manner to prevent future settlement. Backfilling of trenches shall be in conformance with requirements for earthwork in the Architectural Specifications.

G. Street and alley pavement surfaces damaged must be repaired to the satisfaction of the local authorities.

1.13 TESTING

A. Furnish testing equipment and test all piping systems under methods and conditions as specified.

B. Test for a period of not less than 12 hours in the presence of the Architect.

C. Make all necessary replacements and repair and repeat tests until the entire system is approved and satisfactory.

D. Test under pressure with liquid or gas as directed or specified.

1.14 SUBMITTALS

A. General: Follow the procedures specified in Division 1 Section “SUBMITTALS."

B. Increase, by the quantity listed below, the number of mechanical related shop drawings, product data, and samples submitted, to allow for required distribution plus one copy of each submittal required, which will be retained by the Mechanical Consulting Engineer.

Shop Drawings - Initial Submittal: 1 additional blue- or black-line prints.

Shop Drawings - Final Submittal: 1 additional blue- or black-line prints.

Product Data: 1 additional copy of each item.

Samples: 1 additional set.

C. Additional copies may be required by individual sections of these Specifications.

D. Submittal of shop drawings, product data, and samples will be accepted only when signed and submitted by The Mechanical Contractor and the General Contractor. Data submitted from subcontractors and material suppliers directly to the Architect/Engineer will not be processed.

E. Shop drawings submitted without contractor's signature or approval and verification will not be approved. Quantities will not be checked or verified. It is the contractors responsibility to provide the proper quantities required to complete the job.

F. Portions of the work requiring a shop drawing submittal shall not begin until the shop drawing has been approved by the Engineer.

G. Submit wiring diagrams for all mechanical equipment requiring field wiring clearly showing all required connections. This contractor will send one copy of Engineer approved shop drawings to the Electrical Contractor with a transmittal letter. Forward one copy of the transmittal letter to the Engineer's office.

H. Where catalog cuts are used, mark them to indicate equipment, capacities, controls, fittings, valves, sizes, etc.

I. Reference each item to applicable specification paragraph number and plan sheet number. Reference items not appearing in base specification to applicable alternate numbers, change order numbers, letters of authorization, etc.

J. Engineers acceptance of Compliance Submittals will not relieve Contractor from his responsibility for any deviations from the requirements of the Contract Documents unless Contractor has in writing called Engineer's attention to such deviation at the time of submission and Engineer has given written approval to the specific deviation, nor shall any acceptance by Engineer relieve Contractor from responsibility for errors or omissions in Compliance Submittals.

1.15 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Refer to the Instructions to Bidders and the Division 1 Section “SUBMITTALS" for requirements in selecting products and requesting substitutions.

1.16 PRODUCT LISTING

A. Prepare listing of major mechanical equipment and materials for the project.

B. Provide all information requested.

C. Submit this listing as a part of the submittal requirement specified in the Division 1 Section.

D. When two or more items of same material or equipment are required (plumbing fixtures, pumps, valves, air conditioning units, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in Work, except as otherwise indicated.

Provide products which are compatible within systems and other connected items.

1.17 MECHANICAL COORDINATION DRAWINGS

A. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of piping, ductwork, equipment, hangers, and materials. Include the following:

   Clearances for installing and maintaining insulation.

   Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.

   Equipment connections and support details.

   Exterior wall and foundation penetrations.

   Fire-rated wall and floor penetrations.

   Underground piping.

   Sizes and location of required concrete pads and bases.

   Numbered valve location diagrams.

   Valve stem movement.

   Pipe expansion loops.

B. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

C. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

D. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

E. Submit a reproducible drawing to Architect to review for completeness. These drawings will be reviewed and returned with comments. They will not be approved as a shop drawing.

1.18 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1 Section "AS-BUILT DRAWINGS." These drawings shall reflect the actual "As-Built" condition including any change orders, of the mechanical systems and installation. In addition to the requirements specified in Division 1, indicate the following installed conditions:

1. Ductwork mains and branches, size and location, for both exterior and interior; locations of dampers and other control devices; filters, boxes, and terminal units requiring periodic maintenance or repair.

2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Refer to Division 15 Section "MECHANICAL IDENTIFICATION." Indicate actual inverts and horizontal locations of underground piping.

3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.

4. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

5. Contract Modifications, actual equipment and materials installed.

1.19 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1 Section “GUARANTEE." In addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

4. Servicing instructions and lubrication charts and schedules.

1.20 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

Adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.

C. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

D. All spiral duct stored at jobsite shall have ends of duct covered dust tight with plastic. All fans and coils stored in non enclosed areas shall be covered with plastic to prevent moisture dirt and debris from entering. All coils shall be protected from physical damage by plywood or masonite.

E. All piping, valves, plumbing fixtures, motors and equipment stored in non-enclosed areas shall be covered with plastic to prevent moisture, dirt and debris from entering.

PART 2 - PRODUCTS

NOT APPLICABLE

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. The Contractor shall field verify all existing conditions and dimensions. The Contractor shall make field adjustments as required to accommodate the new work.

B. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

3.2 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other building components, including the structure, fire sprinklers, and the electrical lights and equipment.

2. Verify all dimensions by field measurements.

3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.

4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.

9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

11. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "ACCESS DOORS" and Division 15 Section "BASIC MECHANICAL MATERIALS AND METHODS."

12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope, or systems requiring a fixed access clearance.

13. The Mechanical Contractor shall locate and mark the location of all holes and openings which require blocking out, cutting or core drilling.

14. Contractor shall review with Owner location, accessibility, and method of operating all domestic water and HVAC shut-off valves located in plumbing chases, ceiling cavity and mechanical rooms.

15. This contractor shall assist with and provide supervised start-up of the, hot water and chilled water systems, involving air venting, drainage, etc. Monitor the air venting until all air has been eliminated from the building system and the lines within the buildings are completely filled with fluid.

16. The ceiling cavity space is limited. Therefore the ductwork and piping locations shall be closely coordinated with each other as well as the lights, ceiling height, electrical conduit and fire sprinkler piping.

17. It is the intent, where possible to locate the domestic water piping, gas piping, fire sprinkler piping, and HVAC piping above the ductwork and tight to the structure.

18. Selected pipe and duct elevations are shown on the plans as an aid to the contractor in their installation. Where necessary, due to conflicts, these items may be changed as long as conflict with other items does not occur.

19. Ductwork and piping shall rise into the joist or beam space and run between joists or beams where shown on the drawings and as may be required, whether specifically shown or not, to avoid conflict with other trades.

20. This contractor shall be responsible for coordination with the fire sprinkler subcontractor and the Electrical Contractor as required to avoid and or resolve conflicts. Conflicts between piping, ducts, electrical, sprinklers, etc. shall be resolved with no additional cost or change to the contract amount.

3.3 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 1 Section "CUTTING AND REPAIRING." In addition to the requirements specified in Division 1, the following requirements apply:

1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.

2. Remove and replace defective Work.

3. Remove and replace Work not conforming to requirements of the Contract Documents.

4. Remove samples of installed Work as specified for testing.

5. Install equipment and materials in existing structures.

6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

3.4 WARRANTIES

A. Refer to the Division 1 Section: GUARANTEE for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Compile and assemble the warranties specified in Division 15, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

C. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

D. This Contractor shall warrant all material and equipment installed by him for a period of 1 year after completion of the project.

3.5 CLEANING

A. Refer to the Division 1 Section: "SITE CLEAN-UP" for general requirements for final cleaning.

B. Refer to Division 15 Section: "TESTING, ADJUSTING, AND BALANCING" for requirements for cleaning filters, strainers, and mechanical systems prior to final acceptance.

C. Contractor shall clean work area of all construction dirt and debris at the end of each work day.

END OF SECTION 15010

SECTION 15030 - ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Division-1 Specification sections, apply to work of this section.

B. Related Sections: Separate electrical components and materials required for field installation and electrical connections are specified in Division 16.

1.2 SUMMARY

A. This section specifies the basic requirements for electrical components which are an integral part of packaged mechanical equipment. These components include, but are not limited to factory installed motors, starters, and disconnect switches furnished as an integral part of packaged mechanical equipment.

B. Specific electrical requirements (i.e. horsepower and electrical characteristics) for mechanical equipment are scheduled on the Drawings.

1.3 REFERENCES

A. NEMA Standards MG 1: Motors and Generators

B. NEMA Standard ICS 2: Industrial Control Devices, Controllers, and Assemblies.

C. NEMA Standard 250: Enclosures for Electrical Equipment

D. NEMA Standard KS 1: Enclosed Switches

E. Comply with National Electrical Code (NFPA 70).

1.4 SUBMITTALS:

A. No separate submittal is required. Submit product data including wiring diagrams, for motors, starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification sections.

1.5 QUALITY ASSURANCE

A. Electrical components and materials shall be UL labeled.

PART 2 - PRODUCTS

2.1 MOTORS

A. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.

1. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.

2. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range.

3. 2-speed motors shall have 2 separate windings on poly-phase motors.

4. Temperature Rating: Rated for 40 deg. C environment with maximum 50 deg. C temperature rise for continuous duty at full load (Class A Insulation).

5. Starting capability: Frequency of starts as indicated by automatic control system, and not less than 5 evenly time spaced starts per hour for manually controlled motors.

6. Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors.

7. Motor construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque.

Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit specific application.

Bearings: ball or roller bearings with inner and outer shaft seals; re-greasable, except permanently sealed where motor is normally inaccessible for regular maintenance; designed to resist thrust

loading where belt drives or other drives produce lateral or axial thrust in motor; for fractional horsepower, light duty motors, sleeve type bearings are permitted.

8. Enclosure Type: open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation; guarded drip-proof motors where exposed to contact by employees or building occupants; weather protected Type I for outdoor use, Type II where not housed.

9. Overload protection: built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.

10. Noise rating: "Quiet"

11. Efficiency: All new motors shall be "Energy Efficient" motors and shall have a minimum efficiency as listed below. If efficiency is not specified, motors shall have a higher efficiency than "average standard industry motors", in accordance with IEEE Standard 112, test method B.

    Nominal efficiency shall be 85% or better for motors 1 horsepower and larger. Nominal power factor shall be 74 or better for 1, 1 1/2, and 2 HP motors and 85 or better for 3 HP and larger.

12. Nameplate: indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

    Motors used on system voltages 120/60/1 and 480/60/3 shall bear nameplate of 115/60/1 and 230/460/60/3 respectively.

2.2 STARTERS, ELECTRICAL DEVICES, AND WIRING

A. All motor starters shall be provided by the Electrical Contractor, except where noted otherwise on the drawings to be provided with the Mechanical Equipment. Refer to the Electrical Specifications for motor starter requirements.

B. Built-in 120 volts control circuit transformer, fused from line side, where service exceeds 240 volts.

C. Externally operated manual reset.

D. Under-voltage release or protection.

2.3 MOTOR CONNECTIONS

A. Flexible conduit, except where plug-in electrical cords are specifically indicated.

2.4 DISCONNECT SWITCHES

A. Disconnect Switches shall be provided by Electrical Contractor unless specifically called out on plans to be provided by the Mechanical Contractor.

B. Fusible switches: fused, each phase; heavy duty; horsepower rated; non-teasible quick-make, quick-break mechanism; dead front line side shield; solderless lugs suitable for copper or aluminum conductors; spring reinforced fuse clips; electro silver plated current carrying parts; hinged doors; operating lever arranged for locking in the "OPEN" position; arc quenchers; capacity and characteristics as indicated.

C. Non-fusible switches: for equipment 1 horsepower and smaller, shall be horsepower rated; toggle switch type; quantity of poles and voltage rating as indicated. For equipment larger than 1 horsepower, switches shall be the same as fusible type.

2.5 POWER FACTOR CORRECTION

A. Each motor (10 Horsepower and larger) except for motors with variable frequency drives, supplied for use within this project shall be supplied with capacitors as required to correct the power - factor of the individual motor to 95% (lagging) $\pm$ 3%. The Mechanical Contractor shall secure performance data on each individual motor and condenser. Provide operating current values on the condenser, and on the motor, and total line current for the combination. Provide voltage reading at time of disconnecting motor.

B. In no event shall the condenser current exceed the "no-load" values of the motor current. Heating element ratings shall be adjusted if, and as necessary, to provide thermal protection to the motor. In the event the voltage reading at the time of disconnecting the unit exceeds a safe value, the capacitor rating shall be changed to provide safe voltages, as well as providing a power factor within the specified limit. All condensers shall be rated for operation on the system voltage specified and furnished by the equipment manufacturer.

C. Each capacitor shall be suitable for energizing at temperatures as low as -10· F. and for continuous operation in ambient temperatures not exceeding 115· F. when installed and unrestricted ventilation and energized up to 100 percent of rated voltage.

D. Power factor correction capacitors shall be of the unit cell type. Individual capacitor cells shall be factory assembled and wired in a metallic, moisture-resistant enclosure. All power factor correction capacitors shall be UL listed. Capacitors shall be switched on and off with the motor and shall be installed and wired by the Electrical Contractor.

E. Individual capacitor cells shall utilize polypropylene film as the dielectric with vacuum deposited aluminum layers as the electrodes. Each capacitor cell shall be furnished with replaceable fuses with a current limiting interrupting capacity of 100,000 Amps and filled with a completely biodegradable fluid.

F. Discharge resistors shall be provided to reduce the residual voltage to 50 volts or less within one minute after the capacitor has been removed from the line. Resistors shall be mounted external to the capacitor cells to minimize the dielectric operating temperature.

G. Enclosures shall be fabricated from sheet metal having a minimum thickness of 0.026", suitable for indoor or outdoor installations, designed to prevent accidental contact with live conducting parts, finished with a gray enamel and provided with integral mounting brackets for wall or floor mounting.

H. Nameplate shall contain name of manufacturer, rated voltage, frequency, kilovar rating, number of poles and amount of combustible fluid in gallons. Nameplate shall be externally attached to the enclosure.

PART 3 - EXECUTION (Not Applicable).

END OF SECTION 15030

SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Requirements specified in Division 15 Section "BASIC MECHANICAL REQUIREMENTS" apply to this Section.

1.2 SUMMARY

A. This Section includes limited scope general construction materials and methods for application with mechanical installations as follows:

1. Mechanical equipment nameplate data.

2. Excavation for underground utilities and services, including underground piping (under the building and from building to utility connection), tanks, basins, and equipment.

3. Miscellaneous metals for support of mechanical materials and equipment.

4. Wood grounds, nailers, blocking, fasteners, and anchorage for support of mechanical materials and equipment.

5. Joint sealers for sealing around mechanical materials and equipment; and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.

6. Access panels and doors in walls, ceilings, and floors for access to mechanical materials and equipment.

7. V-Belt drives.

1.3 DEFINITIONS

A. The following definitions apply to excavation operations:

1. Additional Excavation: Where excavation has reached required subgrade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached.

2. Subbase: as used in this Section refers to the compacted soil layer used in pavement systems between the subgrade and the pavement base course material.

3. Subgrade: as used in this Section refers to the compacted soil immediately below the slab or pavement system.

4. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction from the Architect.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for the following products:

Access panels and doors.
Joint sealers.

C. Shop drawings detailing fabrication and installation for metal fabrications, and wood supports and anchorage for mechanical materials and equipment.

D. Coordination drawings for access panel and door locations in accordance with Division 15 Section "BASIC MECHANICAL REQUIREMENTS."

E. Samples of joint sealer, consisting of strips of actual products showing full range of colors available for each product.

F. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under "Quality Assurance" article of this Section.

G. Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of Work. Include coordination for shut-off of utility services and details for dust and noise control.

1. Coordinate sequencing with construction phasing and Government occupancy requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer for the installation and application joint sealers, access panels, and doors.

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

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

C. Fire-Resistance Ratings: Where a fire-resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in the UL "Building Materials Directory" for rating shown.

1. Provide UL Label on each fire-rated access door.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver joint sealer materials in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle joint sealer materials in compliance with the manufacturers' recommendations to prevent their deterioration and damage.

1.7 PROJECT CONDITIONS

A. Conditions Affecting Excavations: The following project conditions apply:

1. Maintain and protect existing building services which transit the area affected by selective demolition.

2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.

3. Site Information: Subsurface conditions were investigated during the design of the Project. Reports of these investigations are available for information only; data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Government will not be responsible for interpretations or conclusions drawn from this information.

4. Existing Utilities: Locate existing underground utilities in excavation areas. If utilities are indicated to remain, support and protect services during excavation operations.

5. Uncharted or Incorrectly Charted Utilities: Contact utility owner immediately for instructions.

6. Use of explosives is not permitted.

B. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

PART 2 - PRODUCTS

2.1 MECHANICAL EQUIPMENT NAMEPLATE DATA

A. Nameplate: For each piece of power operated mechanical equipment provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location. Nameplates shall be stamped, permanent type only.

2.2 SOIL MATERIALS

A. Comply with Section "EARTHWORK".

2.3 MISCELLANEOUS METALS

A. Steel plates, shapes, bars, and bar grating: ASTM A 36.

B Cold-Formed Steel Tubing: ASTM A 500.

C. Hot-Rolled Steel Tubing: ASTM A 501.

D. Steel Pipe: ASTM A 53, Schedule 40, Grade B welded.

E. Non-shrink, Non-metallic Grout: Premixed, factory-packaged, non-staining, non-corrosive, nongaseous grout, recommended for interior and exterior applications.

F. Fasteners: Zinc-coated, type, grade, and class as required.

2.4 MISCELLANEOUS LUMBER

A. Framing Materials: Standard Grade, light-framing-size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLIB or AWPA rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative treated in accordance with AWPB LP-2, and kiln dried to a moisture content of not more than 19 percent.

B. Construction Panels: Plywood panels; APA C-D PLUGGED INT, with exterior glue; thickness as indicated, or if not indicated, not less that 15/32 inches.

2.5 JOINT SEALERS

A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.

B. Colors: As selected by the Architect from manufacturer's standard colors.

C. Elastomeric Joint Sealers: Provide the following types:

1. One-part, nonacid-curing, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for masonry, glass, aluminum, and other substrates recommended by the sealant manufacturer.

2. One-part, mildew-resistant, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for glass, aluminum, and nonporous joint substrates; formulated with fungicide; intended for sealing interior joints with nonporous substrates; and subject to in-service exposure to conditions of high humidity and temperature extremes.

3. Products: Subject to compliance with requirements, provide one of the following:

One-Part, Nonacid-Curing, Silicone Sealant:

"Chem-Calk N-Cure 2000," Bostic Construction Products Div.
"Dow Corning 790," Dow Corning Corp.
"Silglaze N SCS 2501," General Electric Co.
"Silpruf SCS 2000," General Electric Co.
"864," Pecora Corp.
"Rhodorsil 5C," Rhone-Poulenc, Inc.
"Spectrum 1," Tremco, Inc.
"Spectrum 2," Tremco, Inc.
"Dow Corning 795," Dow Corning Corp.
"Rhodorsil 6B," Rhone-Poulenc, Inc.
"Rhodorsil 70," Rhone-Poulenc, Inc.
"Omniseal," Sonneborn Building Products Div.

"Chem-Calk 100," Bostik Construction Products Div.
"Gesil N SCS 2600," General Electric Co.

One-Part, Mildew-Resistant, Silicone Sealant:

"Dow Corning 786," Dow Corning Corp.
"SCS 1702 Sanitary," General Electric Co.
"863 #345 White," Pecora Corp.
"Rhodorsil 6B White," Rhone-Poulenc, Inc.
"Proglaze White," Tremco Corp.
"OmniPlus," Sonneborn Building Products Div.

D. Acrylic-Emulsion Sealants: One-part, non-sag, mildew-resistant, paintable complying with ASTM C 834 recommended for exposed applications on interior and protected exterior locations involving joint movement of not more than plus or minus 5 percent.

1. Products: Subject to compliance with requirements, provide one of the following:

"Chem-Calk 600," Bostik Construction Products Div.
"AC-20," Pecora Corp.
"Sonolac," Sonneborn Building Products Div.
"Tremco Acrylic Latex 834," Tremco, Inc.

E. Fire-Resistant Joint Sealers: Two-part, foamed-in-place, silicone sealant formulated for use in through-penetration fire-stopping around cables, conduit, pipes, and duct penetrations through fire-rated walls and floors. Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:

"3M" Fire Stop Systems, St. Paul, Minn.
"Dow Corning Fire Stop Foam," Dow Corning Corp.
"Pensil 851," General Electric Co.

F. Pick-proof Sealant: All interior joints in areas of inmate accessibility.

1. Sealant shall meet or exceed requirements of ASTM C-920, Type M, Grade NS, Class 12-1/2; use T, M.

2. Sealant shall be 2 part and job site mixed.

3. Products: Subject to compliance with requirements, provide one of the following:

"HPL Sealant", Tremco, Inc.
"Dynflex". Pecora Corp.
"Sikadur 32, Hi-Mod" Sika
Peterson Corp.

2.6 ACCESS DOORS

A. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.

B. Frames: 16-gage steel, with a 1-inch-wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling.

1. For installation in masonry, concrete, ceramic tile, or wood paneling: 1 inch-wide-exposed perimeter flange and adjustable metal masonry anchors.

2. For gypsum wallboard or plaster: perforated flanges with wallboard bead.

3. For full-bed plaster applications: galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.

C. Flush Panel Doors: 14-gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.

1. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.

D. Locking Devices: Where indicated, provide 5-pin or 5-disc type cylinder locks, individually keyed; provide 2 keys.

E. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Bar-Co., Inc.
J.L. Industries.
Karp Associates, Inc.
Milcor Div. Inryco, Inc.
Nystrom, Inc.

2.7 V-BELT DRIVES

A. Capacity of V-Belt Drives at rated RPM shall be not less than 150 percent of motor nameplate horsepower rating.

B. V-Belt Drive combinations shall be limited to A, B, C, and fractional horsepower belts. 3V, 5V, and 8V belts and sheaves shall not be used.

C. Drives requiring single belt application shall be of the adjustable pitch type. Multiple belt drives shall be of the non-adjustable type. All fixed pitch sheaves, including single groove fan sheaves, shall be of the bushed type. Fixed bore sheaves will not be acceptable for non-adjustable pitch sheaves.

2.8 DRIP PANS

A. Provide drip pans fabricated from corrosion-resistant sheet metal with watertight joints, and with edges turned up 2-1/2". Reinforce top, either by structural angles or by rolling top over 1/4" steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1" drain line connections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and application of joint sealers and access panels. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION FOR JOINT SEALERS

A. Surface Cleaning for Joint Sealers: Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.

B. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.

3.3 EXCAVATION AND BACKFILL

A. Perform excavation and backfill for mechanical work in accordance with DIVISION 2 SECTION "EARTHWORK".

B. Provide backfill for underground tanks in accordance with the manufacturers requirements for material type, grade and compaction.

C. Rock may be present on this site, and may be encountered during excavation. Refer to soils boring locations shown on civil plans, the soils boring logs, and Section 2 of the Specifications. Copies of the soil boring logs are available for review at the following:

3.4 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS "Structural Welding Code."

3.5 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.6 APPLICATION OF JOINT SEALERS

A. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.

1. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.

2. Comply with recommendations of ASTM C 790 for use of acrylic-emulsion joint sealants.

B. Tooling: Immediately after sealant application and prior to time shinning or curing begins, tool sealants to form smooth, uniform beads; 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 that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

C. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around mechanical services penetrating floors and walls, to provide fire-stops with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

3.7 INSTALLATION OF ACCESS DOORS

A. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.

B. Adjust hardware and panels after installation for proper operation.

3.8 INSTALLATION OF DRIP PANS

A. Locate drip pans under piping passing within 3' horizontally of electrical equipment, and elsewhere as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1" drain line to drain connection, and run to nearest plumbing drain or elsewhere as indicated.

END OF SECTION 15050

SECTION 15055 - BASIC PIPING MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Division 1 Specification sections, apply to work of this section.

1.2 SUMMARY:

A. This Section specifies piping materials and installation methods common to more than one section of Division 15 and includes joining materials, piping specialties, and basic piping installation instructions.

B. Related Sections:

1. Division 15 BASIC MECHANICAL REQUIREMENTS section applies to the work at this Section.

2. Piping materials and installation methods peculiar to individual systems are specified within their respective system specification sections of Divisions 2 and 15.

3. Valves are specified in a separate section and in individual piping system sections of Division 15.

4. Expansion Compensation is specified in a separate section of Division 15.

5. Supports and Anchors are specified in a separate section of Division 15.

6. Mechanical Identification is specified in a separate section of Division 15.

C. Piping Systems - General

1. Pipe for piping systems shall be cut accurately to measurements taken on the job.

2. Install offset connections for alignment of vertical to horizontal piping wherever required to make a true connection.

3. Make branch connections with offsets to provide for movement with the expansion of the piping system.

4. Install horizontal piping parallel to the building walls and partitions.

5. Do not run piping through elevator equipment rooms, transformer vaults or other electrical equipment spaces.

6. Valves, strainers, control valves, check valves and fittings shall be full size of the line they serve. Make change in pipe size noted on plans after last fitting on larger pipe. When supply pipes are larger than equipment tappings, reduce pipe size immediately prior to entry.

1.3 SUBMITTALS:

A. Refer to Division 1 and BASIC MECHANICAL REQUIREMENTS for administrative and procedural requirements for submittals.

B. Product Data: Submit product data on the following items:

Escutcheons
Dielectric Unions and Fittings
Mechanical Sleeve Seals
Strainers
Piping
Fire Barrier Penetration Seals

1.4 QUALITY ASSURANCE:

A. Welders Qualifications: All welders shall be qualified in accordance with ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing.

B. Welding procedures and testing shall comply with ANSI Standard B31.1.0 - Standard Code for Pressure Piping, Power Piping, and The American Welding Society, Welding Handbook.

C. Soldering and Brazing procedures shall conform to ANSI B9.1 Standard Safety Code for Mechanical Refrigeration.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Provide factory-applied plastic end-caps on each length of pipe and tube, except for concrete, corrugated metal, hub-and-spigot, clay pipe. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.

C. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturer uniformity: conform with the requirements specified in Basic Mechanical Requirements, under "Product Options."

B. Manufacturer: Subject to compliance with requirements, provide piping materials and specialties from one of the following:

1. Pipe Escutcheons:

Chicago Specialty Mfg. Co.
Sanitary-Dash Mfg. Co.
Grinnell

2. Dielectric Waterway Fittings:

Epco Sales, Inc.
Victaulic Company of America

3. Dielectric Unions:

Eclipse, Inc.
Perfection Corp.
Watts Regulator Co.

4. Strainers:

Armstrong Machine Works.
Hoffman Specialty ITT; Fluid Handling Div.
Metraflex Co.
Spirax Sarco.
Trane Co.
Victaulic Co. of America. (low pressure applications only)
Watts Regulator Co.

5. Mechanical Sleeve Seals:

Calpico Inc.
Thunderline Corp. (Link Seal)

2.2 PIPE AND FITTINGS:

A. Refer to the individual piping system specification sections in Division 15 for specifications on piping and fittings relative to that particular system.

B. All pipe and fittings shall be domestic manufactured. Foreign manufactured pipe will not be accepted. Each piece of pipe must be clearly labeled or stenciled with manufacturers name, type of pipe and length, in accordance with ASTM standards. All pipe must be new. Re-processed pipe which has been cleaned and re-finished due to extended yard storage will not be accepted. All pipe must be corrosion free. Submit shop drawings on piping along with certified mill specifications. If required by Engineer, the Contractor shall submit job site pipe samples, selected by Engineer, to the pipe manufacturer for verification of type and manufacturer. Any pipe not conforming to these specifications or not certified by manufacturers testing of samples, will be removed and replaced at contractor's expense.

C. Steel Pipe Manufacturers: Newport, Bethlehem Steel Corp., Laclede Steel Co., United States Steel Co., Sawhill, Wheatland, Maverick, or Quanex Belleville Tube.

D. Ferrous Fittings Manufacturers: Walworth, ITT Grinnell, Stockham or Crane.

NOTE: Weld-O-Lets and Thread O-Lets may be used when branch line diameter does not exceed 1/3 of the diameter on the main.

E. Copper Pipe and Fitting Manufacturers: Mueller, Revere, Chase, Copperweld Tubing or Wheatland Tube.

2.3 JOINING MATERIALS:

A. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.

B. Brazing Materials: Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials appropriate for the materials being joined.

C. Soldering Materials: Refer to individual piping system specifications for solder appropriate for each respective system. Do not use lead solder on water lines. Use 95-5 solder on water lines.

D. Gaskets for Flanged Joints: Gasket material shall be full-faced for cast-iron flanges and raised-face for steel flanges. Select materials to suit the service of the piping system in which installed and which conform to their respective ANSI Standard (A21.11, B16.20, or B16.21). Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

2.4 PIPING SPECIALTIES:

A. Escutcheons: Chrome-plated, stamped steel, hinged, split-ring escutcheon, with set screw. Inside diameter shall closely fit pipe outside diameter, or outside of pipe insulation where pipe is insulated. Outside diameter shall completely cover the opening in floors, walls, or ceilings.

B. Unions: Malleable-iron, Class 150 for low pressure service and class 250 for high pressure service; hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends.

C. Dielectric Unions: Provide dielectric unions with appropriate end connections for the pipe materials in which installed (screwed, soldered, or flanged), which effectively isolate dissimilar metals, prevent galvanic action, and stop corrosion.

D. Dielectric Waterway Fittings: electroplated steel or brass nipple, with an inert and non-corrosive, thermoplastic lining.

E. Y-Type Strainers: Provide strainers full line size of connecting piping, with ends matching piping system materials. Screens shall be Type 304 stainless steel, with 3/64" perforations at 233 per square inch.

1. Provide strainers with 125 psi working pressure rating for low pressure applications (15 PSI or less), and 250 psi pressure rating for high pressure application (Above 15 PSI).

2. Threaded Ends, 2" and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with pipe plug.

3. Threaded Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.

4. Flanged Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.

5. Butt Welded Ends, 2-1/2" and Larger For Low Pressure Application: Schedule 40 cast carbon steel body, bolted screen retainer with off-center blowdown fitted with pipe plug.

6. Grooved Ends, 2-1/2" and Larger: Tee pattern, ductile-iron or malleable-iron body and access end cap, access coupling with EDPM gasket.

F. Sleeves:

1. Sheet-Metal Sleeves: 10 gage, galvanized sheet metal, round tube closed with welded longitudinal joint.

2. Steel Sleeves: Schedule 40 galvanized, welded steel pipe, ASTM A53, Grade A.

G. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation. Provide compatible wall sleeve with proper inside diameter to accept the rubber links and with a water stop.

2.5 FIRE BARRIER PENETRATION SEALS

A. Manufacturer: Subject to compliance with requirements, provide fire barrier through penetration protection systems of one of the following:

Electro Products Div./3M
Nelson; Unit of General Signal
Bio Fire Shield, Inc.
Hilti

B. Provide protection systems for any opening through fire-rated walls, floors, roof, or ceilings used as passage for mechanical components such as piping or ductwork. The sealer shall have a T-rating of 4 hours at penetrations in the 4 hour fire separations.

Cracks, Voids or Holes Up to 4" Diameter: Use putty or calking, one-piece intumescent elastomer, non-corrosive to metal, compatible with synthetic cable jackets, and capable of expanding 10 times when exposed to flame or heat, UL-listed.

Openings 4" or Greater: Use sealing system capable of passing 3-hour (or 4 hours where required) fire test in accordance with ASTM E-814, consisting of wall wrap or liner, partitions, and end caps capable of expanding when exposed to temperatures of 250 to 350 deg F (121 to 177 deg C), UL-listed.

C. Execution: Fill entire opening with sealing compound. Adhere to manufacturer's installation instructions.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Ream ends of pipes and tubes, and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from both inside and outside of piping and fittings before assembly.

3.2 INSTALLATIONS:

A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated. Refer to individual system specifications for requirements for coordination drawing submittals. Coordinate locations of piping with ductwork, lights and other equipment.

B. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated otherwise.

C. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

D. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated on the Drawings.

E. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1" clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

F. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

G. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4" ball valve, and short 3/4" threaded nipple and cap.

H. Install manual air vents at high points in mains, risers, and branch lines consisting of a tee fitting, 3/4" ball valve, and short 3/4" threaded nipple and cap.

I. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves shall be steel; with water stop.

J. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, or floors, the fire rated integrity shall be maintained.

K. Install Schedule 40 black steel pipe with welded fittings for emergency generator exhaust pipe. Install muffler and connect exhaust pipe as shown on plans.

3.3 FITTINGS AND SPECIALTIES:

A. Use fittings for all changes in direction and all branch connections.

B. Remake leaking joints using new materials.

C. Install strainers on the supply side of each control valve, pressure reducing or regulating valve, solenoid valve, and elsewhere as indicated.

D. Install unions adjacent to each valve, and at the final connection to each piece of equipment and plumbing fixture having 2" and smaller connections, and elsewhere as indicated.

E. Install Flanges in piping 2-1/2" and larger, where indicated, adjacent to each valve, and at the final connection to each piece of equipment.

F. Install dielectric unions to connect piping materials of dissimilar metals in dry piping systems (gas, compressed air, vacuum).

G. Install dielectric fittings to connect piping materials of dissimilar metals in wet piping systems (water, steam).

3.4 JOINTS:

A. Steel Pipe Joints:

1. Pipe 2" and Smaller: Thread pipe with tapered pipe threads in accordance with ANSI B2.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint lubricant or sealant suitable for the service for which the pipe is intended on the male threads at each joint and tighten joint to leave not more than 3 threads exposed.

2. Pipe Larger Than 2":

Weld pipe joints (except for exterior water service pipe) in accordance with ASME Code for Pressure Piping, B31.

Weld pipe joints of exterior water service pipe in accordance with AWWA C206.

Install flanges on all valves, apparatus, and equipment. Weld pipe flanges to pipe ends in accordance with ASME B31.1.0 Code for Pressure Piping. Clean flange faces and install gaskets. Tighten bolts to torque specified by manufacturer of flange and flange bolts, to provide uniform compression of gaskets.

B. Non-ferrous Pipe Joints:

1. Brazed And Soldered Joints: For copper tube and fitting joints, braze joints in accordance with ANSI B31.1.0 - Standard Code for Pressure Piping, Power Piping and ANSI B9.1 - Standard Safety Code for Mechanical Refrigeration.

Thoroughly clean tube surface and inside surface of the cup of the fittings, using very fine emery cloth, prior to making soldered or brazed joints. Wipe tube and fittings clean and apply flux. Flux shall not be used as the sole means for cleaning tube and fitting surfaces.

2. Mechanical Joints: Flared compression fittings may be used for refrigerant lines 3/4" and smaller.

C. Other Pipe Joints:

1. Joints for other piping materials are specified within the respective piping system sections.

3.5 EXISTING BUILDING

A. Existing HVAC, plumbing, or fire lines not to be used in the completed building shall be discontinued and capped in nearest wall, floor or ceiling so they are completely concealed.

B. Existing piping, fixtures and equipment that are not to be reused shall be removed and shall remain the property of the Government if he wishes to retain ownership of same. If not, equipment shall become the property of this contractor and shall be removed from the site as soon as practical.

C. When existing piping that are to be utilized in the completed program conflict with construction, they shall be relocated and reconnected to maintain the desired services.

D. This Contractor shall give full cooperation to the General Contractor in scheduling and procedure of work.

E. Existing piping and services that are in use by the Government shall not be interrupted without the approval of the Government. The existing building is a 24-hour occupied facility and therefore, it may be necessary to accomplish some work on holidays, weekends, and after regular work-day hours. Due to continuous operation of existing systems, some of the work will have to be phased to accommodate the Government's schedule. No extra costs shall be allowed for these existing conditions and constraints.

F. All cutting and channeling of existing building shall be accomplished in a neat and workmanlike manner without removal of existing materials. This contractor shall patch and replace with material similar to adjacent construction.

3.6 FIELD QUALITY CONTROL

A. Testing: Refer to individual piping system specification sections and Section 15990; “TESTING, ADJUSTING AND BALANCING”.

END OF SECTION 15055

SECTION 15100 - VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Division 1 Specification sections, apply to work of this section.

B. The requirements of Division-15 Section "BASIC MECHANICAL REQUIREMENTS" apply to this Section.

1.2 SUMMARY:

A. This Section includes general duty valves common to most mechanical piping systems.

B. Special purpose valves are specified in individual piping system specifications.

C. Valves tags and charts are specified in Division-15 Section "MECHANICAL IDENTIFICATION."

1.3 SUBMITTALS:

A. Product Data: including body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions.

1.4 QUALITY ASSURANCE:

A. Single Source Responsibility: Comply with the requirements specified in Division-15 Section "BASIC MECHANICAL REQUIREMENTS," under "Product Options." All valves of the same type shall be of the same manufacturer whenever possible.

B. MSS Standard Practices: Comply with the following standards for valves:

MSS SP-45: Bypass and Drain Connection Standard

MSS SP-67: Butterfly Valves

MSS SP-70: Cast Iron Gate Valves, Flanged and Threaded Ends

MSS SP-71: Cast Iron Swing Check Valves, Flanged and Threaded Ends

MSS SP-72: Ball Valves with Flanged or Butt-Welding Ends For General Service

MSS SP-78: Cast Iron Plug Valves, Flanged and Threaded Ends

MSS SP-80: Bronze Gate, Globe Angle and Check Valves

MSS SP-84: Steel Valves - Socket Welding and Threaded Ends

MSS SP-85: Cast Iron Globe and Angle Valves, Flanged and Threaded Ends

MSS SP-92: MSS Valve User Guide

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Preparation For Transport: Prepare valves for shipping as follows:

1. Ensure valves are dry and internally protected against rusting and galvanic corrosion.

2. Protect valve ends against mechanical damage to threads, flange faces, and weld end preps.

3. Set valves in best position for handling. Globe, and gate valves shall be closed to prevent rattling; ball and plug valves shall be open to minimize exposure of functional surfaces; butterfly valves shall be shipped closed or slightly open; and swing check valves shall be blocked in either closed or open position.

B. Storage: Use the following precautions during storage:

1. Do not remove valve end protectors unless necessary for inspection; then reinstall for storage.

2. Protect valves against weather. Where practical store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement and protect in watertight enclosures.

C. Handling: Valves whose size requires handling by crane or lift shall be slung or rigged to avoid damage to exposed valve parts. Handwheels and stems, in particular, shall not be used as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturer: Subject to compliance with requirements, provide valves from one of the manufacturers listed.

2.2 VALVE FEATURES:

A. General: Comply with ASME B31.9 for building services piping, and ASME B31.1 for power piping.

B. Valve Design: Valves shall have rising stem, or rising outside screw and yoke stems; except, non-rising stem valves may be used where headroom prevents full extension of rising stems.

C. Pressure and Temperature Ratings: As scheduled and required to suit system pressures and temperatures.

D. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.

E Operators: Provide the following special operator features:

1. Handwheels, fastened to valve stem, for valves other than quarter turn.

2. Lever Handle on quarter-turn valves 6 inch and smaller, except for plug valves. Provide one wrench for every 10 plug valves.

3. Gear drive operators on quarter-turn valves 8 inches and larger.

F. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.

G. Bypass and Drain Connections: Comply with MSS SP-45 bypass and drain connections.

H. End Connections: as specified in the individual valves specifications.

1. Threads: Comply with ANSI B2.1.

2. Flanges: Comply with ANSI B16.1 for cast iron, ANSI B16.5 for steel, and ANSI B16.24 for bronze valves.

3. Solder-Joint: Comply with ANSI B16.18.

a. Caution: Where soldered end connections are used, use solder having a melting point below 840 deg F for gate, globe, and check valves; below 421 deg F for ball valves.

2.3 GATE VALVES:

A. Gate Valves - 2 Inch and Smaller: MSS SP-80; Class 125, body and bonnet of ASTM B 62 cast bronze, threaded or solder ends, solid disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel. Class 150 and Class 250 valves meeting the above shall be used where pressure requires.

	THREADED		SOLDER	
MANUFACTURER	NRS	RS	NRS	RS
Crane	438	428	1701S	1700S
Milwaukee	105	148	115	1149
Powell	507	500	1822	1821
Stockham	B-130	B-100	B-104	B-108

B. Gate Valves - 2 Inch and Smaller: MSS SP-80; Class 150, body and union bonnet of ASTM B 62 cast bronze, threaded or solder ends, solid disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel. Do not use solder end valves for hot water heating or steam piping applications.

	THREADED		SOLDER	
MANUFACTURER	NRS	RS	NRS	RS
Crane	x	431UB	x	x
Milwaukee	x	1151	x	1169
Powell	2712	2714	x	1842
Stockham	B-130	B-120	x	B-124

C. Gate Valves - 2-1/2 Inch and Larger: MSS SP-70; Class 125 iron body, bronze mounted, with body and bonnet conforming to ASTM A 126 Class B, flanged ends, and "Teflon" impregnated packing and two-piece packing gland assembly.

MANUFACTURER	OS&Y RS	NRS
Crane	465-1/2	461
Milwaukee	F-2885	F-2882
Stockham	G-623	G-612
Powell	1793	1787

D. NOTE: Use valves similar to above (Paragraphs A through C) except Class 250 on steam and condensate return systems where pressure is above 15 PSI.

2.4 BALL VALVES:

A. All shut-off valves on water lines 2" and less used for domestic water or HVAC water shall be ball valves.

B. Ball Valves - 1 Inch and Smaller: rated for 150 psi saturated steam pressure, 400 psi WOG pressure; 2-piece construction, bronze body conforming to ASTM B 62, standard (or regular) port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout proof stem, and vinyl-covered steel handle. Use extended stem length where insulation occurs.

MANUFACTURER	THREADED ENDS	SOLDER ENDS
Conbraco (Apollo)	70-100	70-200
Crane	9302	9322
Jamesbury	351	x
Metraflex	IT	IS
Powell	4210T	x
Stockham	S-216 BR-R-T	S-216 BR-R-S
Watts	B-6000	B-6001

C. Ball Valves - 1-1/4 Inch to 2 Inch: rated for 150 psi saturated steam pressure, 400 psi WOG pressure; 3-piece construction, bronze body conforming to ASTM B 62, full size port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout proof stem, and vinyl-covered steel handle. Use extended length stem where insulation occurs.

MANUFACTURER	THREADED ENDS	SOLDER ENDS
Conbraco (Apollo)	82-100	82-200
Powell	4201R	x
Watts	B-6800	B-6801

For grooved end connections use Victaulic Style 721.

2.5 PLUG VALVES:

A. Plug Valves - 2 Inch and Smaller: 150 psi WOG, bronze body, straightaway pattern, square head, threaded ends.

Lunkenheimer: 454.

B. Plug Valves - 2-1/2 Inch and Larger: MSS SP-78; 175 psi, lubricated plug type, semi-steel body, single gland, wrench operated, flanged ends.

Nordstrom: 143.
Powell: 2201.

2.6 GLOBE VALVES:

A. Globe Valves - 2 Inch and Smaller: MSS SP-80; Class 125, body and screwed bonnet of ASTM B 62 cast bronze, threaded or solder ends, brass or replaceable composition disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel. Class 150 valves meeting the above shall be used where pressure requires.

MANUFACTURER	THREADED	SOLDER
Crane	1	1310
Milwaukee	502	1502
Powell	650	1823
Stockham	B-16	B-14T

B. Globe Valves - 2 Inch and Smaller: MSS SP-80; Class 150, body and union bonnet of ASTM B 62 cast bronze, threaded ends, brass or replaceable composition disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel.

Crane: 17TF.
Milwaukee: 590.
Powell: 150.
Stockham: B-22.

C. Globe Valves - 2-1/2 Inch and Larger: MSS SP-85; Class 125 iron body and bolted bonnet conforming to ASTM A 126, Class B; outside screw and yoke, bronze mounted, flanged ends, and "Teflon" impregnated packing and two-piece backing gland assembly.

	STRAIGHT	ANGLE
MANUFACTURER	BODY	BODY
Crane	351	353
Milwaukee	F2981	F2986
Powell	241	243
Stockham	G-512	G-515

2.7 BUTTERFLY VALVES:

A. Butterfly Valves - 2-1/2 Inch and Larger: MSS SP-67; 200 psi, cast iron body conforming to ASTM A 126, Class B. Valves shall have field replaceable EPDM sleeve, with nickel-plated ductile iron disc, stainless steel stem, and EPDM O-ring stem seals. Sizes 2 through 6 inches shall have lever operators with locks, and sizes 8 through 24 inches shall have gear operators with position indicator. Valves on dead end service or requiring additional body strength shall be lug-wafer type, drilled and tapped.

MODEL NUMBERS FOR NICKEL-PLATED DUCTILE IRON DISCS

	WAFER		LUG	
MANUFACTURER	LEVER	GEAR	LEVER	GEAR
Center Line	Series A		Series LT	
Crane	12		14	
Conbraco-Apollo	6X-13X-01		6L-13X-01	
		6W-13X-02		6L-13X-02
Keystone	239		129	
Powell	1011-DA1		5011-DA1	
Stockham	LG-512-DS3E		LG-712-DS3E	
		LG-522-DS3E		LG-722-DS3E
Watts	BF-04-111-11		BF-03-111-11	
		BF-04-111-12		BF-03-111-12

Grooved Ends: Victaulic Series 700 and 300.

2.8 CHECK VALVES:

A. Swing Check Valves - 2 Inch and Smaller: MSS SP-80; Class 125, cast bronze body and cap conforming to ASTM B 62, horizontal swing, Y-pattern, with a bronze disc, and having threaded or solder ends. Valve shall be capable of being reground while the valve remains in the line. Class 150 valves meeting the above specifications may be used where pressure requires or Class 125 are not available.

	CLASS 125		CLASS 150
	THREADED	SOLDER	THREADED
MANUFACTURER	ENDS	ENDS	ENDS
Crane	37	1342	137
Milwaukee	509	1509	510
Powell	578	1825	596
Stockham	B-319	B-309	B-321

For grooved connections use Victaulic Series 712.

B. Swing Check Valves - 2 Inch and Smaller: MSS SP-80; Class 150, cast bronze body and cap conforming to ASTM B62, horizontal swing, Y-pattern, with a bronze disc, and having threaded ends. Valve shall be capable of being reground while the valve remains in the line.

Crane: 137.
Milwaukee: 510.
Powell: 596.
Stockham: B-321.

For grooved connections use Victaulic Series 711, 715 or 716.

C. Swing Check Valves - 2-1/2 Inch and Larger: MSS SO-71: Class 125 (Class 175 FM approved for fire protection piping systems), cast iron body and bolted cap conforming to ASTM A 126, Class B; horizontal swing, with a bronze disc or cast iron disc with bronze disc ring, and flanged ends. Valve shall be capable of being refitted while the valve remains in the line.

MANUFACTURER	CLASS 125	CLASS 175
Crane	373	X
Milwaukee	F2974	X
Powell	559	X
Stockham	G-931	G-940

D. Wafer Check Valves - (Non-Slam): Class 250, cast iron body, replaceable lapped bronze seat, lapped and balanced twin bronze flappers and stainless steel trim. Valve shall be designed to open and close at approximately one foot differential pressure. Twin flappers shall be loaded with a stainless steel torsion spring to minimize flapper drag and assure even non-slam checking action.

Bell & Gossett: NS.
Center Line: CLC.
Metraflex: Chexx.
Mission: 12 HMP.
Stockham: WG970.

2.9 GATE VALVE (RESILIENT SEAT)

A. Manufacturers: Mueller, Kennedy or approved equal.

B. Resilient seat gate valve: Gate valve shall be designed for a working pressure of not less than 150 pounds per square inch. Valves shall have joints as required for the piping in which they are installed. Valves shall have a smooth unobstructed waterway as large as the inside pipe diameter it is intended for. Valves shall have a non-rising stem, be equipped with an operating nut and be opened by turning counter clockwise. Valve shall be iron bodied with epoxy coating and be equipped with a bubble tight synthetic coated cast iron disc. Valve shall operate in full compression seating and must meet or exceed all the requirements of the latest revision of AWWA C-509.

2.10 GENERAL

A. Provide all valves required for operation, service, and maintenance of systems and equipment, i.e. shut off valves both sides of equipment, coils, etc., balancing valves at leaving sides of coils, etc.

B. Cut off valves in general shall be gate or butterfly valves. All shut-off valves on HVAC and domestic water lines 2" and smaller shall be ball valves.

C. Throttling valves shall be ball or globe valves.

D. Flow control valves shall be plug valves.

E. Standard valves shall have 125 psi. working steam pressure or 200 psi. for water, oil and gas. Valves on steam systems above 15 psi (including steam return piping) shall have 250 or 300 psi working steam pressure.

F. Sweat joint valves shall be used on all copper pipe.

G. All gate and globe valves shall be designed for repacking under pressure when fully opened, and shall be equipped with packing suitable for the intended service. When the valve is fully opened, the back seat shall protect the packing and the stem threads from the fluid. All gate and globe valves shall have a gland follower. The pressure-temperature rating of valves shall be not less than the design criteria applicable to all components of the system.

H. Bronze valves with the basic saturated steam rating of 125 psi or 150 psi shall have pressure containing parts of a material having at least the physical properties of ASTM Specification B-62. Metallic seated bronze globe, angle, check and gate valves with a basic steam rating of 200 or 300 psi shall have pressure containing parts of material conforming to ASTM Specification B-61, for temperatures to 550·F.

I. Pressure containing parts of iron body valves shall be of material conforming to ASTM Specification A-126 Grade B. If the wedge in OS&Y gate valves is fastened to the stem by threads, it shall be secured by a nickel alloy or monel pin.

J. Face-to-face and end-to-end dimensions of iron body valves shall conform to ANSI B16.10. Design, workmanship, materials, and testing shall conform to MSS-SP-70 and MSS-SP-71 (Manufacturers Standardization Society of the Valve and Fitting Industry).

K. Stems of bronze and Iron Bodied Bronze Mounted valves shall be of ASTM-B-198 Class 13C (cast silicon brass), ASTM B-371, Alloy A (rolled silicon brass), or other material equally resistant to dezincification.

L. All pressure casting shall be free of any impregnating materials.

M. Gate valves shall be of the solid wedge type, designed and manufactured in such a way that seating surfaces are prevented from contacting until near the point of closure. Valves two inches and smaller shall be rising stem with threaded, solder, socket, or flanged end to suit service. Valves 2 1/2" and larger shall be flanged, and unless otherwise specified all shall be OS&Y.

N. Globe valves two inches and smaller shall be threaded, flanged, solder end or socket end, to suit service. Globe valves 2 1/2 inches and larger shall be flanged, unless otherwise specified. Where composition discs are used, the disc shall be suitable for the intended service. For steam throttling service, composition disc valves shall be fitted with throttling nut. Metal seated globe valves shall have hardened stainless steel disc and seat ring.

O. By-pass valves shall be globe type, and these two inches and smaller at pressure reducing stations, shall be 500 Brinnel plug disc and seat ring type, or stellite. Those 2 1/2 inches through four inches shall be hardened stainless steel plug disc globe valves.

P. Unless a composition disc is specified, swing check valves two inches and smaller shall be bronze, regrinding, with seating angle 40 to 45 degrees. A stop plug is required as a renewable stop for the hanger, unless otherwise specified. Disc and hanger shall be separate parts, and the disc shall be free to rotate. Hanger pins shall be supported on both ends by removable side plugs.

Q. Lift check valves two inches and smaller shall be bronze or forged steel, to suit the service.

R. Check valves 2 1/2 inches and larger shall be flanged, swing type, unless otherwise specified.

S. Butterfly valves shall conform to MSS-SP-67. Liners and discs shall be suitable for the intended service.

T. Butterfly valves shall be lug type suitable for dead end service. Body constructed of cast or ductile iron - heavy duty stem bushing to absorb operator side thrust - stainless steel stem - EPDM seat -operators with ten position lever lock for sizes 2 1/2" thru 6" - wormgear with handwheel for sizes above 6" - valve pressure rated for 150 psig at 180°F.

U. All steam valves installed in boiler room must conform to ASME Boiler Code Specifications.

V. Each valve is to be given shell and seat tests by the manufacturer and will carry a permanently affixed indication that tests have been successfully completed.

W. Insofar as possible, all valves of the same type shall be of the same manufacturer. Before purchasing any valve, contractor shall submit for approval the name of the manufacturer, the figure number which he proposes to furnish, and engineering data on each figure number, if not using those specified. The intent of this requirement is to obtain the most suitable valve for each service. Nonstandard valves will not be considered.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine valve interior through the end ports, for cleanliness, freedom from foreign matter and corrosion. Remove special packing materials, such as blocks used which prevents disc movement during shipping and handling.

B. Actuate valve through an open-close and close-open cycle. Examine functionally significant features, such as guides and seats made accessible by such actuation. Following examination, return the valve closure member to the position in which is was shipped.

C. Examine threads on both the valve and the mating pipe for form (out-of-round or local indentation) and cleanliness.

D. Examine mating flange faces for conditions which might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size and material, and for freedom from defects and damage.

E. Prior to valve installation, examine the piping for cleanliness, freedom from foreign materials, and proper alignment.

F. Replace defective valves with new valves.

3.2 VALVE SELECTION:

A. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select valves with the following ends or types of pipe/tube connections:

Copper Tube Size 2 Inch and Smaller: Solder ends.

Steel Pipe Sizes 2 Inch and Smaller: threaded or grooved-end.

Steel Pipe Sizes 2-1/2 Inch and Larger: grooved-end or flanged.

3.3 VALVE INSTALLATIONS:

A. General Application: Use gate, ball, and butterfly valves for shut-off duty; globe, ball, and butterfly for throttling duty. Refer to piping system specification sections for specific valve applications and arrangements.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves and unions for each fixture and item of equipment in a manner to allow equipment removal without system shut-down. Unions are not required on flanged devices.

D. Install 3-valve bypass around each pressure reducing valve using throttling type valves.

E. Install valves in horizontal piping with stem at or above the center of the pipe.

F. Installation of Check Valves: Install for proper direction of flow as follows:

1. Swing Check Valves: Install in horizontal position with hinge pin level.

2. Wafer Check Valves: Install between 2 flanges in horizontal or vertical position.

G. Install resilient seat gate valves in the waste line at the kitchen to isolate the commutator.

3.4 SOLDER CONNECTIONS:

A. Cut tube square and to exact lengths.

B. Clean end of tube to depth of valve socket, using steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket in same manner.

C. Apply proper soldering flux in an even coat to inside of valve socket and outside of tube.

D. Open gate and globe valves to fully open position.

E. Remove the cap and disc holder of fully open position.

F. Remove the cap and disc holder of swing check valves with composition discs.

G. Insert tube into valve socket making sure the end resets against the shoulder inside valve. Rotate tube or valve slightly to insure even distribution of the flux.

H. Apply heat evenly to outside of valve around joint until solder will melt upon contact. Feed solder until it completely fills the joint around tube. Avoid hot spots or overheating the valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush.

3.5 THREADED CONNECTIONS:

A. Note the internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.

B. Align threads at point of assembly.

C. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).

D. Assemble joint wrench tight. Wrench on valve shall be on the valve and into the pipe is being threaded.

3.6 FLANGED CONNECTIONS

A. Align flanges surface potential.

B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using a torque wrench.

C. For dead end service, butterfly valves require flanges both upstream and downstream for proper shutoff and retention.

3.7 FIELD QUALITY CONTROL:

A. Testing: After piping systems have been tested and put into service, but before final adjusting and balancing, inspect each valve for leaks. Adjust or replace gaskets and/or packing to stop leaks, replace valve if leak persists.

3.8 ADJUSTING AND CLEANING:

A. Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare to receive finish painting or insulation.

3.9 VALVE PRESSURE CLASSIFICATION SCHEDULES

SERVICE	GATE	GLOBE	BALL	CHECK
Chilled Water	125	125	150	125
Domestic Hot and Cold Water	125	125	150	125
Heating Hot Water	150	150	150	150
Steam (15 PSI And Less)	150	150		150
Steam (15 PSI to 125 PSI)	250	250		250

END OF SECTION 15100

SECTION 15140 - SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Division-1 Specification sections, apply to work of this section.

B. This section is a Division-15 "BASIC MATERIALS AND METHODS" section, and is a part of each Division-15 section making reference to supports and anchors specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of supports and anchors required by this section is indicated on drawings and/or specified in other Division-15 sections.

B. Types of supports and anchors specified in this section include the following:

Horizontal-Piping Hangers and Supports.
Vertical-Piping Clamps.
Hanger-Rod Attachments.
Building Attachments.
Saddles and Shields.
Spring Hangers and Supports.
Miscellaneous Materials.
Roof Equipment Supports.
Anchors.
Equipment Supports.

C. Supports and anchors furnished as part of factory-fabricated equipment, are specified as part of the equipment assembly in other Division-15 sections.

D. Provide seismic restraints as required to comply with BOCA and local codes.

1.3 QUALITY ASSURANCE:

A. Manufacturers Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.

2. UL and FM Compliance: Provide products which are UL-listed and FM approved.

3. MSS Standard Compliance:

Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.

Select and apply pipe hangers and supports, complying with MSS SP-69.

Fabricate and install pipe hangers and supports, complying with MSS SP-89.

Terminology used in this section is defined in MSS SP-90.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor. Submit pipe hanger and support schedule showing Manufacturer's figure number, size, location, and features for each required pipe hanger and support.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly or components.

C. Maintenance Data: Submit maintenance data and parts list for each type of support and anchor. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.1 GENERAL

A. Use strap type pipe ring hangers on pipe up thru 3" equal to Grinnel fig. 69 or CT-69. Use standard duty clevis hangers on piping larger than 3" equal to Grinnel Fig. 260. Use pipe roll hangers as indicated on the drawings.

B. Use inserts or supporting members in construction above for overhead suspension. Set inserts or supporting members for hangers in form for concrete construction. Use expansion inserts only where approved by the Architect.

C. Use heavy welded steel brackets for wall suspension. Mount brackets and wall supports on masonry walls and bolts through the wall and a suitable steel back plate on the back of the wall.

D. All heating hot water supply and return piping 6" line size and larger located at boiler room shall have adjustable constant support tension springs hangers equivalent to Grinnell No. 81H.

E The hot water main at each boiler, and the header shall be installed with cold set equal to expected expansion, such that when hot, the piping is true and parallel to the walls.

2.2 HORIZONTAL-PIPING HANGERS AND SUPPORTS:

A. General: Except as otherwise indicated, provide factory- abricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.

Adjustable Steel Clevis Hangers: MSS Type 1.

Yoke Type Pipe Clamps: MSS Type 2.

Steel Double Bolt Pipe Clamps: MSS Type 3.

Steel Pipe Clamps: MSS Type 4.

Pipe Hangers: MSS Type 5.

Adjustable Swivel Pipe Rings: MSS Type 6.

Adjustable Steel Band Hangers: MSS Type 7.

Adjustable Band Hangers: MSS Type 9.

Adjustable Swivel Rings, Band Type: MSS Type 10.

Split Pipe Rings: MSS Type 11.

Extension Split Pipe Clamps: MSS Type 12.

U-Bolts: MSS Type 24.

Clips: MSS Type 26.

Pipe Saddle Supports: MSS Type 36, including steel pipe base-support and cast-iron floor flange.

Pipe Stanchion Saddles: MSS Type 37, including steel pipe base support and cast-iron floor flange.

Adjustable Pipe Saddle Supports: MSS Type 38, including steel pipe base support and cast-iron floor flange.

Single Pipe Rolls: MSS Type 41.

Adjustable Roller Hangers: MSS Type 43.

Pipe Roll Stands: MSS Type 44.

Pipe Rolls and Plates: MSS Type 45.

Adjustable Pipe Roll Stands: MSS Type 46.

2.3 VERTICAL-PIPING CLAMPS:

A. General: Except as otherwise indicated, provide factory- fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.

B. Two-Bolt Riser Clamps: MSS Type 8.

C. Four-Bolt Riser Clamps: MSS Type 42.

2.4 HANGER-ROD ATTACHMENTS:

A. General: Except as otherwise indicated, provide factory- fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.

Steel Turnbuckles: MSS Type 13.

Steel Clevises: MSS Type 14.

Swivel Turnbuckles: MSS Type 15.

Malleable Iron Sockets: MSS Type 16.

Steel Weldless Eye Nuts: MSS Type 17.

2.5 BUILDING ATTACHMENTS:

A. General: Except as otherwise indicated, provide factory- fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.

Top Beam C-Clamps: MSS Type 19.

Side Beam or Channel Clamps: MSS Type 20.

Center Beam Clamps: MSS Type 21.

Welded Beam Attachments: MSS Type 22.

C-Clamps: MSS Type 23.

Top Beam Clamps: MSS Type 25.

Side Beam Clamps: MSS Type 27.

Steel Beam Clamps W/Eye Nut: MSS Type 28.

Linked Steel Clamps W/Eye Nut: MSS Type 29.

Malleable Beam Clamps: MSS Type 30.

Steel Brackets: One of the following for indicated loading:

Light Duty: MSS Type 31.

Medium Duty: MSS Type 32.

Heavy Duty: MSS Type 33.

Side Beam Brackets: MSS Type 34.

Plate Lugs: MSS Type 57.

Horizontal Travelers: MSS Type 58.

2.6 SADDLES AND SHIELDS:

A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

B. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.

C. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.

Manufacturer: Subject to compliance with requirements, provide thermal hanger shields of one of the following:

Elcen Metal Products Co.
Pipe Shields, Inc.

2.7 MANUFACTURERS OF HANGERS AND SUPPORTS:

A. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:

B-Line Systems, Inc.
Fee & Mason Mfg. Co., Div. Figgie International.
ITT Grinnel Corp.

2.8 MISCELLANEOUS MATERIALS:

A. Metal Framing: Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.

C. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 PREPARATION:

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.

B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.3 INSTALLATION OF BUILDING ATTACHMENTS:

A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

B. Use powder driven anchors or expansion anchors at concrete structure.

C. Install supplementary steel angles, fastened or welded to building structure as required to support pipe and accessories. Use 3" x 5" x 1/4" steel angle with long leg vertical, or heavier if required.

3.4 INSTALLATION OF HANGERS AND SUPPORTS:

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Space hangers 5'-0" on center for steel, iron, and copper pipe up to and including 1 1/2" nominal size.

C. Space hangers 10'-0" on center for steel, iron, and copper pipe above 1 1/2", or as otherwise shown on the drawings. Piping size 12" and above shall have hanger spacing at 12'-0" maximum, unless shown otherwise on the drawings.

D. Space hangers 5'-0" on center for cast iron soil pipe.

E. Space hangers 4'-0" on center for PVC and ABS plastic piping.

F. Mount piping so that all runs are parallel and evenly spaced.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as install for adjacent similar piping.

H. Support fire-water piping independently of other piping.

I. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

J. Provisions for Movement: Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

K. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded.

M. Insulated Piping: Comply with the following installation requirements: Size hangers on insulated pipe 3" and smaller to fit the pipe. Use copper plated hangers for copper pipe. Size hangers on insulated pipe 4" and larger to fit the insulation, and provide pipe sleeves and high density insulation inserts as specified under "Insulation and Pipe Covering".

1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.

2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields. For pipe 8" and over, install wood insulation saddles.

3. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

3.5 INSTALLATION OF ANCHORS:

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and FASTEN to structure. Comply with ANSI B31 and with AWS standards.

3.6 EQUIPMENT SUPPORTS:

A. Concrete housekeeping bases will be provided as work of Division 3. Furnish to Contractor, scaled layouts of all required bases, with dimensions of bases, and location to column center lines. Furnish templates, anchor bolts, and accessories, necessary for base construction.

3.7 ADJUSTING AND CLEANING:

A. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.

B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.8 SEISMIC REQUIREMENTS:

A. Install all hangers, supports, and anchors to comply with BOCA and local codes.

END OF SECTION 15140

SECTION 15190 - MECHANICAL IDENTIFICATION:

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Division-1 Specification sections, apply to work of this section.

B. This section is a Division-15 Basic Materials and Methods section, and is part of each Division-15 section making reference to identification devices specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of mechanical identification work required by this section is indicated on drawings and/or specified in other Division-15 sections.

B. Types of identification devices specified in this section include the following:

Plastic Pipe Markers.
Underground-Type Plastic Line Marker.
Valve Tags.
Valve Schedule Frames.
Equipment Nameplates

C. Mechanical identification furnished as part of factory-fabricated equipment, is specified as part of the equipment assembly in other Division-15 sections.

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

B. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals as specified in Division 1.

C. Maintenance Data: Include product data and schedules in maintenance manuals; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering mechanical identification materials which may be incorporated in the work include, but are not limited to, the following:

B. Manufacturer: Subject to compliance with requirements, provide mechanical identification materials of one of the following:

Allen Systems, Inc.
Brady (W.H.) Co.; Signmark Div.
Industrial Safety Supply Co., Inc.
Seton Name Plate Corp.

2.2 MECHANICAL IDENTIFICATION MATERIALS:

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-15 sections. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.

2.3 PLASTIC PIPE MARKERS:

A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.

B. Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers, complying with ANSI A13.1.

C. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125 deg F (52 deg C) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.

D. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:

1. Snap-On application of pre-tensioned semi-rigid plastic pipe marker.

2. Adhesive lap joint in pipe marker overlap.

3. Laminated or bonded application of pipe marker to pipe (or insulation).

4. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".

E. Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:

1. Laminated or bonded application of pipe marker to pipe (or insulation).

2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2" wide, full circle at both ends of pipe marker, tape lapped 3".

3. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.

F. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.

G. Lettering: Comply with piping system nomenclature as specified, scheduled or shown, and abbreviate only as necessary for each application length.

1. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

2.4 UNDERGROUND-TYPE PLASTIC LINE MARKERS:

A. General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried pipe.

1. Provide multi-ply tape consisting of solid aluminum foil core between 2-layers of plastic tape.

2.5 VALVE TAGS:

A. Plastic Laminate Valve Tags: Provide manufacturer's standard 3/32" thick engraved plastic laminate valve tags, with piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener.

1. Provide 1-1/2" sq. black tags with white lettering, except as otherwise indicated.

2. Provide size, shape and color combination as specified or scheduled for each piping system.

B. Valve Tag Fasteners: Manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

C. Access Panel Markers: Provide manufacturer's standard 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8" center hole to allow attachment.

2.6 VALVE SCHEDULE FRAMES:

A. General: For each page of valve schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

2.7 LETTERING AND GRAPHICS:

A. General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

1. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

2.8 EQUIPMENT NAMEPLATES

A. Nameplates shall be laminated phenolic plastic black front and back with white core. Lettering shall be engraved through front layer to form 1/4" white characters. Nameplates shall be securely fastened to the equipment to be identified, with No. 4 Phillips, round head, cadmium plated, steel self tapping screws or nickel plated brass bolts. In lieu of separate plastic nameplates, engraving directly on device plates is acceptable. Letters engraved thus, shall be filled with contrasting enamel. All nameplates and their installation are part of this work. Free hand lettering or dymo label marker will not be acceptable.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION:

A. General Installation Requirements:

1. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 PIPING SYSTEM IDENTIFICATION:

A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:

1. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot non-insulated pipes.

B. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) exterior non-concealed locations, and piping above lay-in ceilings.

1. Near each valve and control device.

2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.

3. Near locations where pipes pass through walls or floors/ ceilings, or enter non-accessible enclosures.

4. At access doors, manholes and similar access points which permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.

7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

8. Locate pipe markers on all medical and dental gas piping (air vacuum and oxygen) at 20' spacing.

3.3 VALVE IDENTIFICATION:

A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.

B. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Architect/Engineer.

1. Where more than one major machine room is shown for project, install mounted valve schedule in each major machine room, and repeat only main valves which are to be operated in conjunction with operations of more than single machine room.

3.4 EQUIPMENT IDENTIFICATION

A. General: The following items shall be equipped with nameplates:

1. Air Handling Units and/or rooftop HVAC equipment.

2. Exhaust fans

3. Pumps

4. Boilers and Chillers

B. Inscription: Nameplates shall adequately describe the function or use of the particular equipment involved. The name used for a machine nameplate shall be the same as the one used on the contract drawings.

END OF SECTION 15190

SECTION 15200 - NOISE AND VIBRATION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Division-1 Specification sections, apply to work of this section.

B. Division-15 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Extent of Vibration Isolation work is indicated on drawings and schedules, and by requirements of this section.

B. Expected noise levels in various parts of the building shall generally conform to noise criteria recommendations as set forth in the 1970 A.S.H.R.A.E. guide and data book, Chapter 33, pages 513 to 518, as may be updated.

C. Submittal data shall show type, size and deflection of each isolator proposed. All steel bases and concrete inertia bases shall be completely detailed, including O.D., free, operating and solid heights of the springs, isolation efficiency based on the lowest operating speed of the equipment supported and clearly outlining procedures for installing and adjusting the isolators.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Amber Booth Co. - Korfund Vibration Mountings Inc., -Consolidated Kinetic Corporation, Vibration Mountings, Inc. or Mason. All isolation equipment shall be furnished by a single manufacturer.

B. Corrosion Protection:

1. All vibration isolators and bases shall be designed or treated for resistance to corrosion.

2. For indoor installations, steel components shall be PVC coated or phosphated and painted with industrial grade enamel. Bases shall thoroughly be cleaned of welding slag and primed.

3. For outdoor installations, all parts shall be aluminum, PVC coated, hot-dip galvanized, or zinc-electro plated, plus coating of neoprene or bitumastic paint.

4. All nuts, bolts, and washers shall be zinc-electro plated.

B. Design Requirements:

1. All rails, saddles, frames, and bases shall be supplied with equipment mounting templates or shall be drilled to receive the supported equipment.

2. All spring isolators shall be capable of 30% overtravel before becoming solid, and furnished complete with a ribbed neoprene pad bonded to the base plate.

3. All open spring type isolators shall be designed stable, for a minimum KX/KY (horizontal to vertical spring rate) of 1.0.

4. All mechanical equipment over 1 horsepower shall be isolated from the structure by means of resilient vibration and noise isolators, unless otherwise noted.

5. All minimum deflection for spring isolators shall conform to requirements of ASHRAE Chapter 35.

C. Isolate Piping as follows:

1. Isolate all suspended piping in the mechanical equipment rooms and all piping up to and including three supports away from mechanical equipment over 1 HP with combination spring and synthetic rubber hangers.

2. Isolate floor mounted piping with neoprene mounts.

D. Isolate equipment as follows:

1. Floor mounted Make-Up Air Units, Air Handling Units, Cabinet Exhaust Fans and Cabinet Relief Fans, with open spring mount; consisting of one or more coil springs enclosed in an adjustable telescoping cast iron or aluminum top and bottom section, separated by resilient neoprene inserts.

2. Isolate suspended Air Handling units with spring hanger consisting of a coil spring placed within a rectangular steel box.

3. Isolate air compressors and vacuum pumps with ribbed neoprene pad.

4. Isolate suspended supply air fan and return air/relief air fans with combination spring and synthetic rubber hangers.

5. Isolate roof or floor mounted make-up air units with spring isolation rails.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturers instructions.

END OF SECTION 15200

SECTION 15250 - MECHANICAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Division-1 Specification sections, apply to work of this section.

B. Division-15 Basic Materials and Methods sections apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of mechanical insulation required by this section is indicated on drawings, and by requirements of this section.

B. Types of mechanical insulation specified in this section include the following:

1. Piping System Insulation:

Domestic Water Piping Systems.
Storm Water Piping Systems.
Hot Water Piping Systems.
Chilled Water Piping Systems.

2. Ductwork System Insulation:

Dual Temperature Ductwork.

3. Equipment Insulation:

Bottom of Roof Drain Bodies.
Chilled Water Pumps
Expansion Tanks
Air Separators

1.3 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

Armstrong World Industries, Inc.
Certainteed Corp.
Schuller International (Johns-Manville Corp.)
Owens-Corning Fiberglas Corp.
Rubatex Corp.
American Thermal Products, Inc.

C. Installer: A firm with at least 3 years successful installation experience on projects with mechanical insulations similar to that required for this project.

D. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread rating of 25 or less, and smoke-developed rating of 50 or less, as tested by ANSI/ASTM E 84 (NFPA 255) method.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's specifications and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, thickness, and furnished accessories for each mechanical system requiring insulation.

B. Samples: Submit a sample of each type of insulation, clearly labeled, that is to be used on this project. Samples will be delivered to and retained by the Owners observer for comparing to actual installation.

C. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data in maintenance manual.

D. Certifications: Submit certifications or other data as necessary to show compliance with these specifications and governing regulations. Include proof of compliance for test of products for fire rating, corrosiveness, and compressive strength.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard ratings of products.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged insulation; remove from project site.

PART 2 - PRODUCTS

2.1 PIPE INSULATION MATERIALS:

A. Features: All completed insulation of pipe and fittings shall have the following Underwriters Laboratories Fire Hazard Classification:

1. Flame spread not to exceed - 25.

2. Fuel contributed not to exceed - 50.

3. Smoke developed not to exceed - 50.

B. Three or Four (3 or 4 lb.) density glass fiber insulation used for all pipe covering in this section shall have a maximum "K" factor of .24 at 100°F. mean temperature.

C. Insulate domestic hot water supply, domestic hot water recirculating line, heating water supply, heating water return piping with 1" thick glass fiber pipe insulation covered with factory applied flame retardant vapor barrier jacket. Insulate all piping 6" diameter and above with 2" thick glass fiber. Schuller Micro-Lock 850 fiberglass with AP-T Plus jacket or equal.

1. Interior concealed fittings shall be insulated with flexible glass fiber to a thickness equal to the adjoining piping insulation. Finish by spiral wrapping with white vinyl.

2. Interior exposed fittings shall be insulated with PVC fitting covers installed over flexible glass fiber inserts to a thickness equal to the adjoining pipe insulation. Schuller, Zeston or equal.

D. Insulate chilled water supply and return, chilled drinking water, domestic cold water, soft cold water, internal rain leaders and downspouts with 1" thick glass fiber pipe insulation with factory applied flame retardant vapor barrier jacket Schuller Miro-Lok 850 fiberglass with AP-T Plus jacket or equal. Chilled Water Piping sizes 6" and above shall have 1.5 inch thick insulation.

1. Interior concealed fittings and pipe hangers shall be insulated with flexible glass fiber to a thickness equal to the adjoining pipe insulation. Finish by spiral wrapping with white vinyl and apply a brush coat of vapor barrier mastic. Childers CP-30 or equal.

2. Interior exposed fittings shall be insulated with PVC fitting covers installed over flexible glass fiber inserts to a thickness equal to the adjoining pipe insulation. Manville Zestons or equal. Vapor seal all joints with Childers CP-30 or equal.

3. Interior exposed pipe hangers for chilled water shall be insulated with 1/2" thick Armstrong Armaflex sheet insulation Type "FR". Insulation shall be field cut and formed for a neat finished appearance. Vapor seal all joints and Armaflex with Childers CP-30 or equal.

E. Piping runouts 1" and less located in concealed walls or plumbing chases where space is limited may be insulated with 1/2" thick insulation in lieu of 1" thick.

F. Provide high density inserts at hanger locations between the pipe and pipe shield for pipe sizes 4" and larger. Maintain a continuous vapor barrier through the hangers and match the jacketing of adjoining pipe insulation.

G. Outdoor Piping (exposed to weather): Use the same insulation for interior exposed pipes carrying the same product and add: A jacket of .016 smooth sheet aluminum 3003 alloy, H-14 temper. Finish fittings with Foster Sealfas G-P-M 35-00 reinforced with Foster Mast-a-Fab.

H. Insulate "P" trap and exposed hot water supply lines below handicapped accessible lavatories in one of the following manners:

1. Molded flexible vinyl insulation system, Model #101 "Handi Lav-Guard" as manufactured by Truebro.

2. PVC 2 piece "P" trap cover with insulation tubing, "Trap-Guard" as manufactured by Buckaroos. Insulate hot water supply with 1/2" wall flexible closed-cell insulation with enamel coating.

3. Other systems with prior approval only.

2.2 DUCTWORK SYSTEM INSULATION:

A. Manufacturers: Schuller (Johns Manville) Microtex - Textra-fine -Certain-Teed/Saint - Gobain - Owens Corning.

B. Insulate internally low velocity rectangular supply ducts, and return air ducts with 1/2" liner with a minimum density of 2.0 pounds per cu. ft. complying with TIMA AHC-101. Insulate fresh air ducts with 1.0" thick duct liner. Plenums at exterior louvers shall have duct wrap per Paragraph 2.4.E.

C. Applied with coated side to air stream in cut to fit pieces fastened to interiors of duct with adhesive.

D. Coat all exposed edges with Foster's Gray No. 30-70 Lagtone adhesive.

E. Adhere liner to interior sides of duct with minimum 50% coverage of fire retardant adhesive such as Foster 85-11, Childers, or Minnesota Mining. Equivalent to comply with ASC-A-7001.

F. Use mechanical fastening of Graham Welded Pins, or Stick-Klips on maximum 16" centers at top sections when width exceeds 12" and on sides when height exceeds 24". Pins shall comply with SMACNA MF-1.

G. Apply a brush width of Foster's Fire Retardant Coating Gray No. 30-70 Lagtone over all joints, visible cut edges, and leading edges of insulation to prevent fiber erosion.

H. DUCT SIZES ON DRAWINGS ARE FOR DIMENSIONS INSIDE OF LINING AND SHEET METAL SIZE SHALL BE INCREASED ACCORDINGLY. If adhesive is applied in shop use Foster Spark - FAS 85-11 if applied in field use Foster Spark - FAS Adhesive 85-20. Adhesives shall be approved and listed by Underwriters Laboratory and shall bear the U.L. Label.

I. Density and thickness of duct liner shall be printed on the face of the liner by the manufacturer.

J. Duct liner shall have an Underwriters Laboratories fire hazard rating with a flame spread not to exceed 25 and fuel contributed and smoke developed ratings not to exceed 50.

2.3 EQUIPMENT INSULATION MATERIALS

A. Insulate all chilled water pumps with Armstrong Armaflex sheet insulation Type "FR" 1/2" thick, inside an aluminum box which is removable and sets over the pump.

B. Insulate expansion tanks, inline air eliminators, roof drain sump bodies with Type "FR" 1/2" thick Armaflex sheet insulation in cut to fit pieces.

2.4 DUCT INSULATION (EXTERNAL)

A. Manufacturers: Schuller (Manville) - Certain-Teed - Ultralite - Textra-Fine -Owens-Corning - E. O. Wood.

B. Insulate externally all round and oval ducts, all rectangular supply air ducts which are noted or specified to have no duct lining, and all high velocity rectangular ducts with 1-1/2" thickness of .6 - .75 pound density fiberglass ductwrap with a Foil-scrim Kraft vapor barrier applied with outward-clinching staples.

C. Insulation shall be continuous through partitions, coils, etc. Insulate fire damper sleeves to partitions.

D. NOTE: Dual wall ducts with factory installed insulation need not be field insulated.

E. Insulate externally all plenums directly behind louvers with 1" thick, 3 pound density board insulation with FAK facing. Apply over Insul-Anchors and secure with self-locking washers. Tape all joints and washers with 3" wide FSK tape to match the facing of the insulation.

PART 3 - EXECUTION

3.1 PLUMBING PIPING SYSTEM INSULATION:

A. Insulation Omitted: Omit insulation on exposed plumbing fixture runouts from faces of wall or floor to fixture unless otherwise indicated on the plumbing fixture specifications; on unions, flanges, strainers, flexible connections, and expansion joints.

3.2 HVAC PIPING SYSTEM INSULATION:

A. Insulation Omitted: Omit insulation on hot piping, on heating piping on and beyond control valve, located within heated space; on the heating coils. Omit insulation on unions, flanges, strainers, flexible connections, and expansion joints, on hot piping systems.

3.3 INSTALLATION OF PIPING INSULATION:

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation on pipe systems subsequent to testing and acceptance of tests.

C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other. Where insulation is terminated for piping accessories as noted above, the insulation thickness shall be tapered down to the pipe at a 45°angle with proper coating and sizing.

D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

E. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.

F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.

G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

H. Install protective metal shields and insulated inserts wherever needed to prevent compression of insulation.

I. Pipe Hanger Insulation Inserts: Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3 inch wide vapor barrier type or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3 inch wide vapor barrier tape or band.

3.4 INSTALLATION OF DUCTWORK INSULATION:

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation materials with smooth and even surfaces.

3.5 PROTECTION AND REPLACEMENT:

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation Installer shall advise contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 15250

SECTION 15325 - WET PIPE SPRINKLER SYSTEM

PART 1 GENERAL

1.1 WORK INCLUDED

A. Inside and outside wet piping, including sprinkler heads, valves, hangers and supports, sleeves, fire department connections, alarms and accessories. Provide risers as required for wet pipe systems.

1.2 RELATED WORK AND APPLICABLE REQUIREMENTS SPECIFIED ELSEWHERE

A. DIVISION 1 - GENERAL REQUIREMENTS: These shall apply to all work included in this section.

B. Related Work:

1. DIVISION 3 - CONCRETE
2. Section 15330 - AFFF Fire Suppression Systems
3. Section 15335 - Fire Pump Systems
4. Section 15340 - Fire Detection, Alarm and Equipment Activation Systems

1.3 APPLICABLE PUBLICATIONS: The publications listed below form a part to this specification to the extent referenced. The publications are referred to in the text by basic designation only.

A. Federal Specifications (Fed. Spec.):

TT-E-489F & AM 1	Enamel, Alkyd, Gloss (For Exterior and Interior Surface)
TT-P-645A	Primer, Paint, Zinc Chromate, Alkyd type

B. Military Specification (Mil. Spec.):

DOD-P-15328D	Primer (Wash), Pre-Treatment (Formula No. 117 for Metals) (Metric)

C. American Society for Testing and Materials (ASTM) Publications:

A 53-86	Pipe, Steel, Black and Hot Dipped Zinc Coated (Galvanized) Welded and Seamless for Ordinary Uses
A 120-86	Pipe, Steel, Black and Hot Dipped Zinc Coated (Galvanized) Welded and Seamless for Ordinary Uses

D. American Water Works Association (AWWA) Publications:

C601-68	Disinfecting Water Mains.

E. Factory Mutual System (FM) Publications

1995	Approval Guide

F. National Fire Protection Association (NFPA) Publications:

13-94	Sprinkler Systems
24-92	Private Fire Service Mains

G. Underwriters' Laboratories, Inc. (UL) Publications:

1995	Fire Protection Equipment Listing

H. Department of the Air Force:

ETL-90-09	Engineering Technical Letter, as amended by attachment to ANGRC/CEE and ANG/CEE review comments

1.4 QUALIFICATIONS OF INSTALLER: Prior to installation, submit data for approval by the Contracting Officer, showing that the Contractor has successfully installed automatic fire extinguishing sprinkler systems of the same type and design as specified herein. The data shall include the names and locations of at least two installations where the contractor has installed such systems. The Contractor shall indicate the type and design of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 18 months. The design and installation of the wet pipe sprinkler systems shall be coordinated with the systems being furnished and constructed under **SECTIONS: AFFF FIRE SUPPRESSION SYSTEMS, FIRE PUMP SYSTEMS** and **FIRE DETECTION, ALARM AND EQUIPMENT ACTIVATION SYSTEMS**. All the work covered by these sections shall be the responsibility of one fire protection firm. This firm shall normally be engaged in the field of fire protection with a registered fire protection engineer on staff. Certification of this qualification shall be submitted for approval.

A. Description of Work:

1. The work includes designing and providing new automatic wet pipe fire extinguishing sprinkler systems for uniform distribution of water to afford complete fire protection coverage throughout the areas indicated for wet pipe sprinkler system(s) in the project drawings.

2. The design, equipment, materials, installation and workmanship shall be in strict accordance with the required and advisory provisions of NFPA 13 and 24, except as modified herein. Include all materials, accessories and equipment necessary to provide each system complete and ready for use. Design and install each system to give full consideration to blind spaces, piping, electrical equipment, ductwork, and all other construction and equipment to afford complete coverage in accordance with detailed drawings to be submitted for approval. Devices and equipment for fire protection service shall be of an approved make and type listed by the Underwriters' Laboratories, Inc. or approved by the Factory Mutual System. In the publications referred to herein the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; reference to the "authority having jurisdiction" shall be interpreted to mean the Contracting Officer. The work shall begin 5 feet outside of the building walls.

B. Submittals Required: Partial submittals will not be accepted. Annotate descriptive data to show specific model, type, and size of each item the Contractor proposes to furnish. Prepare working drawings on sheets not smaller than 30 inches by 42 inches, in accordance with the requirements for "Working Drawings (Plans)" as specified in NFPA 13, and include data essential to the proper installation of each system. Do not commence work until the design of each system and the various components have been approved. The Contracting Officer will review and approve all submittals. Before any work is commenced, submit for approval complete sets of working drawings and calculations for each sprinkler system, hydraulic calculations to show the basis for the design, graphs, or tables showing the pressure-discharge relationship for the sprinkler heads; and full descriptive data for pipe, fittings, alarm valves, outside stem & yoke valves, check valves, water-motor alarms, sprinkler heads, hangers, pressure switches, devices, materials, and associated equipment.

C. Instruction Manuals: Furnish instruction manuals containing complete operation and maintenance instructions for the specific make and model of the alarm valve furnished. Place one copy of each instruction manual in a flexible oil resistant protective binder and mount in an accessible location on the vicinity of each alarm valve. Furnish three additional copies of each instruction manual.

D. As-Built (Record) Working Drawings: After completion, but before final acceptance of the work, furnish a complete set of drawings of each sprinkler system for record purposes. The drawings shall not be smaller than 30 inches by 42 inches reproducible drawings on mylar film with title block (8 inches by 4 inches) similar to full size contract drawings. Furnish the as-built (record) working drawings in addition to the as-built contract drawings required by Section 01021.

PART 2 - PRODUCTS

2.1 DESIGN OF SPRINKLER SYSTEMS: Wet pipe fire extinguishing systems shall provide a uniform distribution of water over the design area and shall conform to NFPA 13 and to the requirements specified herein. The wet pipe sprinkler systems shall be hydraulically designed in accordance with the requirements of NFPA 13.

A. Sprinkler Heads: Heads shall have nominal 1/2" or 17/32" orifice. Release elements of each head shall be of the intermediate temperature rating or higher as suitable for the individual location where it is installed. Provide chromium plated ceiling plates and pendent sprinklers below suspended ceilings. Provide corrosion resistant sprinkler heads and sprinkler head guards as required by NFPA 13. Sprinkler heads shall be rated for 250 ^{o}F to 300 ^{o}F.

B. Cabinet: Provide extra sprinkler heads and sprinkler head wrench in a metal cabinet adjacent to the alarm valve within each building. The number and types of extra sprinkler heads shall be as specified in NFPA 13.

D. Alarm Valve: Valve shall be of the variable pressure type complete with all accessories and appurtenances necessary for the proper operation of each system and to prevent false alarms due to surges or other conditions in the supply to each system.

E. Density of Application of Water: Size pipe to provide the specified density when the system is discharging the specified total maximum required flow. Application to horizontal surfaces below the sprinklers shall be spaced in accordance with the hazard classifications as specified in NFPA 13 and on the project drawings. In addition an outside hose stream requirement of 250 gpm shall be provided.

F. Sprinkler Discharge Area: Area shall be hydraulically most remote area as defined in NFPA 13 for hazard classification as specified on the project drawings.

G. Friction Losses: Calculate losses in pipe in accordance with the Hazen - Williams formula with 'C' value of 120 for steel pipe, 150 for copper tube, and 140 for buried cement lined ductile iron pipe and asbestos cement pipe.

H. Location of Sprinkler Heads: Heads in relation to the ceiling and the spacing of sprinkler heads shall not exceed that permitted by NFPA 13 for hazard occupancy as specified on the project drawings. The spacing of sprinklers on the branch lines shall be essentially uniform.

I. Water Supply: Base hydraulic calculations on a static pressure of 125 pounds per square inch gauge (psig) with 2,500 gpm being available at the discharge of the primary and reserve pumps.

2.2 ALARMS:

A. Water Motor Alarm: Provide alarms of the approved weatherproof and guarded type, to sound locally on the flow of water in each sprinkler system to which it is connected. Mount alarms on the outside of the outer walls of each building, at a location as directed.

B. Pressure Switch: Provide switch with circuit opener or closer for the automatic transmittal of an alarm over the facility fire alarm system and connect into the fire alarm system.

Alarm actuating device shall be of the mechanical diaphragm controlled water pressure type with retard device. The retard device shall be adjustable from 10 to 60 seconds, and shall be of a type which instantly recycles when pressure is released on the diaphragm. The alarm tone shall be of a "pulsating" type.

2.3 ABOVE GROUND PIPING SYSTEMS: Provide fittings for changes in direction of piping and for all connections. Make changes in piping sizes through standard tapered reducing pipe fittings; the use of bushings will not be permitted. Jointing compound for pipe threads shall be polytetrafluroethylene (PTFE) pipe thread tape, pipe cement and oil, or graphite and oil; apply only on male threads. Pipe nipples 6 inches long and shorter shall be Schedule 40 steel pipe. Run the piping concealed in areas with suspended ceilings.

A. Sprinkler Pipe and Fittings: Sprinkler pipe and fittings shall be in accordance with NFPA 13 except that piping smaller than 2 inch shall be schedule 40. Water motor alarm drain piping shall be zinc coated steel pipe and fittings. Rubber gasketed grooved end pipe and fittings with mechanical couplings shall only be permitted in pipe sizes 2 inch and larger. Grooved mechanical fittings shall be ductile iron or malleable iron with grooved or shouldered designs to accept grooved end couplings. Use of segmentally welded steel fittings, restriction orifices, reducing flanges, and plain-end fittings with mechanical couplings (which utilizes steel gripping devices to bite into pipe when pressure is applied) will not be permitted. Grooved mechanical couplings shall be ductile or malleable iron housings, a synthetic rubber gasket of a central cavity pressure responsive t design, with nuts, bolts, locking pin, locking toggle or lugs to secure rolled grooved pipe and fittings. All coupling and fitting products shall be from a single approved manufacturer.

B. Pipe Hangers (Supports): Provide in accordance with NFPA 13.

C. Valves: Provide valves as required by NFPA 13 and of types approved for fire service.

1. Check Valves: Cast iron body with bolted top, horizontal swing with a bronze disc or cast iron disc ring and flanged ends, or grooved end, electro plated ductile iron body with dual disc design. U.L. listed to 250 psi, tapped for 1/2" ball drip.

2. Gate valves: Flanged, outside screw and yoke type, open by counter-clockwise rotation, rated for at least a 175 psi working pressure.

3. Butterfly valves: Grooved end or wafer style. 2-1/2 inch to 8 inch shall be listed to 175 psi with internal tamper switch. Body and disc shall be ductile iron.

4. Ball Valves: 2 inch and smaller shall be threaded, forged brass construction, with teflon seats and blowout proof stem. UL/FM listed to 600 psi.

D. Identification Signs: Attach properly lettered approved metal signs conforming to NFPA 13 to each valve and alarm device. Permanently affix design data nameplates to the riser of each system.

E. Inspector's Test Connection: Provide test connections approximately 6 feet above the floor for each sprinkler system or portion of each sprinkler system equipped with an alarm device and locate at the hydraulically most remote part of each system. Test Connection shall be an integral UL/FM listed assembly incorporating a combination sight glass/orifice. Orifice to be same as sprinkler head orifice.

F. Main Drains: Provide drain piping to discharge at safe points outside each building or to sight cones attached to drains of adequate size to readily receive the full flow from each drain under maximum pressure. Provide auxiliary drains as required by NFPA 13.

G. Pipe Sleeves: Provide where piping passes through walls, floors, roofs, and partitions. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide not less than 0.25-inch space between exterior of piping or pipe insulation and interior of sleeve. Firmly pack space with insulation and caulk at both ends of the sleeve with plastic waterproof cement.

1. Sleeves in Masonry and Concrete Walls, Floors: Provide ASTM A 53 or ASTM A 120, Schedule 40 or Standard Weight, zinc coated steel pipe sleeves. Sleeves in floor slabs shall extend 3 inches above the finished floor.

2. Sleeves in partitions, and Other Than Masonry and Concrete Walls, Floors, and Roofs: Provide zinc coated steel sheet having a nominal weight of not less than 0.90 pounds per square foot.

H. Escutcheon Plates: Provide approved one piece of split hinge type plates for piping passing through floors, walls and ceilings in both exposed and concealed areas. Provide chromium plated metal plates where pipe passes through finished ceilings. Provide other plates of steel or cast iron with aluminum paint finish. Securely anchor plates in place with set screws or other approved positive means.

I. Fire Department Inlet Connections: Provide inlet connections approximately 3 feet above grade, of the approved two way type with 2.5-inch National Standard female hose threads with plug and chain.

2.4 BURIED PIPING SYSTEMS:

A. Pipe and Fittings: Provide outside coated cement lined ductile iron pipe and fittings conforming to NFPA 24 for piping less than 5 feet outside of the building walls. Anchor the joints in accordance with NFPA 24 using pipe clamps and steel rods. Minimum depth of cover shall be 3 feet. Piping more than 5 feet outside of the building walls shall be provided under Section 02713, "Water Distribution System."

1. Polyethylene for pipe encasement shall be in tube or sheet form, minimum nominal thickness of 0.008 inches, conforming to ANSI/AWWA C105.

PART 3 - EXECUTION

3.1 CONNECTIONS TO WATER SUPPLY SYSTEMS: Connections shall be to the new Fire Pump System.

3.2 CORROSION PROTECTION: All underground ductile iron pipe, valves, and fittings shall be encased in a polyethylene film in accordance with ANSI/AWWA Specification C105.

3.3 DISINFECTION: Disinfect new water piping in accordance with AWWA C601. Fill piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for a minimum of 24 hours. Flush solution from systems with clean water until maximum residual chlorine content is not greater than 0.2 parts per million.

3.4 FIELD PAINTING: Clean, pre-treat, prime, and paint new sprinkler system including valves, piping, conduit, hangers, miscellaneous metalwork, and accessories. Apply coatings to clean dry surfaces using clean brushes. Clean the surfaces to remove dust, dirt, rust, and loose mill scale. Immediately after cleaning, provide the metal surfaces with one coat of Mil. Spec. DOD-P-15328 pre-treatment primer applied to a minimum dry film thickness of 0.3 mil, and one coat of Fed. Spec. TT-P-645 primer applied to a minimum dry film thickness of one mil. Exercise care to avoid the painting of sprinkler heads or protective devices. Remove materials which are used to protect sprinkler heads, while painting is in process, upon the completion of painting. Remove sprinkler heads which are painted and provide new clean sprinkler heads of the proper type. Provide primed surfaces with the following:

A. Sprinkler Systems in Unfinished Areas: Unfinished areas are defined as attic spaces, spaces above suspended ceiling, crawl spaces, pipe chases, and spaces where walls or ceiling are not painted or not constructed of a pre-finished material. Provide primed surfaces with one coat of Fed. Spec. TT-E-489 red enamel applied to a minimum dry film thickness of one mil.

B. Sprinkler Systems in All Other Areas: Provide primed surfaces with two coats of paint to match adjacent surfaces, except provide valves and operating accessories with one coat of Fed. Spec. TT-E-489 red enamel applied to a minimum dry film thickness of one mil. Provide piping with 2-inch wide red enamel or self adhering red plastic tape bands spaced at maximum of 20-foot intervals throughout the piping systems, except in finished areas such as offices the red bands may be deleted.

3.5 ELECTRICAL WORK: Coordinate with other trades, all electrical connections as required by system installation. Furnish all electrical connections as required to provide complete working system.

3.6 FIELD TESTING AND FLUSHING:

A. Preliminary Tests: Hydrostatically test each system at 200 psig for a period of 2 hours. Flush piping in accordance with NFPA 13. Piping above suspended ceilings shall be tested, inspected and approved before installation of ceilings. Test the alarms and other devices. Test the water flow alarms by flowing water through the inspector's test connection. When tests have been completed and corrections made, submit a signed and dated certificate, similar to that specified in NFPA 13, with a request for a formal inspection and tests.

B. Formal Inspection and Tests: Contracting Officer, or Contracting Officer's representative will witness formal tests and approve all systems before they are accepted. Submit the request for formal inspection at least 15 days prior to the date the inspection is to take place. An experienced technician regularly employed by the sprinkler installer shall be present during the inspection. At this inspection, repeat any or all of the required tests as directed. Correct defects in the work provided by the Contractor, and make additional tests until it has been demonstrated that the systems comply with all contract requirements. Everything required for testing shall be provided by the Contractor and all expenses, in connection with the tests, shall be defrayed by him.

SECTION 15340 - FIRE DETECTION, ALARM AND EQUIPMENT ACTIVATION SYSTEMS

PART 1 - GENERAL

A. Work included in This Section: Materials, equipment, fabrication, installation and test in conformity with applicable codes and authorities having jurisdiction for the following:

1.1 Fire Detection, Alarm and Equipment Activation Systems: Zoned, closed circuit, electrically supervised, Class A, Including but not limited to the following:

a. Manual fire alarm stations
b. Space smoke detectors
c. Building fire alarm panel
d. Interface panel
e. Audible and visual devices
f. Building transceiver
g. Lightning arrester
h. Omni directional antenna
i. Coaxial cable assembly
j. Flow and Tamper switch wiring
k. Rate-compensated heat detectors
l. Ultra violet/infrared detectors
m. All necessary appurtenances

B. Related work and applicable requirements specified elsewhere:
1. Conduit and wiring, BASIC MATERIALS AND METHODS Section.

C. Related work:
1. Section 15325 - Wet Pipe Sprinkler System
3. Section 15330 - AFFF Fire Suppression Systems
4. Section 15335 - Fire Pump Systems

D. Existing system: All new equipment and systems shall be compatible with the existing fire alarm system, unless excepted, in written specifications and drawings that are a part of the contract and approved by Contracting, Base Communications and Base CEEE.

1.2 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

A. Factory Mutual System (FM) Publication:

Approval Guide (Equipment, Materials, Services for Property Conversation) 1995.

B. National Fire Protection Association (NFPA) Standards:

70-1993 National Electrical Code.

72-1993 National Fire Alarm Code

C. Underwriters Laboratories, Inc. (UL) Publications:

Fire Protection Equipment Directory (Jan 1995 with Quarterly Supplements)

UL 6 Rigid Metal Conduit.

UL 38 Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems.

UL 228 Door Closers-Holders, with or without Integral Smoke Detectors.

UL 268 Smoke Detectors for Fire Protective Signaling Systems.

UL 464 Audible Signal Appliances.

UL 467 Grounding and Bonding Equipment.

UL 521 Heat Detectors for Fire Protective Signaling Systems.

UL 632 Electrically Actuated Transmitters.

UL 797 Electrical Metal Tubing.

UL 864 Control Units for Fire Protective Signaling Systems.

UL 1242 Intermediate Metal Conduit.

D. Department of the Air Force:

ETL-90-09 Engineering Technical Letter, as amended by attachment to ANGRC/CEE and ANG/CEE review comments

1.3 QUALIFICATIONS OF INSTALLER: Prior to installation, submit data for approval by the Contracting Officer showing that the contractor has successfully installed fire alarm systems and associated equipment of the same type and design as specified herein. The data shall include the names and locations of at least two installations where the Contractor has installed such systems. The Contractor shall indicate the type and design of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 18 months. The design and installation of the fire alarm system shall be coordinated with the systems being furnished and constructed under **SECTIONS: WET PIPE SPRINKLER SYSTEM, AFFF FIRE SUPPRESSION SYSTEMS** and **FIRE PUMP SYSTEMS**. All the work covered by these sections shall be the responsibility of one fire protection firm. This firm shall be normally engaged in the field of fire protection with a registered fire protection engineer on staff. Certification of this qualification shall be submitted for approval.

1.4 **QUALITY ASSURANCE**

A. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall essentially duplicated items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

B. Nameplates: Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a non-corrosive and non-heat sensitive plate which is securely attached to the equipment.

C. Keys and Locks: Locks shall be keyed alike.

D. Tags: Tags with stamped identification number shall be furnished for all keys and locks.

E. Verifications of Dimensions: The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

F. Compliance: The fire detection and internal alarm system shall be configured in accordance with NFPA 72. The central reporting systems shall be configured in accordance with NFPA 72. The equipment furnished shall be compatible with existing equipment and be UL listed or FM approved in accordance with the applicable NFPA standards.

G. Manufacturer's Services: Services of a manufacture's representative who is experienced in the installation, adjustment, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

H. Provide this complete fire alarm system while the existing systems are still in full operation. Program or schedule all new connections to the existing systems with minimal down time and properly coordinated with the Communications Officer.

1.5 SUBMITTALS:

A. Shop Drawings: Shop Drawings for the fire protection/detection system shall be **one integrated submittal**. This submittal shall include sprinkler plans and sections, oscillating monitor plans and sections, fire pump system plans and sections, fire detection and alarm plans and riser, and catalog cuts of proposed equipment. In addition, the shop drawings shall consist of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, performance charts and curves, and installation instructions. Shop drawings shall also contain complete wiring and schematic diagrams and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout and the anchorage of equipment and appurtenances, and equipment relationship to the other parts of the work including clearances for maintenance and operation. Shop drawings shall be submitted on full-size mylar sheets. After updating all deviations, modifications, and changes, the shop drawings will represent the final (mylar) as-built drawings.

B. Test Procedures: The Contractor shall furnish to the Contracting Officer detailed test procedures for the fire detection and alarm system 60 days prior to performing the system tests. The test procedures must be signed by a registered fire protection engineer. For qualifications of this engineer, see paragraph 1.3 QUALIFICATIONS OF INSTALLER.

C. Spare Parts Data: After approval of the shop drawings, and not later than 2 months prior to contract completion, the Contractor shall furnish spare parts data for each different item of materials and equipment specified. The data shall include a complete list of parts and supplies, with current unit prices and a source of supply, and a list of the parts recommended by the manufacturer to be replaced after 1 and 3 year(s) of service.

D. Calculations: Substantiating battery calculations shall be submitted for the supervisory and alarm power requirements. Ampere-hour requirements for each system component and each panel component shall be submitted with the calculations. Battery recharging period shall be included with the calculations.

E. Operating and Maintenance instructions for the system(s) and equipment furnished shall be in accordance with the requirements of this section.

F. The Contractor shall furnish the Contracting Officer 6 complete copies of the operating instructions outlining step-by-step procedures required for system start up, operation, and shut down. The instructions shall include the manufacture's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Operating instructions shall be submitted and approved prior to the training course.

G. The Contractor shall furnish the Contracting Officer 6 copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The instructions shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the systems installed. Maintenance instructions shall be submitted and approved prior to the training course.

H. The Contractor shall conduct a training course for the operating staff as designated by the Contractor Officer. The training period shall consist of 3 training days (8 hours per day) and shall start after the system(s) is functionally completed but prior to final acceptance test. The field instructions shall cover all the items contained in the operating and maintenance instructions.

I. Performance Test Reports: Upon completion and testing of the installed system, test reports shall be submitted in booklet form showing all field test performed to prove compliance with the specified performance criteria. Each test report shall indicate the final position of the controls.

1.6 DELIVERY AND STORAGE

A. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt and dust, and any other contaminants.

1.7 GUARANTEE

A. Guarantee of all equipment and labor by manufacturer for one year from written notice of acceptance by the Government.

1.8 SYSTEM DESIGN

A. Operation: Systems(s) shall be a complete, supervised zoned coded fire alarm system. The system shall be activated into the alarm mode by actuation of any alarm initiating device (see Attachment I). The system shall remain in the alarm mode until initiating device is reset and the fire alarm control panel is manually reset and restored to normal. Electrical supervision shall be Style D or E in accordance with NFPA 72. All circuits shall be capable of operating under a single ground or open condition, except primary and emergency power supplies.

B. Operational Features: The system shall have the following operating features:

1. Electrical supervision of alarm initiating circuits and alarm indicating circuits. Smoke detectors shall have combined alarm initiating and power circuits.

2. Electrical supervision of circuits used to activate fire extinguishing systems. Supervision shall include the coil of the releasing solenoid.

3. Electrical supervision of the primary power (AC) supply, presence of the battery, battery voltage, placement of alarm zone modules within the control panel, and transmitter tripping circuit integrity.

4. Trouble buzzer and trouble lamp (light emitting diode or neon light) to activate upon a single break, open, ground fault, or abnormal position of any switch condition which prevents the required normal operation of the system(s). The trouble signal shall also operate upon loss of primary power (AC) supply, absence of a battery supply, low battery voltage, removal of alarm zone modules, and disconnection of the circuit used for transmitting alarm signals off-premises. A trouble alarm silence switch shall be provided which will silence the trouble buzzer, but will not extinguish the trouble indicator lamp. After the system returns to normal operating conditions, the trouble buzzer shall again sound until the silencing switch returns to normal conditions. The trouble signal shall be transmitted to the central fire station.

5. Transmitter disconnect switch to allow testing and maintenance of the system(s) without activating the transmitter.

6. Evacuation alarm silencing switch or switches which, when activated, will silence alarm devices, but will not affect the zone indicating lamp nor the operation of the transmitter. This switch shall be overridden upon activation of a subsequent alarm from an unalarmed zone.

7. Switch which will bypass AFFF (Aqueous Film Forming Foam) fire suppression system operation. Operation of the switch shall activate the system trouble signal.

8. Electrical supervision of circuits used for supervisory signal services.

9. Zones for alarm initiating circuits shall be arranged as indicated on the contract drawings.

C. Alarm Functions: An alarm condition on a zone circuit shall automatically initiate the following functions:

1. Transmission of a signal via radio transmitter compatible with the existing Monaco System from alarm condition on heat detectors or UV/IR detectors.

2. Visual indication of the zone operated on the fire alarm control panel annunciation from alarm condition on heat detectors or UV/IR detectors

3. Continuous sounding of alarm indicating devices throughout the building from alarm condition on heat detectors or UV/IR detectors

4. Automatic discharge of the AFFF underwing monitors and automatic charging of AFFF pre-action sprinkler piping when any two cross-zoned rate-compensated heat detectors or AFFF manual fire alarm station is activated.

D. Primary Power: Operating power shall be single phase taken from the building electrical service as specified. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and shall not cause transmission of a false alarm. Loss of AC power shall not prevent transmission of a signal via the fire reporting system upon operation of any initiating circuit.

E. Emergency Power: Emergency power shall be through the use of rechargeable, sealed-type storage batteries and battery charger.

1.9 OVERVOLATGE AND SURGE PROTECTION

A. Power Line Surge Protection: All equipment connected to alternating current circuits shall be protected from power line surges. Equipment shall meet the requirements of ANSI C62.41. Fuses shall not be used for surge protection.

B. Communications Link Surge Protection: All communications equipment shall be protected against surges induced on any communications link. All cables and conductors, except fiber optics, which serve as communications links shall have surge protection circuits installed at each end that meet the following two wave forma:

1. A 10 microsecond by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.

2. A 8 microsecond by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes. Protection shall be provided at the equipment. Additional triple electrode gas surge protectors, rated for the application, shall be installed on each wireline circuit within three feet of the building cable entrance. Fuses shall not be used for surge protection.

C. Sensor Wiring Surge Protection: All digital and analog inputs and outputs shall be protected against surges induced by sensor wiring installed outdoors and as shown. The inputs and outputs shall be tested with the following two wave forms:

1. A 10 microsecond by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.

2. A 8 microsecond by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes. Fuses shall not be used for surge protection.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. CONTROL PANEL shall comply with the applicable requirements of UL 864. Panel shall be modular, installed in a surface mounted steel cabinet with hinged door and cylinder lock. Control panel shall be a neat, compact assembly containing all components and equipment required to provide the specified operating and supervisory functions of the system. The panel shall have prominent rigid plastic or metal identification plates for all lamps, zones, control, meters, fuses, and switches. Nameplates for fuses shall also include ampere rating. Separate alarm and trouble lamp shall be provided for each zone alarm initiating circuit, located on the exterior of the cabinet door or be visible through the cabinet door. Control panel switches shall be within locked cabinet. A suitable means shall be provided for testing the control panel visual indicating devices (meters or lamps). Meters and lamps shall be plainly visible when the cabinet of the control unit is closed. Initiating circuits shall have plug-in cards or modules for ease of servicing. Signals shall be provided to indicate by zone any alarm, supervisory or trouble condition on the system. Each initiating circuit shall be powered and supervised so that a signal on one zone does not prevent the receipt of signals from other zones. Loss of power, including any or all batteries, shall not require the reloading of a program from any source. Upon restoration of power, start-up shall be immediate, automatic, and shall not require any manual operation. The loss of primary power shall not affect the transmission of alarm, supervisory or trouble signals. Enclosures shall be provided with ample gutter space to allow proper clearance between enclosure and live parts of the panel equipment. If more than one modular unit is required to form a control panel, the units shall be installed in a single enclosure large enough to accommodate all units.

B. Additional Features: Fire alarm control panel shall provide all primary and emergency power for the operation and the supervision of the AFFF fire extinguishing system. Fire extinguishing systems powered from the fire alarm control panel shall be capable of being powered by the fire alarm system standby emergency batteries. No additional power sources necessary to activate the fire extinguishing systems will be permitted. All wiring used for supervision of or activation of the fire extinguishing systems shall be supervised. Any open or ground shall cause lighting of a trouble lamp and sounding of the system trouble buzzer or bell and transmission of trouble signal to the central fire station.

C. Circuit Connections: Circuit conductors entering or leaving the panel shall be connected to screw-type terminals with each terminal marked for identification.

D. FIRE ALARM TRANSMITTER shall be compatible with the existing base fire alarm receiving system. The existing system is Monaco.

E. STORAGE BATTERIES shall be provided and shall be sealed, lead-calcium, lead-acid or nickel-cadmium with pocket plates types requiring no additional water. The batteries shall have ample capacity, with primary power disconnected, to operate the fire alarm system for a period of 24 hours. Following this period of operation via batteries, the batteries shall have ample capacity to operate all components of the system, including all alarm signaling devices in the total alarm mode for a period of 5 minutes. Batteries shall be sized to deliver 50 percent more ampere/hours than required for the calculated capacities. Battery cabinet shall be a separate compartment within the control panel.

F. BATTERY CHARGER shall be completely automatic, with high/low charging rate, capable of restoring the batteries from full discharge to full charge within 24 hours. A separate voltmeter shall be provided to indicate the state of the battery charge. Pilot light shall indicate when the batteries are manually placed on a high rate of charge as part of the unit assembly, if a high rate switch is provided. Charger shall be located in the control panel.

G. MANUAL FIRE ALARM STATIONS shall conform to the applicable requirements of UL 38. Manual stations shall be connected into alarm initiating circuits. Stations shall be single action type. Stations shall be furnished in red, with raised letter operating instructions of contrasting color. Stations requiring the breaking of glass or plastic panels for operation are not acceptable: however, stations employing glass rods are acceptable. The use of key or wrench shall be required to reset the station. Gravity or mercury switches are not acceptable. Switches and contacts shall be rated for the

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voltage and current upon which they shall operate. Stations shall have a separate screw terminal for each conductor. Surface mounted boxes shall be painted the same color as the fire alarm manual stations.

H. FIRE DETECTING DEVICES shall comply with the applicable requirements of NFPA 72, UL 286, UL 286A, and UL 521. The detector shall be mounted as specified or indicated. Detector base shall have terminals for making connections. No solder connections will be allowed. Detectors shall be connected into alarm initiating circuits.

1. Heat Detectors: Heat detectors shall be designed for detection of fire by rate-compensating principle. The ratings for the rate compensated detectors shall be between 190 ^{o}F and 225 ^{o}F. Detectors shall be located in accordance with their listing by UL or FM and the requirements of NFPA 72. Maximum area of coverage shall be 400 square feet (20 foot x 20 foot) per detector. Detectors, located in areas subject to moisture or exterior atmospheric conditions or hazardous locations as defined by NFPA 70, shall be types approved for such locations. Detectors shall have screw terminals for making all wiring connections. Detectors shall be designed for surface outlet box mounting and supported independently of wiring connections. Detectors shall be hermetically sealed and automatically resetting. Detectors shall be matrix-zoned (see Attachment I) in such a manner that operation of two zone selective detectors in the Hangar shall be necessary to actuate the underwing nozzle system. Actuation of the underwing nozzle system shall operate oscillating nozzles as indicated in zone schedule.

Operation of only one detector shall:

a. Sound the AFFF pre-alarm signal - a “slow whoop” tone
b. Annunciate an unconfirmed fire AFFF alarm at the building Fire Alarm Control panel (FACP) and transmit same to Base Fire Department Control Supervising Station Radio Receiving Console (CSSRRC).

Activation of any two cross-zoned detectors shall:

a. Sound the AFFF pre-discharge signal - a “yelp/wail” tone.
b. Annunciate a confirmed fire AFFF alarm at the FACP and CSSRRC.
c. Trip the deluge valves on the pre-action sprinkler systems.
d. Open the AFFF concentrate solenoid valve supply the proportioner.
e. Activate the AFFF oscillating monitor system.
. Start the fire pumps.
g. Activate only hangar area exhaust fan shutdown systems.

2. Smoke Detectors: Detectors shall operate on the photoelectric light-scattering principle. The detectors shall be listed by Underwriters Laboratories or Factory Mutual approved. The smoke detector shall contain an infrared LED light source and a light sensing photodiode. Detector shall be capable of activating a remote indicating lamp on a remote annunciator. Smoke detector shall only provide an alarm capability at the FACP and CSSRRC.

3. Ultra-Violet/Infrared Detectors (UV/IR): UV/IR detectors shall have dual spectrum sensing and fire event analysis. Provide sufficient detectors to cover entire hangar area based on the viewing angle of the detector selected and manufacturer's instructions. Detectors shall be mounted on the wall with adjustable bracket. Each detector shall be capable of responding to a JP-4 fuel fire 2 ft x 2 ft at a distance of 100 or at the center of the hangar within 5 seconds. All detectors shall be supervised. The UV/IR combination flame detectors shall not be activated by intermittent or continuous direct reflected solar radiation, arc welding, lighting, radiant heat, X-rays, normal jet engine functions including direct exhaust blast, normal artificial lighting or radio transmissions. The UV/IR detectors shall only provide an alarm capability at the FACP and CSSRRC. In addition, detectors shall provide the following features:

a. The detector logic will require UV and IR signals to be present in the proper ratio as emitted by a hydrocarbon fire and require a fire signal to be present for a minimum of 50% of each event period before confirming a fire.

b. The detector must include complete automatic self-testing including through the lens check, UV and IR sensor test, and electronic circuits including all logic and output relay coils without energizing the outputs.

c. In addition to automatic self test, the detector must provide provision for manual testing including through the lens check, sensor test, and electronics circuits including all logic. The output circuits shall be energized.

d. The detector shall be fully functional from -67 degrees F to +185 degrees F. Enclosure shall be passivated aluminum. Suitable for use in NEMA 4, watertight and dusttight environments and NFPA Class I, Division 1 Groups B, C and D: Class II Groups E and G environments, explosion-proof.

e. The detector shall provide outputs for confirmed fire and fault and shall have capability to provide outputs for warning of excessive UV and IR background. All outputs shall be hermetically sealed relay contacts or optional; solid state collector transistor drive.

f. The detector shall be self-contained with processing circuits necessary for confirming the presence of fire and ignoring those signals which would cause false alarms. The detector outputs shall be capable of direct interface with a FM approved releasing panel. The detector outputs shall also be capable of interfacing with annunciator panels and data acquisition systems.

g. The UV/IR detectors shall be FM approved.

h. Detector shall have optical/integrity to monitor the proper operation of the detector, cleanliness of viewing window, and sensitivity of sensors.

i. Detector faults shall be digitally displayed.

j. Detector shall be able to detect a fire in the presence of arc welding, X-ray, or background IR radiation.

k. Detector/controller shall be user programmable to provide adjustable response of intensity and duration of response to signals.

l. The UV/IR detectors shall be matrix-zoned (see Attachment I) in such a manner that the following alarm signals shall be provided:

1. Operation of any one UV/IR detector shall:

- Sound the AFFF pre-alarm (slow whoop tone).
- Annunciate an unconfirmed fire AFFF alarm at the building Fire Alarm Control Panel (FACP) and transmit same to the Base Fire Department Control Supervising Station Radio Receiving Console (CSSRRC).

2. Operation of any two cross-zoned UV/IR detectors shall:

- Sound the AFFF pre-discharge alarm (yelp/wail tone).
- Annunciate a confirmed fire alarm at the building Fire Alarm Control Panel (FACP) and transmit same to the Base Fire Department Control Supervising Station Radio Receiving Console (CSSRRC).

I. SIGNALING DEVICES: Audible signal devices shall be heavy duty, adjustable sound level type conforming to the applicable requirements of UL 446. Devices shall be connected into alarm indicating circuits.

1. Alarm Bells: Bells shall be 10-inch surface mounted with matching mounting back box. Bells shall be of vibrating type, suitable for use in an electrically supervised circuit. Bells shall be the underdome type producing a sound output rating of at least 87 dba at 10 feet. Bells used in exterior locations shall be specifically listed or approved for outdoor use and provided with metal housing and protective grilles. Single stroke, electrically operated, supervised, heavy duty, solenoid bells shall be used for coded applications. Bells shall have a separate screw terminal for each conductor.

2. Alarm Horns: Horns shall be surface-mounted, vibrating type suitable for use in electrically supervised circuit and with a sound output rating of at least 87 DBA at 10 feet. Horns with metal housing and protective grilles shall be specifically listed for outdoor use in exterior locations. Horns shall have a separate screw terminal for each conductor. Alarm tones shall be as specified in Reference 1.2D of these specifications.

3. Strobes: Strobes shall have high intensity optic lens and flash tubes. Strobes may be coupled with an audible signal device. Strobes shall flash at frequencies between three flashes per second and one flash every three seconds. Pulse duration shall be 0.2 second. Strobes shall be listed or approved for a minimum of 100 candela seconds. Strobes shall be surface mounted. Strobes shall have a separate screw terminal for each conductor.

J. ANNUNCIATION PANEL: Panel shall be part of the fire alarm control panel. A visual annunciator shall be provided for each zone and spare zone as indicated. Each lamp shall provide specific identification of the zone by means of a permanently attached rigid plastic or metal sign with either raised or engraved letters. Zone identification shall consist of word description of the zone.

2.2 FIRE DETECTION AND ALARM PERIPHERAL EQUIPMENT:

A. Conduit: Conduit shall be as specified in SECTION: ELECTRICAL WORK, INTERIOR.

B. Wiring: Wiring for 120 V AC power shall be No. 12 AWG minimum. Wiring for low voltage DC circuits shall be No. 16 AWG minimum. Power wiring and control wiring shall be isolated. All wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in metallic conduit or electrical metallic tubing. Surface metal raceway shall be provided in finished areas. All conductors shall be color coded. Conductors used for the same functions shall be distinctively color coded. Two different color codes shall be used for each alarm circuit: one for each loop. Wiring code color shall remain uniform throughout the circuit. Pigtail or T-tap connections to the alarm initiating and alarm indicating circuits are unacceptable.

C. Special Tools and Spare Parts: Special tools necessary for the maintenance of the equipment shall be furnished. Two spare sets of fuses of each type and size required and five spare lamps and LED's of each type shall be furnished. Two percent of the total number of each detector, but no less than two each, shall be furnished. Fuses and lamps shall be mounted in the fire alarm panel.

D. Building Transceiver shall conform to the following:
1. Wall mounted NEMA 12 metal enclosure.
2. Communication link between local alarm Control Panel and a Central Transmitter/Receiver.
3. Monitor a minimum of 16 zones continuously monitored 10 times per second.
4. Alarm codes shall be transmitted three times. Trouble codes shall be transmitted two times.
5. Automatic re-setting of zone monitoring after trouble or alarm transmissions.
6. Field addressable with address numbers 1 to 500
7. Control switches and test LED indicators for "off system" testing.
8. FCC type accepted VHF-FM transmitter and receiver.
9. Shall transmit signals up to 35 miles.

10. Self monitoring of trouble conditions for AC power failure, low battery, and tampering with enclosure.
11. Built-in transient voltage protection.
12. 24 hour standby battery operation upon AC power failure.
13. Power supply module with battery charging circuit.
14. Shall supervise communication lines between the building's transceiver and the buildings fire alarm control panel.
15. The unit must be approved by the Base Fire Department prior to shop drawing submittal.

E. Interface Panel:
1. Shall interface the building's fire alarm control panel with the buildings transceiver.
2. Shall operate at 24 V DC.
3. Shall have a supervisory terminating resistance of 15,000 ohms +/- 5%, 0.5 watt.
4. Shall have a voltage operating range of +/- 15% of rated voltage.
5. Shall have contacts capable of drawing 50 amperes, minimum.

F. Lighting Arrester:
1. Shall withstand 10 surges of 15,000 amperes in 5 micro seconds and a total charge of 21 coulombs.
2. Shall have a breakdown voltage that will withstand as initial surge of 2,500 V DC and repeated surges of 1,500 V DC.
3. Shall allow a maximum of 30 V DC to be applied to equipment during surge dissipation.
4. Shall have a shunt capacitance of 16 nanofarads.
5. Shall have a RF power capability of 1 KW RF 100% modulated AM.
6. Shall have an impedance of either 52 or 72 ohms.
7. Shall have a frequency range that goes up to 300 MHZ.
8. Shall have a replacement indication of 10 M ohms, or less, center conductor to ground.

G. Omnidirectional Antenna:
1. Receive and send signals equally in all directions.
2. 3 db, 5/8 wave ground plane forward gain.
3. Stainless steel construction.
4. Vertical polarization.
5. Maximum power rating of 200 watts.
6. 52 ohms nominal RF impedance.
7. VSWR at resonance 1.3 to 1 maximum.
8. Shall have 4 ground wires.
9. Shall have a wind load resistance that will withstand 125 mph.

10. Shall have a SO-239 RF connector.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation: All work shall be installed as shown on the approved shop drawings and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified.

B. Power Supply for the System: A single dedicated branch-circuit connection for supplying power to each building system shall be provided. Emergency power supply shall be automatically transferred upon failure of the normal power supply.

C. Wiring: Wiring for the systems shall be installed in 3/4 inch minimum diameter conduit: however, the wiring for the fire alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting or power systems. No more than one conductor shall be installed under any screw terminal. All circuit conductors entering or leaving any mounting box, outlet box enclosure or cabinet shall be connected to terminals with each terminal marked in accordance with the wiring diagram for identification. Connections shall be made with either crimp-on terminal spade lugs or with approved pressure type terminal blocks. All wiring within any control equipment shall be readily accessible without removing any component parts. The fire alarm equipment manufacturer's representative shall be present for the connection of the wiring to the control panel.

D. Control Panel: The control panel and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 12 inches above the finished floor nor more than 78 inches above the finished floor. All manually operable controls shall be at least 3 feet and less than 5 feet above the finished floor. Panel shall be installed to comply with the requirements of UL 864.

E. Detectors: Detectors shall be installed in accordance with NFPA 72. Detectors shall be at least 12 inches from any part of any lighting fixture. Detectors shall be located at least 3 feet from diffusers of air handling systems. Each detector shall be provided with the appropriate mounting hardware as required by its mounting location. Detectors which mount in free space shall be mounted directly to the end of the stubbed down rigid conduit drop. Conduit drops shall be firmly secured to minimize detector sway. Where length of conduit drop from ceiling or wall surface exceeds 3 feet, sway bracing shall be provided.

1. Locations: Detectors shall be installed in the areas shown on the contract drawings. These drawings are schematic in nature and are intended to show the areas where detectors are required. The actual number and locations of detectors required shall be in accordance with the applicable sections of NFPA 72.

F. Signaling Devices: Signaling devices shall be mounted a minimum of 8 feet above the finished floor unless limited by ceiling height or otherwise indicated.

G. Annunciator Equipment: Annunciator equipment shall be mounted and provided where indicated.

H. Grounding: Grounding shall be provided to building ground or ground rods shall be driven. Maximum impedance to ground shall be 25 ohms. Ground rods shall not protrude more than 6 inches above grade.

3.2 TEST

A. TESTING: The Contractor shall notify the Contracting Officer 30 days before the performance and acceptance test are to be conducted. The tests shall be performed in the presence of the Contracting Officer under the supervision of the fire alarm system manufacturer's qualified representative. The Contractor shall furnish all instruments and personnel required for the tests.

B. Preliminary Tests: Upon completion of the installation, the system shall be subjected to functional and operational performance tests including tests of each installed heat and smoke detector. Test shall include the meggering of all system conductors to determine that the system is free from grounded or open circuits. The megger test shall be conducted prior to the installation of fire alarm equipment. Smoke detector bases shall be equipped with jumpers for the megger test. If deficiencies are found, corrections shall be made and the system shall be retested to assure it is functional.

C. Acceptance Test: The testing shall be in accordance with NFPA 72 and shall verify that all previous deficiencies have been corrected. The test shall included the following:

1. Test of each function of the control panel

2. Test of each circuit in both trouble and normal modes.

3. Test of alarm initiating devices in both normal and trouble conditions.

4. Test of each control circuit and device.

5. Tests of each alarm indicating device.

6. Tests of the battery charger and batteries.

7. Complete operational tests under emergency power supply.

8. Visual inspection of all wiring.

9. Opening the circuit at each alarm initiating and indicating device to test the wiring supervisory feature.

10. An operational test will be conducted involving the UV/IR detectors and the foam monitor cannons. The contractor shall furnish a 2 ft x 2 ft x 4 inch deep pan filled with water to within 1 inch of the top and add enough JP-4 fuel to provide sufficient fire to fill the pan. The Contractor shall also perform arc welding during the flame test to ensure system will activate while welding takes place. The pan shall be placed 100 ft from or centered between the UV/IR detectors. The contractor shall be liable for all damage and clean-up associated with the test. The Base fire department will provide a standby truck with a crew and a 150 lb Halon flight line fire extinguisher. The Contractor will also provide the initial and refill foam required for all tanks. The test will be repeated until satisfactory results are obtained at no additional cost to the Government. This test may be video taped by the Government.

3.3 POST CONTRACT MAINTENANCE

A. Complete maintenance and service for the fire alarm system shall be provided by factory trained authorized representatives of the manufacturers of the major equipment for a period of two years after acceptance of the installation by the Contracting Officer.

B. Maintenance and inspection service shall be performed by factory trained representatives of the major equipment manufacturers.

C. Maintenance service shall include the following:

1. Inspection:
   a. Systematic examination of all equipment at six months intervals.

b. Testing, cleaning, adjusting, repairing and replacing of all components as necessary, to keep the system in reliable condition and proper working order.
c. Furnishing all tools, test instruments, cleaning materials and parts required.
d. Battery and charger maintenance shall be included.

2. Emergency Service:
a. Normal and overtime emergency call-back service shall consist of responding to calls within two hours of notification of system trouble.
b. Overtime emergency call-back service shall be limited to minor adjustments and repairs to effect the integrity of the system.

3. Non-included Work: Maintenance service shall not include the performance of any work due to improper use, accidents or negligence for which the contractor is not directly responsible.

D. Service and emergency personnel shall report to the Contracting Officer or his authorized representative upon arrival at the base and again upon completion of the required work. A copy of the work ticket containing a complete description of the work performed and parts replaced shall be given to the Contract Officer.

E. The contractor shall maintain a log at the Central Station. The log shall list the date and time of all examinations and trouble calls, condition of the system, and name of the technician. Each trouble call shall be fully described, including the nature of the trouble, necessary correction performed, and parts replaced.

Attachment I
Fire Alarm Matrix For Fuel System Maintenance Hangar

				FACP & CSSRRC												
Input/Output Matrix (Fire Suppression System)	Pre-Alarm (Slow Whoop Tone)	Pre-Discharge (Yelp/Wail Tone)	Discharge (Pulsating Tone)	Unconfirmed Fire	Confirmed Fire	AFFF Discharge	Wet Pipe Sprinkler Discharge	AFFF Hand Line Discharge	Start Fire Pumps	Open AFFF Concentrate Solenoid Valve	Activate Hangar Drain Controls	Activate Hangar Exhaust Controls	Open Riser Deluge Valve	FACP & CSSRRC Abort	Close AFFF Riser Deluge Valves	Transmit Signal to FACP & CSSRRC
Single UV/IR Detector	XXXX			XXXX												
Any Two Cross-Zoned UV/IR Detectors		XXXX			XXXX											
One Heat Detector	XXXX			XXXX												
Any Two Cross-Zoned Heat Detectors		XXXX			XXXX	XXXX (Monitors)			XXXX	XXXX	XXXX	XXXX	XXXX			
Any One Smoke Detector	XXXX			XXXX												
Wet Pipe System HAD			XXXX		XXXX		XXXX		XXXX							
AFFF Pre-action System HAD			XXXX		XXXX	XXXX			XXXX	XXXX	XXXX	XXXX	XXXX			
AFFF Monitor Manual Station			XXXX		XXXX	XXXX			XXXX	XXXX	XXXX	XXXX	XXXX			
Manual Pull Station	XXXX				XXXX											
AFFF Hand Hose Line Station			XXXX		XXXX			XXXX	XXXX		XXXX	XXXX				
AFFF Abort Station														XXXX	XXXX	
Trouble Signal																XXXX

SECTION 15411 - WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Division-1 Specification sections, apply to work of this section.

B. Requirements of the following Division 15 Sections apply to this section:

"BASIC MECHANICAL REQUIREMENTS".
"BASIC MECHANICAL MATERIALS AND METHODS"
"VALVES"
"SUPPORTS AND ANCHORS"

1.2 SUMMARY:

A. This Section specifies the water distribution piping system, including potable cold, soft, hot, and recirculated hot water piping, fittings, and specialties within the building and to a point 5 feet outside the building.

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

1. Division 2 Section "POTABLE WATER PIPING" for specifying water service piping (which connects the "Water Distribution Piping" to wells and public utilities).

2. Division 2 Section "EARTHWORK" for trenching and backfilling materials and methods for underground piping installations.

3. Division 15 Section "BASIC PIPING MATERIALS AND METHODS" for materials and methods for sealing pipe penetrations through floors and fire and smoke barriers.

4. Division 15 Section "METERS AND GAGES" for thermometers, flow meters, and pressure gages.

5. Division 15 - Section "MECHANICAL IDENTIFICATION" for labeling and identification of piping system.

6. Division 15 - Section "PLUMBING PUMPS" for circulators and accessories.

7. Division 15 - Section “VALVES”

C. Products installed but not furnished under this Section include water meters that will be furnished by the Utility Company to the site and ready for installation if applicable.

1.3 SUBMITTALS

A. Product data for each piping specialty and valve specified.

B. Test reports specified in Part 3 of this Section.

1.4 QUALITY ASSURANCE:

A. Regulatory Requirements: comply with the provisions of the following:

1. ASME B 31.9 "Building Services Piping" for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label.

2. UPC Uniform Plumbing Code.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Store pipe in a manner to prevent sagging and bending. Store piping with ends capped to prevent entrance of foreign material.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate the installation of pipe sleeves for foundation wall penetrations.

B. Coordinate with other trades to assure timely installations and to avoid conflicts and interference. Work closely with the metal stud partitions installer and/or mason to assure that anchors, sleeves, and similar items are provided in sufficient time to avoid delays; chases and openings are properly sized and prepared. Coordinate layout of water piping systems in all spaces, and identify all piping accurately and in accordance with coded paint color required.

1.7 EXTRA STOCK

A. Maintenance Stock: Furnish one valve key for each key operated hydrant, bibb, or faucet installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Bibbs and Faucets:

Chicago Faucets
Hammed Valve Corp.
Nibco Inc.
Prier Brass Mfg. Co.
Watts Regulator Co.
Woodford Mfg. Co.

C. Hydrants:

Josam Mfg. Co.
Smith, (Jay R.) Mfg. Co.
Wade Div. of Tyler Pipe.
Woodford Mfg. Co.
Zurn Industries Inc., Hydromechanics Div.

D. Backflow Preventers:

Febco Sales, Inc.; Subs. of Charles M. Bailey Co., Inc.
Hersey Products, Inc.
ITT Lawler; Fluid Handling Div.
Watts Regulator Co.
Conbraco

E. Relief Valves

Cash (A.W.) Valve Mfg. Corp
Conbraco Industries, Inc.
Watts Regulator Co.
Zurn Industries, Inc; Wilkins-Regulator Div.

F. Water Hammer Arresters:

Amtrol, Inc.
Josam
Sioux Chief
Smith (Jay R.) Mfg. Co.
Wade Div. of Tyler Pipe
Zurn Industries, Inc.; Hydromechanics Div.

G. Dielectric Unions:

Perfection Corp.
Watts Regulator Co.

H. Pressure-Regulating Valves

Cash (A.W.) .Valve Mfg. Corp.
Cal-Val Co.
Spence Engineering Co., Inc.
Watts Regulator Co.
Zurn Industries Inc., Wilkins Regulator Div.

2.2 PIPE AND TUBE MATERIALS:

A. General: Refer to Part 3, Article "PIPE APPLICATIONS" for identification of systems where the below materials are used.

1. Drawn Temper Copper Tubing: ASTM B88, Type L.

2. Annealed Temper Copper Tubing: ASTM B88, Type K.

2.3 FITTINGS

A. Wrought-Copper Fittings: ANSI B16.22, streamlined pattern.

B. Dielectric Unions: Threaded or soldered end connections as required to suit application; constructed to isolate dissimilar metals, prevent galvanic action, and prevent corrosion.

2.4 JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, 95-5 Tin-Antimony.

2.5 VALVES

A. General duty valves (i.e., gate, globe, check, ball, and butterfly valves) are specified in Division 15 Section "VALVES." Refer to Part 3 Article "VALVE APPLICATION" for specific uses and applications for each valve specified.

2.6 PIPING SPECIALTIES:

A. Water Hammer Arresters: Bellows type, with stainless steel casing and bellows, pressure rated for 250 psi, or piston type, Type L copper tube casing, tested and certified in accordance with PDI Standard WH-201. Sizes called out on the plan are P.D.I. sizing symbols. Water Hammer Arresters shown in inaccessible chases shall be approved for that application.

B. Hose Bibbs: Bronze body, renewable composition disc, removable keyed handle with key, 3/4" NPT inlet, 3/4" hose outlet, non-removable vacuum breaker.

C. Projecting Non-Freeze Wall Hydrants: Cast bronze with chrome plated or nickel bronze face, tee handle key, vacuum breaker, 3/4" inlet and hose outlet. Bronze casing shall be length to suit wall thickness.

D. Backflow Preventers:

1. Reduced pressure principle assembly consisting of shutoff valves on inlet and outlet, and strainer on inlet. Assemblies shall include test cocks, and pressure-differential relief valve located between 2 positive seating check valves, and comply with requirements of ASSE Standard 1013.

2. Double Check Valve Assembly consisting of two check valves between two NRS gate valves. Check valves shall be cast iron with bronze seats. Assembly shall include bronze body ball valve test cocks, and shall comply with ASSE Standard 1015.

E. Relief Valves: Provide proper size for relief valve, in accordance with ASME Boiler and Pressure Vessel Codes, for indicated capacity of the appliance for which installed.

F. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210 deg. F, and pressure relief at 150 psi.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Verify all dimensions by field measurements. Verify that all water distribution piping may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Examine rough-in requirements for plumbing fixtures and other equipment having water connections to verify actual locations of piping connections prior to installation.

C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PIPE APPLICATIONS

A. Install Type L, drawn copper tubing with wrought copper fittings and solder joints for 6 inch and smaller, above ground, within building. Install Type K, annealed temper copper tubing for 6 inch and smaller, with minimum number of joints, below ground.

3.3 PIPING INSTALLATION:

A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated.

B. Use fittings for all changes in direction and all branch connections.

1. At Contractor's option, mechanically formed tees may be used in lieu of wrought copper tees for the domestic water lines as follows:

Use only for main lines of 2-1/2" line size and larger with branch lines at least two pipe sizes smaller than the main.

Mechanically extracted collars shall be formed in a continuous operation consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the tube wall. The collaring device shall be fully adjustable as to insure proper tolerance and complete uniformity of the joint.

The branch shall be notched to conform with the inner curve of the run tube and dimpled to insure penetration of the branch tube into the collar if of sufficient depth for brazing and that the branch tube does not obstruct the flow in the main line tube.

All joints shall be brazed in accordance with the Copper Development Association Copper Tube Handbook using B-cup series filler metal.

Note: Soft soldered joints will not be permitted.

All mechanically formed branch collars shall be listed by the National Standard Plumbing Code, B.O.C.A., I.A.M.P.O., S.B.C.C., HUD, U.S. Army Corps of Engineers and Underwriters Laboratory.

C. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

D. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

E. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

F. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1 inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

G. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

H. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4 inch ball valve, and short 3/4 inch threaded nipple and cap.

I. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical (link seal) sleeve seals. Pipe sleeves smaller than 6 inch shall be steel.

J. Fire Barrier Penetrations: Where pipes pass though fire rated walls, partitions, ceilings, and floors, maintain the fire rated integrity. Refer to Division 7 for special sealers and materials.

K. Provide air compression chambers equal to 12 pipe diameters, 18" maximum, on all water supply connections to fixtures and equipment, except where water hammer arresters are installed.

3.4 HANGERS AND SUPPORTS

A. General: Hanger, supports, and anchors devices are specified in Division 15 Section "SUPPORTS AND ANCHORS." Conform to the table below for maximum spacing of supports:

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 10 feet in length.

2. Use copper plated hangers for copper piping.

C. Install hangers with the following minimum rod sizes and maximum spacing:

Nom. Pipe Size	Max. Span-Ft.	Min. Rod-Size-Inches
3/4"	5	3/8
1	5	3/8
1-1/2	5	3/8
2	10	3/8
3	10	1/2
3-1/2	10	1/2
4	10	5/8
6	10	5/8

D. Support vertical runs at each floor.

3.5 PIPE AND TUBE JOINT CONSTRUCTION

A. Soldered Joints: Comply with the procedures contained in the AWS "Soldering Manual." Use 95-5 solder.

1. CAUTION: Remove stems, seats, and packing of valves and accessible internal parts of piping specialties before soldering.

2. Heat joints to proper and uniform temperature.

B. Threaded Joints: Conform to ANSI B1.20.1, tapered pipe threads for field cut threads. Join pipe fittings and valves as follows:

1. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.

2. Align threads at point of assembly.

3. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).

4. Assemble joint wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

a. Damaged Threads: Do not use pipe with threads which are corroded or damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.

C. Flanged Joints: Align flanges surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

3.6 SERVICE ENTRANCE:

A. Extend water distribution piping to connect to water service piping, of size and in location indicated for service entrance to building. Water service piping shall be Type K copper.

B. Install sleeve and mechanical sleeve seal at penetrations through foundation wall for watertight installation.

C. Install a double check valve assembly with shutoff valves at service entrance inside building.

D. Install water meter in accordance with Utility Company's installation instructions and requirements.

E. Install shut-off valves, pressure reducing station, pressure relief valve and pressure gauge per plans.

3.7 VALVE APPLICATIONS

A. General Duty Valve Applications: The Drawings indicate valve types to be used. Where specific valve types are not indicated the following requirements apply:

1. Shut-off duty: Use ball valve for line sizes 2" and less. Use gate or butterfly valves for line size 2 1/2" and above.

3.8 INSTALLATION OF VALVES:

A. Sectional Valves: Install sectional valves on each branch and riser, close to main, and elsewhere as indicated. For sectional valves 2" and smaller, use ball valves; for sectional valves 2-1/2" and larger, use gate or butterfly valves.

B. Shutoff Valves: Install shutoff valves on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated. For shutoff valves 2" and smaller, use ball valves; for shutoff valves 2-1/2" and larger, use gate or butterfly valves.

C. Hose Bibbs: Install on exposed piping where indicated, with vacuum breaker.

3.9 EQUIPMENT CONNECTIONS:

A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes and indicated, but in no case smaller than required by Plumbing Code.

B. Mechanical Equipment Connections: Connect hot and cold water piping system to mechanical equipment as indicated. Provide shut-off valve and union for each connection.

3.10 BACKFLOW PREVENTERS:

A. Install where shown on plans and where required by the Uniform Plumbing Code. Locate in same room as equipment being protected. Provide funnel and pipe relief outlet to nearest floor drain. Test by certified technician prior to final acceptance.

3.11 FIELD QUALITY CONTROL:

A. Inspections:

1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the authority having jurisdiction.

2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made.

3. Re-inspections: Whenever the plumbing official finds that the piping system will not pass the test or inspection, make the required corrections and arrange for re-inspection by the plumbing official.

4. Reports: Prepare inspection reports, signed by the plumbing official.

B. Test water distribution piping as follows:

1. Test for leaks and defects all new water distribution piping systems and parts of existing systems, which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.

2. Leave uncovered and unconcealed all new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.

3. Cap and subject the piping system to a static water pressure of 110 psi. Isolate the test source and allow to stand for a period of 4 hours. Leaks and loss in test pressure constitute defects which must be repaired.

4. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.

5. Prepare reports for all tests and required corrective action.

3.12 ADJUSTING AND CLEANING:

A. Clean and Disinfect water distribution piping as follows:

1. Purge all new water distribution piping systems and parts of existing systems, which have been altered, extended, or repaired for a minimum of 4 hours prior to use.

2. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction, or in case a method is not prescribed by that authority, the procedure described in either AWWA C601, or AWWA D105, or as described below:

a. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet.

b. Fill the system or part thereof, with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) the system, or part thereof, and allow to stand for 24 hours.

c. Drain the system, or part thereof, of the previous solution, and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for 3 hours.

d. Following the allowed standing time, flush the system with clean potable water until chlorine does not remain in the water coming from the system.

e. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.

3. Prepare reports for all purging and disinfecting activities.

3.13 COMMISSIONING

A. Fill the system.

B. Before operating the system perform these steps:

1. Open valves to full open position. Close drain, valves, hydrants, and sill cocks.

2. Remove and clean strainers.

C. Bleed all air from the system.

END OF SECTION 15411

SECTION 15420 - DRAINAGE AND VENT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Division 1 Specification sections, apply to work of this section.

B. Requirements of the following Division 15 Sections apply to this section:

"BASIC MECHANICAL REQUIREMENTS"
"BASIC MECHANICAL MATERIALS AND METHODS"
"SUPPORTS AND ANCHORS"

1.2 SUMMARY:

A. This Section specifies building sanitary and storm drainage and vent piping systems, including drains and drainage specialties.

B. Related Sections:

Division 2 Section "EARTHWORK," for trenching and backfilling materials and methods for underground piping installations.

Division 2 Section "STORM SEWAGE SYSTEMS," for storm water drainage piping beginning from 5' - 0" outside the building.

Division 2 Section "SANITARY SEWAGE SYSTEM," for sanitary drainage piping beginning from 5' - 0" outside the building.

Division 15 Section "BASIC PIPING MATERIALS AND METHODS," for materials and methods for sealing pipe penetrations through basement and foundation walls, and fire and smoke barriers.

Division 15 Section "MECHANICAL IDENTIFICATION," for labeling and identification of drainage and vent piping.

1.3 SUBMITTALS:

A. Product Data for the following products:

Drainage piping specialties
Floor drains
Roof drains
Oil Separator

1.4 QUALITY ASSURANCE:

A. Regulatory Requirements: comply with the provisions of the following:

UPC Uniform Plumbing Code.

1.5 SEQUENCING AND SCHEDULING:

A. Coordinate the installation of roof drains, flashing, and roof penetrations.

B. Coordinate flashing materials installation of roofing, waterproofing, and adjoining substrate work.

C. Coordinate the installation of drains in poured-in-place concrete slabs, to include proper drain elevations, installation of flashing, and slope of slab to drains.

D. Coordinate with installation of sanitary and storm sewer systems as necessary to interface building drains with drainage piping systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturer: Subject to compliance with requirements, provide drainage and vent systems from one of the following:

1. Drainage Piping Specialties, including backwater valves, expansion joints, drains, trap primers, and vandal-proof vent caps:

Josam Mfg. Co.
Smith (Jay R) Mfg. Co.
Wade Div.; Tyler Pipe.
Zurn Industries Inc; Hydromechanics Div.

2. Grease Interceptor

Owens Corning
McTighe
Wemac
Highland Tank

2.2 ABOVE GROUND DRAINAGE AND VENT PIPE AND FITTINGS:

A. Hubless Cast-Iron Soil Pipe: CISPI Standard 301, Service weight, cast-iron soil pipe and fittings, with neoprene gaskets conforming to CISPI standard 310.

2.3 UNDERGROUND BUILDING DRAIN PIPE AND FITTINGS:

A. Cast-Iron Soil Pipe: ASTM A74, standard weight, hub-and-spigot soil pipe and fittings. Pipe and fittings shall have a heavy coating of coal tar varnish or asphaltum on both inside and outside surfaces.

Neoprene Compression Gaskets: ASTM C564.

2.4 DRAINAGE PIPING SPECIALTIES:

A. Backwater Valves: Valve assembly shall be bronze fitted cast-iron, with bolted cover. Flapper shall provide a maximum 1/4" clearance between flapper and seat for air circulation. Valve ends shall suit piping material.

B. Expansion Joints: Cast-iron body with adjustable bronze sleeve, bronze bolts with wing nuts.

C. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.

D. Floor Cleanouts: Cast-iron body and frame, with cleanout plug and adjustable round top as follows:

1. Nickel-Bronze Top: Manufacturer's standard cast unit with exposed flush top, standard non-slip scored or abrasive finish, vandalproof cover. Stainless steel tamperproof screws.

E. Wall Cleanouts: Cast-iron body adaptable to pipe with cast-bronze or brass cleanout plug; stainless steel cover including stainless steel tamperproof screws.

F. Flashing Flanges: Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide underdeck clamp and sleeve length as required.

G. Vent Flashing Sleeves: Cast-iron calking type roof coupling for cast-iron stacks.

H. Vandal-proof Vent Caps: Cast iron body full size of vent pipe, with caulked base connection.

I. Downspout Nozzles: Cast bronze downspout nozzle, loose wall flange and inlet threaded connection with rough bronze finish.

2.5 FLOOR DRAINS:

A. Floor drain designations and sizes are indicated on Drawings.

B. FD-1: Cast iron floor drain with flange, flashing collar with adjustable 4" x 8" rectangular satin nickel bronze strainer with stainless steel vandal-proof screws. Wade W-1100-H8-5 or equal.

C. FD-2: Cast iron floor drain with flange, flashing collar with adjustable 5" dia. satin nickel bronze strainer secured with stainless steel vandalproof screws. Wade W-1102-STD5-5 or equal.

D. FD-3: Cast iron floor drain with flange, flashing collar with adjustable 5" dia. satin nickel bronze strainer. Wade W-1100-STD5 or equal.

E. Floor drains in boiler rooms, chiller rooms, and AHU rooms. Cast iron medium duty 12" dia. floor drain with flange, flashing collar and heavy duty loose set grate. Wade W-1210 or equal.

F. Floor sink shall be cast iron with ARE interior, 12 x 12x 8 with aluminum sediment bucket and 3/4 grate. Wade W-1940-16-27.

2.6 ROOF DRAINS AND OVERFLOW ROOF DRAINS:

A. Roof drain type designations and sizes are indicated on Drawings.

B. Roof Drain: Suitable for use on single-ply roof. Cast-iron body and combined flashing collar and gravel stop, cast-iron dome, with the following features:

Underdeck clamp;
Extension as required for roof insulation;
Sump receiver;
Bottom outlet, inside caulk.

C. Roof drains will be flashed with single ply roofing material by General Contractor.

D. Overflow drains will be furnished with 2" high dam; either internal or external to strainer.

2.7 OIL INTERCEPTOR

A. Storage capacity of 750 gallon minimum fuel oil.

B. See schedule for required features..

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Verify existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.

B. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.

C. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.

D. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION FOUNDATION FOR UNDERGROUND BUILDING DRAINS

A. Grade trench bottoms to provide a smooth, firm, and stable foundation, free from rock, throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicate invert elevation.

C. Shape bottom of trench to fit bottom of pipe for 90-degrees (bottom 1/4 of the circumference). Fill unevenness with tamped sand backfill. At each pipe joint dig bell holes to relieve the bell of the pipe of all loads, and to ensure continuous bearing of the pipe barrel on the foundation.

3.3 PIPE APPLICATIONS - ABOVE GROUND, WITHIN BUILDING

A. Install hubless service weight, cast iron, soil pipe and fittings for drainage and vent pipe.

3.4 PIPE APPLICATIONS - BELOW GROUND

A. Install hub-and-spigot, service weight, cast-iron, soil pipe and fittings with gasketed joints for 15 inch and smaller drainage pipe.

3.5 PIPE AND TUBE JOINT CONSTRUCTION:

A. Cast-Iron Soil Pipe: Make compression joints, and hubless joints in accordance with the recommendations in the CISPI Cast Iron Soil Pipe and Fittings Handbook, Chapter IV.

3.6 INSTALLATION:

A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into account many design considerations. So far as practical, install piping as indicated.

B. Use fittings for all changes in direction and all branch connections.

C. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

D. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

E. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

F. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Allow sufficient space above removable ceiling panels to allow for panel removal.

G. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6 inch shall be steel; pipe sleeves 6 inch and larger shall be Schedule 10 or Schedule 40 steel pipe.

H. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, and floors, maintain the fire rated integrity. Refer to Division 7 for special sealers and materials.

I. Make changes in direction for drainage and vent piping using appropriate 45-degree wyes, half-wyes, or long sweep quarter, sixth, eighth, or sixteenth bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn tees where two fixtures are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than 90 degrees shall be made. Where different sizes of drainage pipes and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited

J. Install underground building drains to conform with the plumbing code, and in accordance with the Cast Iron Soil Pipe Institute Engineering Manual. Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

K. Except where noted otherwise on the drawings, install building sanitary drain pitched down at minimum slope of 1/4" per foot (2 percent) for piping 3" and smaller, and 1/8" per foot (1 percent) for piping 4" and larger.

Install storm drain at 1/8" per foot (1 percent).

L. Extend building sanitary drain to 5' outside of building, (or farther if shown otherwise on drawings) of size and in location indicated for service entrance to building. Sanitary sewer piping is specified in a separate section of Division 2. Make final connection to service main.

M. Extend building storm drain to 5' outside of building, (or farther if shown otherwise on drawings) of size and in location indicated. Storm sewer piping is specified in a separate Section of Division 2. Make final connection to service main.

N. Install sleeve and mechanical sleeve seal through foundation wall for watertight installation.

3.7 HANGERS AND SUPPORTS

A. General: Hanger, supports, and anchors devices are specified in Division 15 Section "BASIC MECHANICAL MATERIALS AND METHODS." Conform to the table below for maximum spacing of supports:

B. Install the following pipe attachments:

Adjustable steel clevis hangers for individual horizontal runs less than 20 feet in length.

C Install hangers at the following intervals:

PIPE MATERIAL	MAX HORIZ SPACING	MAX VERT SPACING
	IN FEET	IN FEET
Cast-Iron Pipe	5	15

3.8 INSTALLATION OF PIPING SPECIALTIES:

A. Install backwater valves in sanitary building drain piping as indicated, and as required by the plumbing code. For interior installation, provide cleanout cover flush to floor centered over backwater valve cover and of adequate size to remove valve cover for service.

B. Install expansion joints on vertical risers as indicated, and as required by the plumbing code.

C. Above Ground Cleanouts: Install in above ground piping and building drain piping as indicated, and:

as required by plumbing code;

at each change in direction of piping greater than 135 degrees;

at minimum intervals of 100';

at base of each vertical soil or waste stack.

D. Cleanouts Covers: Install floor and wall cleanout covers for concealed piping, types as indicated.

E. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.

F. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

3.9 INSTALLATION OF FLOOR DRAINS:

A. Install floor drains in accordance with manufacturer's written instructions and in locations indicated.

B. Trap all drains connected to the sanitary sewer.

C. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.

D. Position drains so that they are accessible and easy to maintain.

3.10 INSTALLATION OF ROOF DRAINS:

A. Install roof drains at low points of roof areas, in accordance with the roof membrane manufacturer's installation instructions. Locate overflow drains 2" higher than roof drains.

B. Install drain flashing collar or flange so that no leakage occurs between roof drain and adjoining roofing. Maintain integrity of waterproof membranes, where penetrated.

C. Position roof drains so that they are accessible and easy to maintain.

3.11 INSTALLATION OF OIL INTERCEPTOR:

A. Install per manufacturer's instructions and backfill to grade.

B. Manhole rings to be set in concrete dock.

3.12 CONNECTIONS:

A. Piping Runouts to Fixtures: Provide drainage and vent piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the plumbing code.

B. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

3.13 FIELD QUALITY CONTROL:

A. Inspections:

1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.

2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.

3. Re-inspections: Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for re-inspected by the plumbing official.

4. Reports: Prepare inspection reports, signed by the plumbing official.

B. Piping System Test:

1. Test for leaks and defects all new drainage and vent piping systems and parts of existing systems, which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.

2. Leave uncovered and unconcealed all new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.

3. Rough Plumbing Test Procedures: Except for outside leaders and perforated or open jointed drain tile, test the piping of plumbing drainage and venting systems upon completion of the rough piping installation. Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before the inspection starts, through completion of the inspection. Inspect all joints for leaks.

4. Finished Plumbing Test Procedure: After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight. Plug the stack openings on the roof and building drain where it leaves the building, and introduce air into the system equal to a pressure of 1"

water column. Use a "U" tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without the introduction of additional air throughout the period of inspection. Inspect all plumbing fixture connections for gas and water leaks.

5. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.

6. Prepare reports for all tests and required corrective action.

3.14 ADJUSTING AND CLEANING:

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Clean drain strainers, domes, and traps. Remove dirt and debris.

3.15 PROTECTION:

A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

END OF SECTION 15420

SECTION 15440 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Division-1 Specification sections, apply to work of this section.

B. Related Sections:

Separate grab bars and toilet accessories not an integral part of plumbing fixtures are specified in Division 10.

1.2 SUMMARY:

A. PLUMBING FIXTURES - GENERAL

1. All fixtures shall be furnished complete with trim. All exposed trim shall be chromium plated brass. China fixtures shall be of the best grade vitreous ware without pit holes or blemishes and the outlines shall be generally true. The Architect reserves the right to reject any pieces which, in his opinion are faulty.

2. All fixtures shall be set true and level with solid backing behind lavatory supports. Nipples through the wall to the fixture connection shall be brass and all necessary supports for the fixtures shall be installed before the wall is finished. All fixtures fitting against walls shall have ground backs. All fixtures shall be cleaned before setting, and the installation shall be left ready for use.

3. Fixtures indicated on the plans by a "P" number must be set and all plumbing connections required for its function installed. A detailed description of each fixture is on the plans or herein.

B. PLUMBING FIXTURE SCHEDULE: APPROVED MANUFACTURERS

Subject to compliance with requirements, provide products of one of the following: Whenever possible all products will be provided by the same manufacturer.

1. China Fixture Manufacturers: American Standard - Crane - Kohler - Eljer.

2. Carrier Manufacturers: Zurn - Josam - Wade - J. R. Smith. Specific carriers shall be submitted for approval with fixture shop drawings.

3. Water Closet Seat Manufacturers: Church - Olsonite - Beneke.

4. Flush Valve Manufacturers: Sloan - Delany - Zurn.

5. Stainless Steel Security Fixtures: Bradley - Acorn - Metcraft.

6. Stainless Steel Fixtures: Elkay - Just - Kohler.

7. Drinking Fountain Manufacturers: Haws - Elkay - Halsey Taylor -Oasis.

8. Terrazzo Basins: Fiat - Stern Williams.

9. Plaster Trap: Wade - Josam - Zurn - J. R. Smith.

10. Bed Pan Washer: Chicago Faucet.

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. UPC Uniform Plumbing Code.

B. Design Concept: The drawings indicate types of plumbing fixtures and are based on the specific descriptions, manufacturers, models, and numbers indicated. Plumbing fixtures having equal performance characteristics by other manufacturers may be considered provided that deviations in dimensions, operation, color or finish, or other characteristics are minor and do not change the design concept or intended performance as judged by the Architect and Engineer. Burden of proof for equality of plumbing fixtures is on the proposer.

Trim shall be of model and manufacturer indicated, with no substitution.

1.4 SUBMITTALS:

A. Product Data: Submit Product Data and installation instructions for each fixture, faucet, specialties, accessories, and trim specified; clearly indicate rated capacities of selected models of water coolers.

B. Shop Drawings: Submit rough-in drawings. Detail dimensions, rough-in requirements, required clearances, and methods of assembly of components and anchorages.

C. Maintenance Data: Include data in Maintenance Manual specified in Division 1 “GUARANTEE”.

D. Quality Control Submittals:

1. Submit certification of compliance with specified ANSI, UL, and ASHRAE Standards.

2. Submit certification of compliance with performance verification requirements specified in this Section.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Store fixtures where environmental conditions are uniformly maintained within the manufacturer's recommend temperatures to prevent damage.

B. Store fixtures and trim in the manufacturer's original shipping containers. Do not stack containers or store in such a manner that may cause damage to the fixture or trim.

1.6 SEQUENCE AND SCHEDULING:

A. Schedule rough-in installations with the installation of other building components.

1.7 MAINTENANCE:

A. Extra Stock:

1. Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Government with receipt in a quantity of one device for each 10 fixtures.

PART 2 - PRODUCTS

2.1 FITTINGS, TRIM, AND ACCESSORIES:

A. Toilet Seats: elongated, solid white plastic, closed back/open front, less cover, and having stainless steel check hinge and replaceable bumpers unless otherwise specified on the plans.

B. Supplies and Stops for non-security Lavatories and Sinks: polished chrome-plated, loose-keyed angle stop having 1/2" inlet and 3/8" O.D. x 12" long flexible tubing outlet, and wall flange and escutcheon.

C Traps: Cast brass, adjustable "P" trap with cleanout and waste to wall.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Examine rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.

C. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

D. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings, and pertinent codes and regulations, the original design, and the referenced standards.

B. Comply with the installation requirements of Americans With Disabilities (ADA) with respect to plumbing fixtures for the physically handicapped.

C. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.

D. Install a stop valve in an accessible location in the water connection to each fixture.

E. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork.

F. Seal fixtures to walls and floors using a sanitary type, one part, mildew resistant, silicone sealant. Use pick-proof sealant on all security fixtures.

3.3 FIELD QUALITY CONTROL:

A. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.

B. Inspect each installed unit for damage. Replace damaged fixtures.

3.4 ADJUSTING:

A. Adjust water pressure at drinking fountains, faucets, and flush valves to provide proper flow and stream.

B. Replace washers of leaking or dripping faucets and stops.

3.5 CLEANING:

A. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

3.6 PROTECTION:

A. Provide protective covering for installed fixtures, and trim.

END OF SECTION 15440

SECTION 15458 - WATER HEATERS AND WATER SOFTENERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Division-1 Specification sections, apply to work of this section.

B. Division-15 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of water heater and water softener work required by this section is indicated on drawings and schedules, and by requirements of this section.

B. Refer to other Division-15 sections for water piping, and specialties, which are required external to water heaters and water softeners for installation; not work of this section.

C. Electrical Work: Refer to Division-15 section “ELECTRICAL PROVISIONS OF MECHANICAL WORK” for requirements.

D. Refer to Division-16 sections for other electrical wiring including motor starters, disconnects, wires/cables, raceways, and other required electrical devices; not work of this section.

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of water heaters and water softeners of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. UL Compliances: Construct water heaters in accordance with the following UL standards:

UL 1453, "Electric Booster and Commercial Storage Tank Water Heaters".

2. Provide water heater components which are UL-listed and labeled.

C. NEC Compliance: Install electric water heaters in accordance with requirements of NFPA 70, "National Electrical Code".

D. ASHRAE Compliance: Provide water heaters with Performance Efficiencies not less than prescribed in ASHRAE 90A, "Energy Conservation in New Building Design".

E. NFPA Compliance: Install gas-fired water heaters in accordance with requirements of NFPA 54, "National Fuel Gas Code".

F. AGA Labels: Provide water heaters which are listed and labeled by American Gas Association.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data including rated capacities and efficiencies of selected model clearly indicated; operating weights; furnished specialties and accessories; and installation and start-up instructions.

B. Shop Drawings: Submit manufacturer's assembly type shop drawings indicating dimensions, required clearances, and methods of assembly of components.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for electrical power supply wiring. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring required for final installation of equipment and controls. Differentiate between portions of wiring that are factory-installed and portions that are to be field-installed.

D. Maintenance Data: Submit maintenance data and parts lists for each type and size of water heater and softener, control, and accessory; including "trouble-shooting" maintenance guide. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual; in accordance with requirements of Division 1.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Handle equipment and components carefully to prevent damage, breaking, denting and scoring. Do not install damaged equipment or components; remove from site and replace with new.

B. Store equipment and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

C. Comply with manufacturer's rigging and installation instructions for unloading equipment, and moving units to final location for installation.

PART 2 - PRODUCTS

2.1 COMMERCIAL GAS-FIRED WATER HEATERS:

A. General: Provide commercial gas-fired water heaters of sizes and capacities as indicated on plan. Provide certification of design by AGA under Volume III tests for commercial water heaters for delivery of 180 deg F (82 deg C) water.

B. Heater: Construct for working pressure of 150 PSI; boiler type hand hole cleanout; magnesium anode rod; 3/4" tapping for relief valve; glass lining on internal surfaces exposed to water.

C. Safety Controls: Equip with automatic gas shutoff device to shut off entire gas supply in event of excessive temperature in tank; and pilot safety shutoff.

D. Draft Hood: Equip with AGA certified draft hood.

E. Jacket: Insulate tank with vermin-proof glass fiber insulation. Provide outer steel jacket with baked enamel finish over bonderized undercoating.

F. Accessories: Provide brass drain valve; 3/4" pressure and temperature relief valve; and radiant floor shield.

G. Controls: Provide gas pressure regulator; pilot gas regulator; thermostat; and temperature limit control.

H. Manufacturers: Subject to compliance with requirements, provide commercial gas-fired water heaters of one of the following:

Bock Water Heaters, Inc.
Lockinvar Water Heater Corp.
PVI Industries, Inc.
Rheem Water Heater Div; City Investing Co.
Ruud Water Heater Div; City Investing Co.
Smith Corp. (A.O.); Consumer Products Div.
State Industries, Inc.
Viking Superior Corp.

2.2 AIRCRAFT/VEHICLE WASHER

A. Standard Product: The Hydroblaster system defined herein is a standard Hydro Engineering Inc., design. The basic unit is a skid mounted 5/3000EHGV/M Hydroblaster. These units are installed (hard wired/hard piped) in place. Each unit is equipped with a completely configured Remote Equipment Module (REM) stanchion.

1. Access: The Hyrdroblaster system has been designed for complete accessibility for maintenance, parts replacement in the event of wear, breakage or required adjustments. Components will not exceed their design capability.

2. Instructions and Manuals: A complete instruction manual will be provided with the delivery of each unit. This manual will include parts lists, operating procedures, daily requirements, inspections, preventative maintenance and repair information as required. This manual will also include all sub-contractor documents for the operation, control, maintenance and rework of all major sub-components.

B. Materials: All material included in the fabrication of this equipment will be new and consistent with the requirements of Hydro Engineering designs as established for "Military" construction, which is at or above the fabrication standards for industrial/commercial grade equipment.

C. Construction: The frame of the Hyrdoblaster is fabricated with heavy duty 3 inch channel iron and structural steel, with 6 inch steel legs. The electric motor and pump are mounted on a pre-formed 3/16 inch steel base plate. All access covers, inspection plates, skirt panels and the burner cover are stainless steel. The water proof stainless steel cover over the motor and pump is hinged for easy access. The REM stanchion is manufactured from 1/8 inch steel plate with 2x3 inch support column on a 14 inch square base with welded fillets. The backboard is 36" square and is 76" off the floor. Mounting bolt holes in the base are 1/2 inch with a 13 inch square bolt pattern. The backboard contains two commercial hand crank hose reels, a 1 GPM 60 PSI pneumatic pump and an explosion proof remote control switch.

D. Workmanship: All external surfaces will be smooth and all edges will be rounded or beveled as required to provide a "snag-free" surface.

E. Instruments and Controls: All controls are located on the front control panel of the EHGV unit and are identified with permanent decals for function and operation. The instruments consist of an hour meter and temperature gauge. The 0 to 5000 PSI pressure gauge is located on the outlet pressure pipe from the burner water coil.

F. Controls and Regulations:

1. Operating Controls: Panel mounted pump on/off switch with Magnetic motor starter. Three way “on/off/on” Burner control switch. (“ON” for control at machine - “OFF” to run with cold water and “ON” for remote switch selection.)

2. Remote Controls: A remote control system with Class I Division II Explosion proof off/on switch control box with control lights. Control system is 24 volt AC. One each provided and mounted on the REM for each 5/3000EHGV/M unit.

3. Flow Regulators: A regulator control system is provided to protect the pump and the fluid flow system. An unloader valve bypasses the fluid from the pump to the 2 gallon water breaker tank when the dual trigger gun is in the off position. The high pressure pop-off valve is a backup device to the unloader valve. It relieves excess fluid pressure at the pump, and also directs the fluid flow to the breaker tank. This is the Hydro Engineering redundant safety fluid flow control system.

4. Burner Controls: Three control systems are provided for safe burner operation and to prevent the coil from overheating: (NO standing pilot light)
(a), A flow control switch will turn off the burner when the fluid flow is zero.
(b), A high temperature limit switch will turn the burner off when the output fluid temperature exceeds approximately 225 degrees F. When the fluid temperature drops to normal, the burner is turned on again.
(c), A pressure control switch will turn the burner off when the fluid pressure is zero. This is the Hydro Engineering redundant safety burner control system.

G. Trigger Gun Operation: After the system has been turned on at the control panel, (or the remote switch), all operations are controlled by the trigger gun. When the trigger gun is in the “off” position, the pump goes into the bypass mode, the fluid circulates through the breaker tank, and the burner is turned off. Liquid flow and burner operation are controlled automatically as outlined above. The controls and regulators allow for gun operation, and provide operator safety and equipment protection should over pressure or over temperature conditions exist.

H. Instruction Decals: Permanent decals are located on the control panel which provides detailed operating instructions, functions of the controls and all safety warnings applicable to the operation of the Hydroblaster.

I. Safety Provisions: The fluid control system provides a pressure regulator and secondary pressure relief valve which redirects the fluid flow through the bypass system should an over pressure condition exist. The burner control system is controlled by fluid flow, high temperature and fluid pressure. This is defined as the Hydro Engineering operator redundant safety system. It eliminates over pressure and over temperature conditions, designed to physically protect both the operator and the Hydroblaster system. The electrical system is protected from phase failure, imbalance and reversal, overload and ground fault by a GFI system. The shutdown timer automatically shuts the system down when the equipment is not in use for a predetermined length of time. (generally 7 minutes).

J. PERFORMANCE AND PRODUCT CHARACTERISTICS:

1. Heating System: The burner is naturally aspirated and has a cast iron spreader ring with impinged brass burner jets. It is rated at 440,000 BTU's input and has a 10 inch exhaust stack. The coil is schedule 80 steel pipe with cold wrap insulator, and stainless steel insulated "cool touch" protective shield. The burner electrical system provides a 24 volt AC on-demand ignition system with electronic pilot. (no standing pilot light) The unit will operate on natural gas. A draft Diverter is provided with each unit. This system will provide a nominal 190 Degree F water temperature continuously.

2. Electric Motor: 10 HP, 440 volt, 3 Phase 60 Hz. Magnetic starter and shut-down timer. 30 AMP dedicated circuit required.

3. Pump: Ceramic triplex plunger with bronze and stainless steel fluid end, with oil bath crankcase.

4. Draft Diverter: A draft Diverter is provided with each 5/3000EHGV/M unit.

5. Water Breaker Tank: A 2 gallon stainless steel water breaker tank is installed between the outside water source and the pump. This unit dampens water surges and provides a reservoir for the pump recirculation by-pass operation.

6. Operating Temperature and Altitudes: The 5/3000EHGV/M system is designed to operate at ambient temperatures from 32 to 125 degrees F, at altitudes up to 6,000 feet above sea level. Water temperature decreases are proportional to altitudes above sea level.

7. Weight and Dimensions: Dry weight of the 5/3000EHGV/M = 460 pounds. The unit is 34" wide x 47" long x 50" high to the top of the burner.

8. Remote Equipment Module (REM). The stanchion is 68 inches high by 36 inches wide with a 14 inch square base. Approximate weight on the stanchion is 200 pounds with 2 reels with 100 feet of hose on each reel, the pneumatic soap pump and the Class I Division II Explosion proof remote switch mounted on the back board.

K. Storage: Storage rings are provided on each side of the REM to hold the wands when not in use.

L. Painting: The unit will be painted as follows:

1. Painting: All non stainless steel surfaces will be coated with an acid etch primer and will have a polyurethane catalyzed acrylic enamel top coat on both the Hydroblaster and the Remote Equipment Module (REM).

2. Markings: All markings on the Hydroblaster and REM are provided with permanent decals.

M. Identification of Product: A name plate will be securely attached to the frame of the Hydroblaster and will contain the following information:

1. HYDROBLASTER - EHGV
Model Number 5/3000EHGV/M2 or M4
Serial Number.....
Mfg. Name and Address: Hydro Engineering Inc., 865 West 2600 South, Salt Lake City, UT 84119 - Telephone 800-247-8424.

2. REMOTE EQUIPMENT MODEL (REM):
(same information as above)

N. Accessories: In addition to the basic 5/3000EHGV/M units, the following will be included.

1. Each EHGV unit will be delivered with a Remote Equipment Module (REM Part number EHGV-0025) and the serial number which will contain the following:

a. Hand crank Hose reel with 100 feet of 3/8 inch high pressure hose with applicable quick disconnects.
b. Hand crank Hose reel with 100 feet of 1/2 inch low pressure hose for soap delivery.
c. Pneumatic pump with foamer attachment- operated from standard 100 PSI shop air line. Rated at I GPM at 60 PSI for soap delivery.

d. Remote switch: Class I Division II Explosion Proof control box with control light, 24 volt DC. Located 57 inches off the floor.
e. Dual shut off variable high pressure control trigger gun.
f. Shut-off trigger gun for low pressure soap delivery.

2. Each 5/3000EHGV/M will be equipped with the following:

a. A draft Diverter to control the movement of cold air during inclement weather.

b. A set of Nozzles: High pressure stainless steel.), 15, 25, and 40 degrees on quick disconnects, and a chemical application 40 degrees low pressure nozzle. A complete set is provided with each EHGV unit in storage grommets on the body of the EHGV.

c. Legs to raise unit motor and burner, control circuits min of 18” AFF of hangar.

3. The Hyrdroblaster unit is designed to operate under all types of adverse conditions.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF WATER HEATERS:

A. General: Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

B. Support: Place units on concrete pads, orient so controls and devices needing service and maintenance have adequate access.

C. Piping: Connect hot and cold water piping to units with shutoff valves and unions. Extend relief valve discharge to mop basin or floor drain.

D. Gages: Provide thermometers on inlet and outlet piping of water heaters, in accordance with Basic Mechanical Materials and Methods Section "Meters and Gages."

3.3 GAS FIRED WATER HEATERS:

A. Connect gas supply to gas line with drip leg, tee, gas cock, and union; full size of unit inlet connection. Locate piping so as not to interfere with service of unit.

1. Flue: Connect flue to draft hood with gas-tight connection. provide flue of minimum size as flue outlet on heater. Comply with gas utility requirements.

3.4 FIELD QUALITY CONTROL:

A. Start-Up: Start, test and adjust gas-fired water heaters in accordance with manufacturer's start-up instructions, and utility company's requirements. Check and calibrate controls, adjust burner for maximum efficiency.

END OF SECTION 15458

SECTION 15575 - BREECHINGS, CHIMNEYS, AND STACKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Division-1 Specification sections, apply to work of this section.

1.2 RELATED SECTIONS:

A. Refer to other sections of Division 15 for insulation of breechings, chimneys, and stacks.

B. Refer to other sections of Division 15 for fuel burning equipment, draft hoods, and accessories associated with fuel burning equipment.

1.3 SUMMARY:

A. This Section specifies double wall metal vents and accessories for gas-fired appliances. Use positive pressure double wall vents for boilers, make-up air unit. Use type B gas vents for gas fired furnaces and unit heaters. Boiler double wall metal vents shall be suitable for oil firing.

1.4 SUBMITTALS:

A. Product Data: Submit product data including materials, dimensions, weights, and accessories.

B. Shop Drawings: Submit shop drawings including required clearances, assembly and installation instructions, and support of components.

C. Quality Control Submittals:

1. Certificates: Submit certificates of materials compliance with specified ASTM, UL, and ASHRAE requirements.

2. Certificates: Submit complete engineering report certifying that stacks meet the design wind and seismic loads.

1.5 QUALITY ASSURANCE:

A. Codes and Standards:

1. UMC: Uniform Mechanical Code.

2. NFPA: Comply with NFPA 211 "Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances."

3. UL: Comply with applicable portions of UL safety standards; provide products which have been UL listed and labeled.

4. SMACNA: Comply with SMACNA Low Pressure Duct Standards for fabricated breeching and smokepipe.

5. ASHRAE: Comply with the ASHRAE Equipment Handbook, Chapter 27, for Chimney, Gas Vent, and Fireplace Systems, material requirements and design criteria.

PART 2 - PRODUCTS

2.1 DOUBLE WALL METAL VENTS:

A. Type B Gas Vents:

1. Available Manufacturers: Subject to compliance with requirements, provide Type B double wall gas vents of one of the following:

Metalfab
Hart & Cooley Mfg. Co.
Selkirk Metalbestos.

2. Description: Double wall gas vents, UL listed for Type B, consisting of an inner pipe of sheet aluminum, and outer pipe of galvanized sheet steel, with the following minimum thicknesses:

Size	Inner Pipe	Outer Pipe
Round, up to 6"	0.012"	28 gage
Round, 7" to 18"	0.014"	28 gage
Round, 20" to 24"	0.018"	26 gage
Oval, up to 4"	0.012"	28 gage
Oval, 5" to 6"	0.014"	28 gage

3. Accessories: UL-labeled tees, elbows, increasers, draft hood connectors, metal cap with bird barrier, adjustable roof flashing, storm collar, support assembly, thimbles, fire stop spacers, and fasteners, fabricated of similar materials and designs as vent pipe straight sections.

B. All Steel, Positive Pressure, Double Wall Vents:

1. Manufacturers: Subject to compliance with requirements, provide all steel, positive pressure double wall vents of one of the following:

Metalfab
Selkirk Metalbestos.
Van Packer
Stacks, Inc., Div of Air Management, Inc.

2. Description: UL-labeled double wall metal stacks for use with building heating equipment burning gas, solid, or liquid fuels as described in NFPA 211.

3. Construction: 1" minimum air space between walls; inner jacket of Type 316 stainless steel, 0.035" thick; outer jacket of aluminum coated steel of the following thickness:

Size 10" to 24": 0.025" thick.
Size 28" to 48": 0.034" thick.

4. The portion of the high pressure boiler flue vent pipe which is located inside the building shall have 1" thick insulation within the annular space between the dual wall vent pipes.

5. The portion of the emergency generator diesel exhaust pipe which is located inside the building shall have 2" thick insulation within the annular space between the dual wall vent pipes.

6. The insulation shall be a fiber type 6 pounds per cubic foot, thermally stable and corrosion resistant.

7. The insulated and non-insulated pipe and accessories shall be listed as a U.L. system for 1000°F continuous operation and intermittent operation (1 hour or less) of 1400°F.

8. Accessories: UL-labeled tees, elbows, increasers, draft hood connectors, metal cap with bird barrier, adjustable roof flashing, storm collar, support assembly, thimbles, fire stop spacers, and fasteners fabricated of similar materials and designs as vent pipe straight sections.

PART 3 - EXECUTION

3.1 INSTALLATION OF DOUBLE WALL CONNECTORS, BREECHINGS, AND VENTS:

A. Install Type B gas vents in accordance with manufacturer's installation instructions and UL listing. Maintain minimum clearances from combustibles specified in UL listing.

B. Install all steel, positive pressure, double wall gas vents in accordance with manufacturer's installation instructions and UL listing. Maintain minimum clearances from combustibles specified in UL listing.

C. Seal joints between sections of positive pressure vents in accordance with manufacturer's installation instructions, and using only sealants recommended by manufacturer.

D. Support vents at intervals recommended by the manufacturer to support the weight of the vent and all accessories, without exceeding loading of appliances.

3.2 ADJUSTING AND CLEANING:

A. Clean breechings internally during installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth.

3.3 PROTECTION:

A. Temporary Closure: At ends of breechings and chimneys which are not completed or connected to equipment, provide temporary closure which will prevent entrance of dust and debris until installations are completed.

END OF SECTION 15575

SECTION 15891 - METAL DUCTWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of metal ductwork is indicated on drawings and in schedules, and by requirements of this section.

B. Refer to other Division-15 sections for ductwork accessories; not work of this section.

C. Refer to other Division-15 sections for fans and air handling units; not work of this section.

D. Refer to other Division-15 sections for testing, adjusting, and balancing of metal ductwork systems; not work of this section.

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of metal ductwork products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.

C. Codes and Standards:

1. SMACNA Standards: Comply with 1985 Edition, SMACNA "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.

2. ASHRAE Standards: Comply with ASHRAE Handbook, Equipment Volume, Chapter 1 "Duct Construction", for fabrication and installation of metal ductwork.

3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems".

D. Field Reference Manual: Have available at project site field office, copy of "SMACNA HVAC Duct Construction Standards 1985 Edition.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data and installation instructions for metal ductwork materials and products.

B. Record Drawings: At project closeout, submit record drawings of installed ductwork, duct accessories, and outlets and inlets; in accordance with requirements of Division 1.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Protection: Protect shop-fabricated and factory-fabricated ductwork, accessories and purchase products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.

B. Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS:

A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, oil canning, stains and discolorations, and other imperfections, including those which would impair painting.

B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 527, lockforming quality, with G 60 zinc coating in accordance with ASTM A 525; and mill phosphatized for exposed locations.

C. All round ductwork both high velocity and low velocity shall be machine made spiral duct, constructed per SMACNA with not less than 26 gauge galvanized sheet metal.

2.2 MISCELLANEOUS DUCTWORK MATERIALS:

A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment. Round ductwork shall be minimum of 26 gauge.

B. Fittings: For round ductwork provide radius type fittings fabricated of multiple sections with maximum 15 deg change of direction per section. Unless specifically detailed otherwise, use 45 deg laterals and 45 deg elbows for branch takeoff connections. Where 90 deg branches and takeoffs are indicated, provide conical type tees.

C. Duct Liner: Fibrous glass, complying with Thermal Insulation Manufacturers Association (TIMA) AHC-101; of thickness indicated in Insulation Section of Specifications.

D. Duct Liner Adhesive: Comply with ASTM C 916 "Specifications for Adhesives for Duct Thermal Insulation".

E. Duct Liner Fasteners: Comply with SMACNA HVAC Duct Construction Standards, Article S2.11.

F. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.

G. Duct Cement: Non-hardening migrating mastic or liquid neoprene based cement, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.

H. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

I. Flexible Ducts: Either spiral-wound spring steel with flameproof vinyl sheathing, or corrugated aluminum; complying with UL 181.

1. Provide 1" thick continuous flexible fiberglass sheath with vinyl vapor barrier jacket.

2.3 FABRICATION:

A. Shop fabricate ductwork in 4, 8, or 10 foot lengths, unless otherwise indicated or required to complete runs. Pre-assemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.

B. Shop fabricate ductwork of gages and reinforcement complying with SMACNA "HVAC Duct Construction Standards", 1985 Edition. Unless noted otherwise on the drawings, supply ductwork at air handling units and make-up air units shall be constructed for 3" static pressure. Exhaust and supply ductwork after fan powered terminal units shall be constructed for 2" static pressure. Return, and fresh air ductwork shall be fabricated for (NEG.) 1.0 static pressure. Reinforcement spacing shall be 5' maximum.

C. Seal all transverse joints, fittings, connections, and seams with duct sealant specifically manufactured for that purpose. Refer to and comply with notes on drawings concerning duct sealant, which shall take precedent.

D. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.

E. Make all rectangular duct branch connections with 45° entry clinch collar. All elbows 30° and greater shall have turning vanes.

F. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division-15 section "Ductwork Accessories" for accessory requirements.

G. Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive, and fasten with mechanical fasteners.

H. Rectangular duct sizes called out on plans are clear inside dimensions. Increase duct size as required to accommodate duct liner.

2.4 FACTORY-FABRICATED HIGH PRESSURE AND LOW PRESSURE DUCTWORK

A. General: Provide factory-fabricated duct and fittings, manufactured on automatic spiral duct forming machines, for round (spiral) low, medium and high velocity duct systems.

B. Round and Oval Ductwork: Construct of galvanized sheet steel complying with ASTM A527 by the following methods and in minimum gages listed.

Diameter	Minimum Gage	Method Of Manufacture
3" to 14"	26	Spiral Lockseam
15" to 26"	24	Spiral Lockseam
27" to 36"	22	Spiral Lockseam
37" to 50"	20	Spiral Lockseam

Provide locked seams for spiral duct; fusion-welded butt seam for longitudinal seam duct.

C. Fittings and Couplings: Construct of minimum gages listed. Provide continuous welds along seams.

Diameter	Minimum Gage
3" to 36"	20
38" to 50"	18

Use duct taps for conical 90° tees or takeoffs as per plans. Five piece 90° or smooth ells with 1 1/2 diameter radius, conical 90° reducing tees, conical 90° cross and bell mouth plenum taps.

D. Internally Insulated Duct and Fittings: Construct with outer pressure shell, 2" thick insulation layer, with thermal conductivity (K-factor) of .27 BTU/Hr/Ft/°F and perforated or solid inner liner as specified on the drawings. Construct shell and liner of galvanized sheet steel complying with ASTM A 527, of spiral lockseam construction, use longitudinal seam for over 59", in minimum gages listed.

Nominal Duct Diameter	Outer Shell	Inner Liner
3" to 12"	26 ga.	24 ga.
13" to 24"	24 ga.	24 ga.
25" to 34"	22 ga.	24 ga.
35" to 48"	20 ga.	24 ga.

E. Fittings and Couplings: Construct of minimum gages listed. Provide continuous weld along seams of outer shell.

Nominal Duct Diameter	Outer Shell	Inner Liner
3" to 34"	20 ga.	20 ga.
36" to 48"	18 ga.	20 ga.

F. Inner Liner: Perforate with 3/32" holes for 22% open area or solid liner as specified on the drawings. Provide metal spacers welded in position to maintain spacing and concentricity.

All supply ductwork with perforated inner liner serving Hospital Sensitive Areas shall have 100% mechanical separation of insulation and air stream, to provide positive protection against any possibility of fiber entrainment. United Type PM or equal.

G. Manufacturers: Subject to compliance with requirements, provide factory-fabricated ductwork of one of the following:

Semco Mfg., Inc.
United Sheet Metal Div., United McGill Corp.
Wichita Sheet Metal
Western Eng.

2.5 FLEXIBLE DUCTS

A. Flexible ducts - Thermaflex Type MKE for low pressure, low velocity, or equivalent by Wiremold meeting amended code standards of NFPA Pamphlet 90A with U.L. Fire rating of not over 25 flame spread and a developed smoke rating of not over 50. U.L. Standard 181 Class 1 air duct. Duct shall be factory made and composed of: a CPE liner duct permanently bonded to a coated spring steel wire helix and supporting a fiber glass insulating blanket. Low permeability outer vapor barrier of fiber glass reinforced film laminate shall complete the composite. Insulation 1" thick 3/4 lb. density glass blanket with vapor barrier. A maximum of six feet of flexible duct with one 90· elbow or 10 feet of straight run will be used for each connection. Pressure rating of 6" W.G. positive and 2" W.G. negative.

Accessories: Strap clamps Spin-in duct tap connections with Belmouth connector and butterfly dampers.

Installation: Duct connections to collars shall be made in accordance with the duct manufacturer's recommendations. Install flexible duct only where specifically shown on the drawings.

PART 3 - EXECUTION

3.1 INSPECTION:

A. General: Examine areas and conditions under which metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF METAL DUCTWORK:

A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight (2% leakage) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor. Field verify exact amount of space available for ducts prior to fabrication. REFER TO NOTES ON DRAWINGS FOR ADDITIONAL INFORMATION.

B. Inserts: Install concrete inserts for supports of ductwork in coordination with formwork, as required to avoid delays in work.

C. Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.

D. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

E. Electrical Equipment Spaces: Do not route ductwork through transformer vaults and their electrical equipment spaces and enclosures.

F. Penetrations: Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2". Fasten duct and substrate.

1. Where ducts pass through fire-rated floors, walls, or partitions, provide firestopping between duct and substrate, in accordance with requirements of Division-7 Section "Firestopping".

G. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

H. Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards.

I. Hanger Spacing:

1. Maximum hanger spacing for round duct shall be 10'-0"

2. Maximum hanger spacing for rectangular duct shall be 5'-0".

J. Ductwork downstream of humidifier shall have all seams and joints welded for a distance equal to the absorption distance plus 3 feet. Absorption distance is that noted on the humidifier schedule.

3.3 INSTALLATION OF DUCT LINER:

A. General: Install duct liner in accordance with SMACNA HVAC Duct Construction Standards.

B. Note that duct sizes called out on drawings is clear inside dimensions of ductwork. Increase outside dimensions of ductwork to accommodate duct liner.

3.4 INSTALLATION OF FLEXIBLE DUCTS:

A. Maximum Length: For any duct run using flexible ductwork, do not exceed 6' - 0" extended length.

B. Installation: Install in accordance with Section III of SMACNA's "HVAC Duct Construction Standards, Metal and Flexible".

C. Flexible duct shall be used only where specifically shown on drawings.

D. Install by peeling back the insulation, and install tie strap around flex duct liner and the sheet metal collar.

E. Restore insulation to original position and duct tape over the end of the insulation to provide vaporproof seal.

3.5 EQUIPMENT CONNECTIONS:

A. General: Connect metal ductwork to equipment as indicated, provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. Provide access doors as indicated.

3.6 ADJUSTING AND CLEANING:

A. Clean Ductwork internally, unit-by-unit as it is installed, of dust and debris. Clean external surfaces of dust, dirt and foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, which might interfere with painting or cause paint deterioration.

B. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

C. Balancing: Refer to Division-15 section "Testing, Adjusting, and Balancing" for air distribution balancing of metal ductwork; not work of this section. Seal any leaks in ductwork that become apparent in balancing process.

3.7 DUCTWORK PRESSURE TEST

A. Duct pressure tests shall be performed using a duct pressurization fan. Test shall be done in accordance with SMACNA HVAC Air Duct Leakage Test Manual by an Independent Balance Agency.

B. The four tests will be conducted on the following:

1. Low Pressure Supply Air Duct

2. Return Air Duct

3. Exhaust Air Duct.

4. High pressure supply air duct.

C. The specific ducts to be tested will be selected at random by the Engineer.

D. If the duct does not meet the SMACNA leakage requirements, it shall be repaired and sealed and retested at the Contractor's expense. Furthermore all other like duct systems shall also be leak tested and sealed if required, all at the Contractor's own expense.

E. Coordinate pressure test preparation requirements with Test and Balance Agency. Rework of ductwork to accommodate specified testing shall be at the contractor’s own expense.

END OF SECTION 15891

SECTION 15910 - DUCTWORK ACCESSORIES

PART l - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Division-l Specification sections, apply to work of this section.

B. Division-15 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of ductwork accessories work is indicated on drawings and in schedules, and by requirements of this section.

B. Types of ductwork accessories work required for project include the following:

Dampers.

Low pressure manual dampers.
Control dampers.
Counterbalanced relief dampers.

Fire and smoke dampers.
Turning vanes.
Duct hardware.
Duct access doors.
Flexible connections.
Sound attenuators

C. Refer to other Division 15 sections for testing, adjusting, and balancing of ductwork accessories; not work of this section.

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of duct accessories, or types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Codes and Standards:

1. SMACNA Compliance: Comply with applicable portions of SMACNA "HVAC Duct Construction Standards, Metal and Flexible", 1985 Edition.

2. Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.

3. UL Compliance: Construct, test, and label fire dampers in accordance with UL Standard 555 "Fire Dampers and Ceiling Dampers".

4. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories.

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction; and installation instructions.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of ductwork accessory showing interfacing requirements with ductwork, method of fastening or support, and methods of assembly of components and installation instructions.

C. Maintenance Data: Submit manufacturer's maintenance data including parts lists for each type of duct accessory. Include this data, product data, and shop drawings in Maintenance Manual; in accordance with requirements of Division 1.

PART 2 - PRODUCTS

2.1 DAMPERS:

A. Where specifically called out on the drawings, provide dampers equal to the model numbers specified on the drawing. All other dampers shown on the drawings or required for balancing shall be as specified below.

B. Low Pressure Manual Dampers: Provide dampers with opposed blades for 2- position control, or opposed blades for modulating control. Construct blades of 16 ga. steel, provide heavy-duty molded self-lubricating nylon bearings, 1/2" diameter steel axles spaced on 9" centers. Construct frame of 4" x 1-1/4" x 16 ga. channel. Provide galvanized steel finish with aluminum touch-up. No single blade rectangular dampers shall be used without specific approval of engineer. Dampers in outside air ducts shall be ultra low leak type with blade and jamb seals, having a maximum leakage of 10 CFM/Ft^2 of damper area at one-inch W.G. pressure differential.

C. Control Dampers: Refer to Division-15 section "Control Systems" for control dampers; not work of this section.

D. Counterbalanced Relief Dampers: Provide dampers with parallel blades, counterbalanced and factory-set to relieve at indicated static pressure. Construct blades of 16 ga. aluminum, provide 1/2" diameter ball bearings, 1/2" diameter steel axles spaces on 9" centers. Construct frame of 4" x 1-1/4" x 16 ga channel. Provide galvanized steel finish on frame with aluminum touch-up.

E. Manufacturer: Subject to compliance with requirements, provide dampers of one of the following:

Air Balance Inc.
Airguide Corp.
American Warming & Ventilating, Inc.
Greenheck
Louvers & Dampers, Inc.
Penn Ventilator Co.
Ruskin Mfg. Co.

2.2 FIRE DAMPERS:

A. Fabricated Fire Dampers: Provide dampers constructed and labeled in accordance with U.L. Standard 555 "Standard for Fire Dampers", dynamic rating. Fire dampers shall bear the U.L. Label Class "B" and shall conform to National Fire Code #90A.

B. Provide fire dampers, of types and sizes indicated Rated 1.5 hours. Provide fusible link rated at 165 deg F (74 deg C) unless otherwise indicated. Provide damper with positive lock in closed position, and with the following additional features:

1. Damper Blade Assembly: Multi-blade type.

2. Blade Material: Steel, match casing.

C Frame: Type A or Type B as indicated. Fabricated with roll formed, 20 gage, galvanized steel, with mitered and interlocking corners. Integral 20 gage steel frame.

D. Features: Wall and Floor dampers shall be equal to Ruskin DIBD20 Series and constructed with one piece frame and factory sleeve combination and interlocking blades which will form a solid curtain of steel when closed. When open, the blades are compactly grouped. Dampers suitable for vertical or horizontal installation.

E. Ceiling fire dampers shall be equal to Ruskin CFD 5 Series, U.L. classified radiation dampers specifically tested and classified to provide fire and heat protection where HVAC components penetrate the ceiling membrane. Provide each unit with thermal radiation blankets to meet U.L. classification for 1 hour roof/ceiling assembly, Kaowool 1/4" thick 8 lb/Ft^3 ceramic fiber. Damper sizes shall be compatible with diffuser and grille neck sizes and volume dampers.

F. Installation of fire dampers must comply with NFPA 90A, U.L. Safety Standard 555, and fire damper manufacturer's instructions. Secure factory sleeve with l4 Ga. 1 1/2 x 1 1/2" perimeter angles and install exterior insulation over sleeve.

G. Install insulated access door in duct where required for access to fire damper - one 12" x 6" door required in ducts up to 12" wide one 12" x 12" doors required in ducts 13" wide to 30" wide two 12" x 12" doors required in ducts 31" wide to 48" wide three 12" x 12" doors required in ducts 49" wide to 72" wide - Four 12" x 12" doors required in ducts over 72" wide. Multiple doors shall be equally spaced. Each access door for fire and/or smoke damper shall be labeled with letters at least 1/2" high reading "Fire Damper".

H. All fire dampers in round ductwork shall have 100% free area.

I. In addition to the fire dampers, shown and called out on the drawings provide additional 1 1/2 hour rated wall type Class "B" fire dampers as specified below to be installed where designated by the Engineer:

(3) Each 12" wide x 12" High
(3) Each 18" wide x 12" High

J. Manufacturer: Subject to compliance with requirements, provide fire and smoke dampers of one of the following:

Air Balance, Inc.
American Warming & Ventilating, Inc.
Louvers and Dampers, Inc.
Penn Ventilator Co.
Ruskin Mfg. Co.
Greenheck

2.3 FIRE/SMOKE DAMPERS:

A. Fabricated Fire/Smoke Dampers: Provide dampers constructed and labeled in accordance with U.L. Standard 555S "Standard For Leakage Rated Dampers For Use In Smoke Control Systems." Dampers shall bear the U.L. Label for 1.5 hour rated fire damper and shall conform to National Fire Code #90A.

B. Provide smoke dampers, of types and sizes indicated. Provide fusible link rated at 165 deg F (74 deg C) unless otherwise indicated. Provide control shaft for operation by electric or pneumatic motor.

C. Rectangular smoke damper shall be equal to Ruskin FSD 36 with Class 2 leakage for low velocity applications and FSD 60, airfoil blade damper, Class I for medium and high velocity applications and may be either parallel or opposed blade damper with galvanized frame and blades - with silicone rubber gasket at blade edges - Oilite or SS bearings. Actuators shall be electric normally open and rated for 350°F. multi product type motor actuators are not acceptable.

D. Fire/Smoke Dampers are to close on signal from "Products of Combustion Detector" or from power failure.

E. Fire/Smoke Dampers are to open automatically on signal from "products of Combustion Detector" or power on.

F. Fire/Smoke Dampers shall also operate as a 1 1/2 hour fire damper and shall have a 165 °F. fusible link.

G. Provide insulated access door in duct similar to fire dampers for access to smoke damper.

H. All Fire/Smoke Dampers size 12” x 12” and smaller shall be Style C, CO, or CR as applicable. Dampers larger than 12” x 12” may be Style A.

I. Cable operated Fire/Smoke Dampers are not acceptable.

J. Manufacturer: Subject to compliance with requirements, provide fire and smoke dampers of one of the following:

Air Balance, Inc.
Ruskin Mfg. Co.
Greenheck
Nailor

2.4 TURNING VANES:

A. Fabricated Turning Vanes: Provide fabricated turning vanes and vane runners, constructed in accordance with SMACNA "HVAC Duct Construction Standards".

B. Manufacturer: Subject to compliance with requirements, provide turning vanes of one of the following:

Aero Dyne Co.
Airsan Corp.
Duro Dyne Corp.
Environmental Elements Corp.; Subs. Koppers Co., Inc.

2.5 DUCT HARDWARE:

A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:

1. Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.

2. Quadrant Locks: Provide for each damper, quadrant lock device with wing nut on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

B. Manufacturer: Subject to compliance with requirements, provide duct hardware of one of the following:

Ventfabrics, Inc.
Young Regulator Co.

2.6 DUCT ACCESS DOORS:

A. Standard: Provide access doors in conformance with SMACNA.

B. Location: Provide access doors in casings, plenums, and ducts where shown on the drawings and where specified for ready access to operating parts including fire dampers, smoke dampers, valves, and concealed coils.

C. Pressure Clarification: Construct and install access doors in accordance with SMACNA Standards to suit the static pressure classifications and the locations where installed.

D. Access Doors in Ducts: Provide and size doors as follows:

1. Minimum 12-inch by 12-inch clear opening.

2. When field conditions require an access opening smaller than 16-inch by 12-inch, provide a 24-inch long removable section of casing or duct, secured with quick acting locking devices, 6 inches on centers, to permit ready access without dismantling other equipment.

E. Door Requirements: Provide doors in casings and duct as follows:

1. Arrange doors so that system air pressure will assist closure and prevent opening when the system is in operation.

2. Coordinate doors and equipment to provide unrestricted passage through clear door opening, without removal of any equipment.

3. Where pressure regulating dampers are installed in ducts or plenums, provide access doors with a clear wire glass observation port, 6-inch by 6-inch minimum size. Anchor port with structural metal frame, resilient gaskets and stainless steel bolts.

4. Hinges for doors in zinc coated or aluminum construction shall be steel or iron, zinc coated with brass pins.

5. Hinges for doors in copper, copper nickel alloy construction shall be all brass.

6. Seal around frame attachment to duct and door to frame with neoprene or foam rubber seals.

7. Each access door for fire and/or smoke damper shall be labeled with letters at least 1/2" high reading "Fire Damper".

8. Access Door Materials Schedule

Duct Pressure Class	Door Size Inches	Number Of Hinges *	Number Of Locks	Metal Gage		
				Frame	Door	Back
2 Inches & Less	12 x 12	2	1-S	24	26	26
	16 x 20	2	2-S	22	24	26
	24 x 24	3	2-S	22	22	26
3 Inches	12 x 12	2	1-S	22	22	26
	16 x 20	2	1-S,1-T,1-B	20	20	26
	24 x 24	3	2-S,1-T,1-B	20	20	24
4 To 10 Inches	12 x 12	2	1-S,1-T,1-B	20	20	26
	16 x 20	3	2-S,1-T,1-B	20	18	24
	24 x 24	3	2-S,2-T,2-B	18	18	24

S: Side
T: Top
B: Bottom
*: Optional To Use Continuous Piano Hinge

F. Manufacturer: Subject to compliance with requirements, provide duct access doors of one of the following:

Air Balance Inc.
Duro Dyne Corp.
Ruskin Mfg. Co.
Ventfabrics, Inc.
Zurn Industries, Inc., Air Systems Div.

2.7 FLEXIBLE CONNECTIONS:

A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL Standard 181, Class 1.

B. Fans Provide flexible connections between fans and ducts or casings where indicated on the drawings or required to accommodate expansion and vibration.

C. Length: Limit flexible connections to 4-inch active length in the direction of air flow.

D. Standard: Construct in accordance with SMACNA Standards.

E. Material: Construct connections of following as applicable:

1. Conventional Indoor System Flexible Connectors Fabric: Glass fabric double coated with polychloreprene.

Minimum Weight: 26 oz per sq. yd.

Tensile Strength: 480 lb per inch in the warp and 360 lb per inch in the filling.

2. Conventional, Outdoor System Flexible Connectors Fabric: Glass fabric double coated with Du Point's HYPALON or other synthetic-rubber weatherproof coating resistant to the sun's ultraviolet rays and ozone environment. Temperature range -10°F to +250°F.

Minimum Weight 26 oz. per sq yd.

Tensile Strength: 530 lb per inch in the warp and 440 lb per inch in the filling.

3. High-Temperature System Flexible Connectors: Glass fabric coated with silicone rubber and having a minimum weight of 16 oz. per sq yd and tensile strength of 285 lb. per inch in the warp, and 185 lb per inch in the filling. Temperature Range -25°F to +500°F.

2.8 SOUND ATTENUATORS

A. Manufacturers: Rink, Titus, Koppers Co., - Industrial Acoustics Co. -Anemostat, United Sheet Metal.

B. Capacities: Capacity and size as scheduled on the plans.

C. The attenuators shall be constructed of 22 gauge or heavier galvanized steel sheets. Lock formed seams shall be mastic filled. Casing shall be airtight up to 10" of water static pressure.

D. The interior configurations shall be straight through passages of consistently exact dimensions to insure uniform performance.

E. Circular silencers shall have round duct connections.

F. The interior panels shall be 22 gauge galvanized steel, die stamped in one piece, and a perforated air passage, corrugated in the direction of the airflow.

G. All interior components of the sound traps shall be held in place by spot welding.

H. The acoustical filler shall be inorganic compressed not less than 5% covered by a mylar liner to comply with hospital regulations.

I. U. L. Composite Fire Ratings:

Flame Spread not over 15
Fuel Contributed 0
Smoke Developed 0.

J. Copies of Lab. test reports shall be furnished by attenuator manufacturer to verify compliance with specifications.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF DUCTWORK ACCESSORIES:

A. Install duct accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.

B. Install turning vanes in square or rectangular 30 deg elbows or greater, in supply and exhaust air systems, and elsewhere as indicated.

C. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.

D. Installation of fire dampers must comply with NFPA 90A U.L. Safety Standard 555, and fire damper manufacturer's instructions. Secure sleeve with 14 Ga. 1 1/2 x 1 1/2" perimeter angles and install exterior insulation over sleeve.

E. In addition to installing fire dampers as shown and called out on the drawings, the Contractor shall include in his bid the installation of the following additional fire dampers at locations designated by the Engineer:

(3) Each 12" Wide x 12" High.
(3) Each 18" Wide x 12" High.

F. Install insulated access door in duct where required for access to fire damper - one 12" x 6" door required in ducts up to 12" wide one 12" x 12" doors required in ducts 13" wide to 30" wide two 12" x 12" doors required in ducts 31" wide to 48" wide three 12" x 12" doors required in ducts 49" wide to 72" wide - Four 12" x 12" doors required in ducts over 72" wide.

G. Coordinate with other work, including ductwork, as necessary to interface installation of duct accessories properly with other work.

H. Provide air tight seal where flexible connection attaches to duct work.

I. Install sound attenuators with rigid angle iron supports anchored to structure.

3.3 FIELD QUALITY CONTROL:

A. Operate installed duct accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leakproof performance.

B. All fire dampers shall be tested for proper closure by the Contractor witnessed by the Contracting Officer's Representative, and duly recorded and submitted to Engineer for approval. Selected fire dampers may be additionally tested during final inspection.

3.4 ADJUSTING AND CLEANING:

A. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.

1. Label access doors in accordance with Division-15 section "Mechanical Identification".

2. Final positioning of manual dampers is specified in Division-15 section "Testing, Adjusting, and Balancing".

B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.5 EXTRA STOCK:

1. Furnish extra fusible links to Contracting Officer’s Representative, one link for every 10 installed of each temperature range; obtain receipt.

END OF SECTION 15910

SECTION 15932 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.

B. Types of outlets and inlets required for project include the following:

Ceiling air diffusers.
Wall and floor registers and grilles.

C. Refer to other Division-15 sections for ductwork and duct accessories required in conjunction with air outlets and inlets; not work of this section.

D. Refer to other Division-15 sections for balancing of air outlets and inlets; not work of this section.

1.3 QUALITY ASSURANCE:

A. Manufacturers Qualifications: Firms regularly engaged in manufacture of outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".

2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".

3. ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual".

4. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters."

5. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.4 SUBMITTALS:

A. Product Data: Submit manufacturer's data on outlets and inlets including the following:

1. Schedule of air outlets and inlets indicating drawing designation, type, room location, number furnished, model number, size, and accessories furnished.

2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.

3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses, throw and drop, and noise criteria ratings. Indicate selections on data.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.

C. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 1.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B. Store outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 CEILING AIR DIFFUSERS:

A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.

D. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on diffuser schedule. Use all steel diffusers where fire dampers are required.

E. Manufacturer: Subject to compliance with requirements, provide diffusers of one of the following:

Krueger Mfg. Co.
Titus Products Div.; Philips Industries, Inc.
Air Guide
Price

2.2 WALL AND FLOOR REGISTER AND GRILLES:

A. General: Except as otherwise indicated, provide manufacturer's standard wall registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide wall or floor registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Wall or Floor Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall or floor systems, and that are specifically manufactured to fit into wall or floor construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall construction which will contain each type of wall register and grille.

D. Types: Provide wall or floor registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule. Provide all steel registers where fire dampers are required.

E. Manufacturer: Subject to compliance with requirements, provide registers and grilles of one of the following:

Titus Products Div.; Phillips Industries, Inc.
Krueger
Air Guide
Price

PART 3 - EXECUTION

3.1 INSPECTION:

A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended functions.

B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

C. Locate ceiling air diffusers, registers, and grilles, as indicated on plans. Unless otherwise indicated locate units in center of acoustical ceiling modules. Locate units so that ceiling grid is not cut.

D. Install balancing damper with locking quadrant in runout to linear slot diffusers.

END OF SECTION 15932

SECTION 15990 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1. RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Division-1 Specification sections, apply to work of this section.

B. Division-15 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 DESCRIPTION OF WORK:

A. Extent of testing, adjusting, and balancing work required by this section shall include a preliminary balance of Air and Water systems together with preparation of the systems for, and cooperation with, the independent Air and Water Balance Contractor. This work by the Mechanical Contractor shall include the following:

1. Carefully check all piping during installation to make certain that water systems are installed free from foreign material (stones, sand etc.).

2. Clean the water in the piping system, remove strainer covers and clean baskets, and place all associated equipment in operation.

3. Bleed all air from the hydronic system.

4. Provide Pete's Plug gage ports with screw on caps at the inlet and outlet of each piece of equipment attached to the water heating, cooling and piping systems. (Coils, pumps, connectors, airtrol fittings, etc.).

5. Make water system modifications as required by the balancing engineer.

6. Clean air filters, ductwork, coils, fans, etc. in the air system to remove all construction dust and debris.

7. Start, lubricate and balance all fans. Change and/or adjust drive pulleys on fans to give required RPM.

8. Supply and install balancing dampers as required for final balancing as determined by the balancing engineer.

9. Furnish workmen familiar with this project and of the proper trade to assist the balancing engineer in the air and water balancing. Also make available subject to request by the balancing engineer trained servicemen of the control, and other equipment suppliers to assist as needed during the testing of their portion of the project.

10. Furnish plans, operating manuals, and shop drawings of all equipment installed for use by the Air and Water Balancing Agency.

11. Have all systems in full operation a minimum of 72 hours before Balance Contractor arrives on job.

PART 2 - PRODUCTS

2.1 TESTING AND BALANCING:

A. The Mechanical Contractor shall procure the services of a Professional Engineer and Contracting Officer approved independent test and balance agency to test water and air moving equipment and air distribution and exhaust systems and to supervise the balance and adjustment of these systems. All work shall be done under direct supervision of a qualified Heating and Ventilating Engineer. The Contractor shall provide access as required, including any necessary scaffolding, and shall cooperate with testing laboratory personnel. All instruments used in this work shall be accurately calibrated within the 9 months prior to initiating work, and maintained in good working order. If requested the tests shall be conducted in the presence of the Mechanical Engineer responsible for the project and/or his representative. Air balance and testing shall not begin until the system has been completed and is in full working order. The Contractor shall award the test and balance contract upon receipt of his contract to proceed with the air conditioning installation, to allow the Air Balance and Testing Engineer to schedule his work in cooperation with other trades involved and comply with completion date. Upon completion of the air conditioning system installation, the Air Balance and Testing Engineer shall perform the following tests, supervise adjustments and system modifications, and compile the test data as required for evaluation and approval.

B. The independent test and balance agency shall be a full member in good standing of either NEBB or AABC. All work shall be performed in accordance with the standards set forth by either NEBB or AABC.

C. Submit a pre-balance check list of items to be preformed by the Mechanical Contractor prior to balance.

D. Submit a test and balance agenda outlining methods, procedures and instrumentation to be used during balancing. This agenda shall be submitted within 3 months after award of the building contract.

E. Perform an opposite season check-out of the HVAC system (Air and Water) approximately 6 months after original balance to verify that all systems are operating properly and adjust as required. Submit report to the Contracting Officer.

PART 3 - EXECUTION

3.1 AIR SYSTEM TEST AND BALANCE PROCEDURE:

A. Bring all fans to design RPM.

B. Bring air volume in each air handling system to the design air volume using pitot tube transverse method.

C. Test and record fan motor data.

D. Test and record static pressure and air volume in high velocity duct extremities.

E. Measure, record and adjust air diffusers and registers to design CFM.

F. Make recommendations for system modifications and adjustments required to facilitate proper system balancing as determined by preceding test.

G. Perform duct pressurization tests as specified in Section 15891.

H. Retest and readjust all system segments affected by system modifications.

3.2 WATER SYSTEM TEST AND BALANCE PROCEDURE:

A. Review systems, automatic fill valve and strainer, expansion tank level, water cleanliness, pump strainers, air vent location and pressure tap locations.

B. Inform Mechanical Contractor if there is additional work required by the Contractor prior to balancing.

C. Measure circulating pump capacities using calibrated flow meter. Record differential pressure and dead head measurements, amperage and voltages. Position all automatic valves, hand valves and balancing cocks for full flow through coils, converters, etc. during pump adjustment. Use only calibrated test gages for pump adjustment; the use of pressure gages installed with the system will not be allowed.

D. Coordinate the setting of controls to maintain coil water inlet design temperatures, with coil valves positioned for full flow through coil during adjustment. Balance individual water coils at full flow to maintain temperature differential specified.

E. Test all equipment on the water system (coils, pumps, converters, etc.) for design flow.

F. Mark settings of all balancing cocks at required positions.

3.3 DATA FILE:

A. Prepare complete balance report, and data file on all equipment and devices tested indicating name plate data, design requirements and final operating conditions. Prepare drawing showing final CFM adjacent to each supply, return, and exhaust device. Submit seven (7) copies of the final balance report to be distributed as follows:

General Contractor	- 1 copy
Mechanical Contractor	- 1 copy
Architect	- 1 copy
Engineer	- 1 copy

Remaining three (3) copies to be included in the operation and maintenance manuals presented to the Contracting Officer.

B. Final report shall include stamp and/or seal of NEBB or AABC certified member.

3.4 RETESTING

A. Perform all necessary retesting and rebalancing required to bring all systems into compliance with design parameters of ±10% on airflow and ±5% on water flow, at the pump and ± 10% on water flow at the terminal device.

B. Perform all retesting necessary after contractors rework to bring non-conforming systems into compliance.

C. Perform all retesting and readjusting as requested by engineer after review of test report and submit revised report as required.

3.5 INSTRUCTION:

A. At the completion of the balancing, review the operating and maintenance brochures as supplied by the Mechanical Contractor supplement these instructions as determined through balancing experience. Meet with owners personnel and with Mechanical Contractor and controls subcontractor to review proper operating procedures.

B. Warranty that the system is set in accordance with values as established by the plans and specifications.

END OF SECTION 15990

SECTION 16050 - BASIC METHODS AND REQUIREMENTS (ELECTRICAL)

PART 1 - GENERAL

1.1 GENERAL CONDITIONS:

A. The General Conditions, Supplementary General Conditions, General Requirements, and Special Conditions shall be and are hereby made a part of this Section of the specifications.

B. In case of conflicts between the electrical drawings and Division 16 of these specifications, the more stringent requirements shall govern. In all cases, notify the project engineer for direction.

C. The requirements of SECTION 16050 - BASIC METHODS AND REQUIREMENTS establish minimum requirements, apply to, and are hereby made a part of all sections of Division 16 of this specification.

D. The contractor shall be responsible for excavation of all earth, soil, and rock conditions at the site. Review the elevations and soil boring logs and include all associated costs.

1.2 DESCRIPTION:

A. The electrical work shall include all labor, materials, tools, transportation, equipment, services and facilities, required for the complete, proper and substantial installation of all electrical work shown on the plans, and/or outlined in these specifications. The installation shall include all materials, appliances, and apparatus not specifically mentioned herein or noted on the drawings but which are necessary to make a complete working installation of all electrical systems.

B. All of the electrical related work required for this project (unless specified otherwise) is a part of the Electrical Contract price but is not necessarily specified under this division of the specifications or shown on the electrical drawings. Therefore, all divisions of the specifications and all drawings shall be consulted.

C. The floor plan drawings are schematic only and are not intended to show the exact routing of raceway systems unless dimensions are noted on the drawings. Final routing will be governed by field conditions (structural members, mechanical equipment, ductwork, etc.) and shall be determined by the contractor and approved by the architect. Any changes in routing shall not change the design of the raceway system.

D. The floor plan drawings showing device and equipment locations are schematic only and are not intended to show exact locations unless dimensions are noted on the drawings. The contractor shall review all contract drawings that may affect the location of devices and equipment to avoid possible interference and permit full coordination of all work. The right to make any reasonable change in location within 6'-0", is reserved by the architect up until the time of rough-in at no extra cost.

E. Furnish and install electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings. Capacities and ratings of transformers, cable, switchgear, panelboards, motor control, and other items, arrangement for specified items in general are shown on drawings.

F. Electrical service entrance equipment (arrangements for temporary and permanent connections to the power distribution system) shall conform to Texas National Guard requirements. Coordinate fuses, circuit breakers and relays with the power distribution system, and obtain approval from SANGB MI Utility Supervisor. Provide all required temporary building power and lighting. Remove when finished. Installation of temporary power and lighting shall comply with N.E.C. and OSHA requirements.

G. Ampacities specified or shown on the drawings, are based on copper conductors, with the conduit and raceways accordingly sized.

1.3 MINIMUM REQUIREMENTS:

A. Codes Rules And Regulations: Execute all work under ADA the latest rules and regulations of the National Electrical Code Standard of the National Board of Fire Underwriters, the National Fire Protection Association, and with all laws, regulations and ordinances of the County, State, City, and the Utility Company.

B. Codes shall govern in case of any direct conflict between codes and plans and specifications; except when plans and specifications require higher standards than those required by code. Variance from the plan and specifications made to comply with code must be approved by the architect. If approved they shall be made with no increased cost to the Government.

1.4 STANDARDS:

A. All material and equipment shall be listed, labeled or certified by Underwriters Laboratories, Inc., where such standards have been established. Equipment and material which are not covered by UL

Standards will be accepted provided equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as NEMA, or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings.

B. Definitions:

1. Certified: Equipment is "certified" if:

a. Equipment has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.

b. Production is periodically inspected by a nationally recognized testing laboratory.

c. It bears a label, tag, or other record of certification.

2. Nationally recognized testing laboratory: A testing laboratory which is approved, in accordance with OSHA regulations, by the Secretary of Labor.

1.5 QUALIFICATIONS (PRODUCTS AND SERVICES):

A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.

B. Product Qualification:

1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.

2. The engineer reserves the right to require the contractor to submit a list of installations where the products have been in operation before approval.

C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will respond within twohours of receipt of notification that service is needed. Submit name and address of service organization.

1.6 MANUFACTURED PRODUCTS:

A. Materials and equipment furnished shall be new, of best quality and design, free from defects, of current production by manufacturers regularly engaged in the manufacture of

such items, for which replacement parts should be available. All items used on this project shall be free of asbestos, PCB, and mercury material.

B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:

1. Components of an assembled unit need not be products of the same manufacturer unless indicated otherwise.

2. Manufacturers of equipment assemblies, which include components made by others, shall be completely responsible for the final assembled unit.

3. Components shall be compatible with each other and with the total assembly for the intended service.

4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory and Field wiring shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Testing is Specified:

1. The engineer shall have the option of witnessing factory tests. The contractor shall notify the engineer a minimum of 15 working days prior to the manufacturer making the factory tests.

2. Four copies of certified test reports containing all test data shall be furnished to the engineer prior to final inspection and not more than 90 days after completion of the tests.

3. When equipment fails to meet factory test and reinspection is required, the contractor shall be liable for all additional expenses, including expenses of the engineer.

1.7 EQUIPMENT PROTECTION:

A Equipment and material shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain.

B. During installation, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter and be vacuum cleaned both inside and outside before testing, operating and painting.

C. Damaged equipment shall be, as determined by the engineer, placed in satisfactory operating condition or be returned to the source of supply for repair or replacement.

D. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.

E. Damaged paint on equipment and materials shall be restored to the original quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.8 GENERAL WORK REQUIREMENTS:

A. Arrange, phase and perform work to assure electrical service both temporary and permanent for buildings at all times.

B. Coordinate location of equipment and conduit with other trades to minimize interferences.

C. Examination of Site:

1. Visit the site, inspect the existing conditions and check the drawings and specifications so as to be fully informed of the requirements for completion of the work.

2. Lack of such information shall not justify an extra to the contract price.

D. PERMITS:

1. Obtain and pay for all licenses and permits, fees, inspection and certificates required for the execution of this work.

2. Pay fees and charges for connection to outside services and use of property.

3. Deliver permits and certificates to the architect to be transmitted to the Government.

E. SERVICES:

1. This contractor shall pay for all expenses, deposits, reimbursements, etc., required by the local rules and codes for the service to the buildings, complete and ready for use. See plot plan.

2. Consult Texas National Guard Engineering Representative for their requirements and for coordinating installation. Contractor shall provide any work thus required beyond that indicated by the drawings and specifications. He shall bear all expense involved for the complete installation of the electrical service (both temporary and permanent) to the building ready for operation.

3. He shall consult all local departments to verify requirements and bid installation of service in accordance with local codes and SANGB MI rules and regulations.

4. He shall bear all expense involved for the complete telephone CATV and "LAN" System Fiber as detailed on the plans. Verify complete installation with SANGB MI Communications Supervisor and bid installation to comply with their requirements.

F. RESPONSIBILITY:

1. This contractor will be held responsible for any and all damage to any part of the building or to the work of other contractors, as may be caused through his operation.

2. Any mutilation of building finishes or equipment initiated by electrical construction shall be properly corrected by the respective finishing contractor and paid for by the Electrical Contractor.

3. The operation of the temporary power and the permanent electrical system shall be the responsibility of this contractor until acceptance of the building by the Government.

G. WORK TO BE DONE BY GENERAL CONTRACTOR:

1. Build in all openings sleeves, chases etc., for conduit and equipment as established, furnished and set by this contractor. He shall seal or grout all openings after this contractor has installed his conduits.

2. Build in bolts, brackets, hangers etc. for work established, furnished and set by this contractor.

3. All concrete work required for equipment furnished and set by this contractor including clean up pads under electrical gear, fixture bases, transformer bases, etc.

4. Painting: All painting of electrical equipment installed in finished areas shall be done by the general contractor. Painting will not be required on receptacles, switches, circuit breakers etc. All fixtures and exterior poles specified to be factory-primed shall be painted by general contractor. Paint all wiremold, exposed conduit and equipment, etc. to match final wall colors.

5. Provide fireproofing above fixtures located in fire rated ceilings per U.L. requirements.

6. Pay all utility costs for operation of electrical system during construction until acceptance of building by the Government.

H. WORK DONE BY THE MECHANICAL CONTRACTOR:

1. The mechanical contractor shall furnish wiring diagrams and temperature control drawings of all equipment furnished to the electrical contractor. Catalog information is unacceptable, provide point to point drawings.

2. The mechanical contractor shall furnish and install all control equipment requiring connections to air, water, steam, etc., such as pneumatic electric relays, remote bulb temperature controls, solenoid valves, aquastats and pressure controls.

3. The mechanical contractor shall reimburse the electrical contractor for any changes in system design i.e.; control or equipment which effects the electrical contractor. Also refer to equipment connections, controls and instrumentation in 16050.

I. WORKMANSHIP AND COORDINATION:

1. Make installation substantially as shown on the plans.

2. Make alterations in location of apparatus or conduit as may be required to conform to building construction without extra charge.

3. Mechanical equipment service clearances and electrical apparatus service clearances as specified in their respective manufacturer's product data shall be maintained free from conduit.

4. Cooperate with other trades in their installation of work.

5. Complete the installation in a workmanlike manner, completely connected and ready to give proper and continuous service.

6. Use only experienced licensed electricians.

J. CUTTING AND PATCHING:

1. Notify the general contractor in ample time, of the location of all chases, sleeves, and other openings required in connection with the work of this contract.

2. Cutting and patching made necessary because of failure to comply with the above shall be done by the general contractor at the expense of the electrical contractor.

3. When it is necessary for the electrical contractor to cut building materials to install his work, it shall be done in a neat and workmanlike manner meeting with the approval of the architect.

4. Holes through concrete shall be carefully drilled with a "Concrete Termite" drill. A Star drill or Air Hammer will not be permitted. Structural members shall not be cut without approval from the architect.

5. Any penetrations thru the roof shall be made with flashing connections approved by the roof system manufacturer or as approved by the architect.

6. Any penetrations made in exterior or basement foundation walls shall be sealed with Thunderline "Link-Seal" connections, as manufactured by Thunderline Corporation, Wayne, Michigan.

K. MANUFACTURER'S INSTRUCTIONS:

1. Apply, install, connect, erect, use, clean, and condition articles, materials and equipment as directed by the manufacturer.

1.9 EQUIPMENT INSTALLATION AND REQUIREMENTS:

A. Equipment location shall be as close as practical to locations shown on the drawings.

B. Working spaces shall not be less than specified in the National Electrical Code for all voltages specified.

C. Inaccessible Equipment:

1. Where the engineer determines that the contractor has installed equipment without proper clearances or not readily accessible for operation and maintenance, equipment shall be removed and reinstalled as directed at no additional cost to the Government.

a. Install access panels as approved by the architect to provide access to all equipment, J-boxes and outlets located in non-accessible spaces. Panels shall be flush locking type with a fire rating equal to the ceiling system.

2. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping, and ductwork. Outlet and box covers shall be removable by using regular length (8") screw drivers.

D. Distribution Equipment:

1. All items of Electrical Distribution Equipment (switchboards - panelboards - disconnects) shall be of one manufacturer, unless specifically noted on the drawings, in the specifications, or approved by the engineer. Intermixing of distribution equipment by different manufacturers will not be permitted.

2. Provide a surge arrester for lightning protection on each service entrance for each building. Refer to drawings for voltage and phasing of service. Arrester shall be located within the main switch, panel or switchboard enclosure. Surge Arrester: shall be injection molded high temp. thermoplastic utilizing metal oxide varistors with a fusible link and an LED indicating light.

   a. 277/480V.: Voltage rating line to ground shall be 650V. RMS min. Response time shall be instantaneous. Max. clamping voltages shall be 1800 volt at 1500 Amps line to ground, 2500 volt at 5,000 Amps line to ground, 3,400 volt at 10,000 Amps line to ground. Minimum life at 1.5 KA is 2,500 operations. 36,000 Amp peak single pulse transient. Square 'D' #SDSA3650.

3. Equipment layouts on the drawings are based on one manufacturer. Verify all actual equipment sizes with equipment manufacturer prior to bidding.

4. If layout changes are required due to differing electrical manufacturers equipment size, they must be submitted to and approved by the engineer. National Electric Code working clearances must be maintained at all times. Extra remuneration will not be allowed for layout changes that differ from those shown.

5. Provide and install all steel supports as required for mounting of electrical equipment.

6. Anchor all free standing electrical equipment including switchboards, switchgear, substations, motor control centers, paralleling gear, transfer switches, transformers, etc. to the floor with plated, 1/2" diameter minimum, anchor bolts or as recommended by the manufacturer.

1.10 EQUIPMENT CONNECTIONS, CONTROLS AND INSTRUMENTATION:

A. General: The following applies to all electrical power and control connections for all equipment requiring electrical installation work provided by others.

B. Electrical contractor shall install and connect the following items for equipment requriing electrical power that is either furnished or specified by other contractor and/or the Government. Where these required items are not furnished with the equipment being connected. It shall be the electrical contractors responsibility to provide the necessary items including conduit boxes and wiring.

1. Starters
2. Disconnecting Devices
3. Thermal Overload Devices
4. Overcurrent Devices
5. Short Circuit Protective Devices
6. Power Factor Correction Devices
8. Voltage Transformation Equipment
9. Control Devices (Local and Remote)
10. Audible and Visual Control Status Annunciation Devices
11. Equipment Mounting Structures
12. Additional Miscellaneous Devices

In general all major equipment will be specified to be factory prewired with only service and interconnecting wiring required at the site by the electrical contractor; however, he shall check all divisions of the specification to verify if the equipment is specified factory prewired and if not, then it shall be the responsibility of the electrical contractor to provide the complete wiring of the equipment in accordance with wiring diagrams provided by other contractors and/or Government to the electrical contractor. All interconnecting of equipment shall be by the electrical contractor.

C. All line and low voltage wiring and connections required to control the equipment are a part of this section. All wiring shall be in conduit. When mechanical controls are to be provided by a Temperature Controls Contractor (TCC), low volatage control wiring for the control system shall be provided by the TCC and installed by the Electrical Contractor. Terminations will be made by TCC.

D. The electrical contractor shall provide 120 volt control power supply; #12 Ga. CU. THHN/THWN in 1/2"C. minimum at all points required by controls, instrumentation and sprinkler risers. Circuit as shown on the plans or to the nearest 120 volt panel if no circuiting is indicated. Use spare 20 Amp. breakers. Each control panel shall be on a separate circuit unless otherwise indicated. If the controlled equipment is fed from the emergency system, then the control power supply must feed from the emergency system.

E. The contractor shall familiarize himself with the equipment to be furnished by the other contractors and/or the Government in connection with this work and that provisions for such connections and work has been included in the contractor's price. Extra remuneration will not be allowed for such work.

F. Connections to all equipment have been designed from units as specified on the drawings or in the specifications. In the event equipment or control differs on approved shop drawings it shall be the responsibility of the supplying contractor to coordinate electrical connections to the units and reimburse electrical contractor for any changes in system design. These changes shall not involve additional cost to the Government.

G. Review all plans and specifications to verify all equipment connections that are required by mechanical and/or other contractors. Although the electrical drawings will show equipment connection requirements, it is the electrical contractor's responsibility to connect all equipment furnished by other contractor's at no extra cost to the Government even if this equipment connection is not shown on the electrical drawings. Coordinate all required connections not shown on the electrical drawings with the engineer.

1.11 NAMEPLATES:

A. General: The following items shall be equipped with nameplates:

1. Disconnect switches (fused or nonfused), transformers, switchgear, switchboards, panelboards, separately mounted circuit breakers, starters, contactors, relays, junction boxes and pull boxes.

2. Special Electrical Systems (fire alarm, sound system, etc.) shall be so identified at junction and pull boxes, terminal cabinet and equipment racks.

3. Wall switches or other control devices controlling equipment or special lighting configuration.

4. All devices on the emergency system shall be 'Red' with red plates labeled "Emerg."

B. Inscription: Nameplates shall adequately describe the function or use of the particular equipment involved. Nameplates for panelboards and switchboards shall include the panel designation, voltage, phase, A.I.C. rating of the supply (see schedules, one-line diagram, and color coding). For example, "Panel A" 120/208 V, 3-Phase, 4-Wire, 10,000 A.I.C.":

Phase A - Black
Phase B - Red
Phase C - Blue
Neutral - White
Ground - Green

The name used for a machine nameplate shall be the same as the one used on the machine's motor starter, disconnect and P.B. station nameplates. Nameplates for fused switches and panels shall also indicate fuse type and size. All panelboards fed from the emergency system shall be labeled "Emergency System", in addition to the instructions listed above.

C. Construction: Nameplates shall be laminated phenolic plastic white front and back with black core. Nameplates for emergency system panelboards and transfer switch shall be laminated phenolic plastic red front and back with white core. Lettering shall be engraved through front layer to form 1/4" black characters. Nameplates shall be securely fastened to the equipment to be identified, with No. 4 Phillips, round head, cadmium plated, steel self tapping screws or nickel plated brass bolts. Motor nameplate may be nonferrous metal not less than 0.03 inches thick, die stamped. In lieu of separate plastic nameplates, engraving directly on device plates is acceptable. Letters engraved thus, shall be filled with contrasting enamel. All nameplates and their installation are part of this work. Free hand lettering or dymo label marker will not be acceptable, except for separately mounted disconnect switches, circuit breakers, starters and similar separately mounted devices.

1.12 MATERIALS OF APPROVED EQUAL:

A. Where items of equipment and/or materials are specifically identified herein by a manufacturer's name, model or catalog number, only such specific items may be used in the base bid, except as hereinafter provided.

B. Unless requests for changes in base bid specifications are received, approved and noted by written addendum prior to the opening of bids, the successful contractor will be held to furnish specified items.

C. After contract is awarded, changes in specifications shall be made only as defined under "Substitution of Equipment".

1.13 SUBSTITUTION OF EQUIPMENT:

A. After execution of the contract, substitution of equipment of makes other than those specifically named in the contract documents may be approved by the engineer only if the equipment named in the specifications cannot be delivered to the job in time to complete the work in proper sequence to work of other contractors, due to conditions beyond control of the contractor. Provide documentary proof in writing from the manufacturer that the specified equipment will not be available in time. If the contractor is responsible for the delay, the substitution will not be approved.

B. Requests for substitutions must be accompanied by documentary proof of equality or difference in price and delivery, if any, in form of certified quotations from suppliers of both specified and proposed equipment.

1.14 SUBMITTALS: In accordance with Section SUBMITTALS, furnish the following:

A. The engineer's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.

B. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the engineer to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.

C. Submittals shall be complete and submitted together for each section. Individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assemble as a whole. Partial submittals will not be considered for approval.

1 Mark the submittals, "SUBMITTED UNDER SECTION_____". Mark out all statements on sheets that do not apply otherwise. The engineer may select options and equipment not originally specified. All options that are not marked out will be assumed that the contractor will furnish the same.

2. Submittals shall be marked to show specification reference including the section and paragraph numbers.

3. Submit each section separately.

4. Mark catalog cuts to indicate equipment, capacities, finishes, sizes, etc. Each individual item shall have its own sheet provided for approval. (Example: Separate sheets for each panelboard.)

D. The submittals shall include the following:

1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.

2. Elementary and interconnection wiring diagrams for communication and signal systems, control system and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.

3. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.

4. Quantities of materials will not be verified by the architect or engineer. Approval stamp on shop drawings does not constitute approval of quantities listed on shop drawings.

5. Shop drawings:

   a. All shop drawings shall be checked and signed by this contractor and general contractor prior to submittal to the architect/engineer.

   b. Shop drawings submitted without contractors signatures or approval and verification will not be approved.

   c. Shop drawings shall be submitted on wire, cables, devices, lighting fixtures (including distribution curves), motor starters, panelboards, disconnects, substations, transformers, switchgear, switchboards, motor control centers, conduit, raceway systems, all systems, etc.

6. Each sheet shall be either 8 1/2" x 11"; 8 1/2" x 13"; or 11" x 17" bond with a 5" x 3" clear area for engineers stamp. (This area shall not be used by this contractor or the generals stamp.) Larger drawings shall be able to be blue printed.

7. Submittals for all systems (fire alarm, security, PA, controls, etc.) shall include complete riser diagrams showing all conductors and conduit sizes.

E. Engineers acceptance of Compliance Submittals will not relieve the contractor from his responsibility for any deviations from the requirements of the contract documents unless contractor has in writing called engineer's attention to such deviation at the time of submission and engineer has given written approval to the specific deviation, nor shall any acceptance by engineer relieve contractor from responsibility for errors or omissions in Compliance Submittals.

F. Quantity of Submittals: See the general specification sections and AF Form 66.

1.15 ELECTRICAL WORK COMPLETION:

A. Before requesting final inspection the following work must be completed.

B. Operating Instructions:

1. The contractor shall submit along with the shop drawings of the equipment, three (3) copies of operating instructions for all items. Instructions shall be prepared by the manufacturer of the equipment. Verify quantity with Architect.

2. After the operating instructions have been approved by the engineer, the contractor shall include the remaining three copies in maintenance instructions brochures.

3. The contractor shall also obtain all manufacturer's instructions, manuals, and one complete set of drawings and turn these over to the architect at the completion of the project.

4. The contractor shall keep in a safe place, all keys and special wrenches furnished with equipment under this contract and shall give same to the architect at the completion of the project.

5. The contractor shall prepare a complete brochure, in triplicate, covering all systems and equipment furnished and installed under his contract. Brochures shall be submitted to the architect-engineer for approval and delivery to the Government. The cost of this brochure shall be included in the contract cost. Brochures shall contain the following:

   a. Certified equipment drawings and/or catalog data clearly marked for equipment furnished as required for approval submission under detailed section of the specifications.
   b. Complete operating and maintenance instructions for each item of equipment.
   c. Complete part list for each equipment item.
   d. Any special emergency operating instructions or a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to the various parts of the system.

6. Brochures shall be bound in hard backed three ring binders with an index, subdividers and reinforced sheets.

   a. Project name and address.
   b. Section of work covered by brochure, i.e. "Electrical Work".
   c. Name and address of architect.
   d. Name and address of engineer.
   e. Name and address of contractor.
   f. Telephone number of contractor, including night or emergency number.

7. In addition to these written instructions, each respective contractor shall fully and carefully instruct the Government, or his selected representatives, as to the proper operation, care and maintenance of each system and its equipment.

8. Fire Alarm, Security, Sound, PA, Clock, etc., Systems: The manufacturer shall conduct a device by device test. Verify completely proper operation. Record all items checked for each device and device location on a form. Submit this final checkout form to the engineer.

1.16 TESTING AND ADJUSTMENT:

A. Record loads on each phase of all panelboards, distribution panels, switchboards, transformers and submit final readings to the architect for records. This contractor shall adjust equipment, instruments, gages, meters etc., as required to test and adjust these systems.

B. Check, test, and adjust the mechanisms of all electrical equipment and adjustable parts of lighting fixtures as required for optimum performance.

C. Perform tests for insulation resistance in accordance with the requirements of the National Electrical Code and insure that all circuits are free from short circuits.

D. Keep a calibrated voltmeter and ammeter available at all times and provide service for test readings when and as required up until the project is accepted by the Government.

1.17 AS-BUILT DRAWINGS:

A. Show on blue line prints in red ink all changes from original plans made during the installation. Return two (2) sets of red marked drawings, specifications and addenda, as set forth in the General Conditions, to the architect upon completion of the project.

1.18 FINAL INSPECTION:

A. Final inspection will be made upon written request from the general contractor after the project is completed.

B. Furnish a workman familiar with this project to accompany the engineer on final inspection and have available ladders, drop cords, and other equipment as required to gain access to any portion of this system.

C. This contractor and his principal subcontractors shall be represented at the inspection by a person of authority responsible to demonstrate to the engineer that his work conforms to the intent of the plans and specifications.

D. Extra inspections made necessary by the electrical contractor's failure to comply with the conditions as set forth above shall be charged to the contractor for the inspector's time both on the job and spent in travel between the office and the project site.

1.19 GUARANTEE:

A. Guarantee all work, material and equipment for a period of one year after date of substantial completion.

B. During the one year guarantee period the electrical contractor shall be responsible for any defects which develop in the electrical systems. Upon notification of a defect by the general contractor he shall make immediate effort to correct it and shall notify the architect when this work is completed. This guarantee does not include ordinary lamp failure.

C. Repairs and/or replacements shall be made with no cost to Government.

D. Provide as part of the work of this contract, in addition to the first year's guarantee on equipment and materials, the following routine maintenance and inspection. (The one year time period will not start until each item is completed in accordance with plans and specifications and accepted by the Government). Correct and adjust all emergency systems, controls, fire alarm, transformer, etc. This service to be provided throughout the guarantee period.

1.20 SINGULAR NUMBER:

A. Where any device or part of equipment is referred to in these specifications in the singular number (such as "the switch"), such reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.21 SPECIAL SYSTEMS

A. Equipment and wiring for special systems shall be as shown in the following schedule:

SYSTEM	EQUIPMENT FURNISHED BY	EQUIPMENT INSTALLED BY	WIRING FURNISHED AND INSTALLED BY
Communications	Government	Government	Contractor
Telephone	Government	Government	Contractor
Television	Government	Government	Government
Public Address	Contractor	Contractor	Contractor
Fire Alarm	Contractor	Contractor	Contractor

B. Power wiring for all systems shall be furnished and installed by the contractor as shown on the drawings and as required by the equipment manufacturer.

C. Low voltage outlets shall be installed for all systems as shown on the drawings and shall be as specified for telephone outlets, hereinbefore, or as otherwise shown or required by the application or by the equipment manufacturer.

D. Telephone, CATV, communications and fire alarm systems shall be completely installed in separate conduit systems. All cable for these systems shall be in conduit and shall not be combined with any other system cable. Conduits systems shall be furnished and installed by the Electrical Contractor.

E. Conduits shall be sized as required by the number and type of conductors applied and/or as noted on plans (min. 3/4") and shall be not smaller than sizes recommended by the equipment manufacturer. All conduits shall be labeled to identify which system it is to be used for i.e.: Fire Alarm, Telephone, P.A. Etc.

F.. Typically ceiling voids in the building are not used as air plenums and wiring in these ceiling voids is not required to be fire rated for such service. However when ceiling voids are used as air return plenums, only U.L. Listed plenum cable (Where cables are not required to be in conduit) shall be used or non-rated cables shall be completely routed in conduit.

G. Any low voltage wiring installed in ceiling voids shall be bundled, neatly routed, suspended above the grid system or with appropriate tags as to service.

H. Low voltage wire and cable shall be specifically designed to function with equipment supplied. Cable shall be color coded for ease of installation and service, twisted, shielded, and grounded for control of voice circuits and covered with wear-resistant moisture proof protective insulation. Wire shall bear manufacturer's trademark either embossed or printed on cable.

END OF SECTION 16050

SECTION 16110 - RACEWAY SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section includes the furnishing, installation, and connection of raceways, fittings, and boxes to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.

B. Definitions: the term conduit, as used in this specification, shall mean any or all of the raceway types specified.

PART 2 - PRODUCTS

2.1 MATERIAL:

A. Raceway Size: In accordance with the NEC but not less than 1/2-inch unless otherwise shown. Where permitted by the NEC, 1/2-inch flexible conduit may be used for tap connections to recessed lighting fixtures.

B. Raceways: Install raceway types as shown on drawings and as listed below.

1. Rigid steel: UL 6.

2. Rigid aluminum: Fed. Spec. WW-C-540.

3. Rigid intermediate steel conduit (IMC): UL 1242.

4. Electrical metallic tubing (EMT): U.L. 797. Maximum size 5-inch. Permitted only with cable rated 600 volts or less.

5. Flexible steel conduit (commercial greenfield): Fed. Spec. WW-C-566 and UL 1.

6. Liquid-tight flexible metal conduit: Flexible galvanized steel tubing covered with extruded liquid-tight jacket of polyvinyl chloride (PVC). Provide conduit with a continuous copper bonding conductor spiral between the convolutions.

7. P.V.C. Conduit: UL approved Schedule 40, minimum 3/4" C. When PVC conduit is used, a ground wire sized per NEC 290-95 shall be added if not already specified.

C. Conduit Fittings:

1. Rigid steel and IMC conduit fittings:

a. Standard threaded couplings, locknuts, bushings, and elbows: Fed. Spec. W-F-408, except only material of steel or malleable iron are acceptable. Integral retractable type IMC couplings are acceptable also.

b. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure

c. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted. Bushings for conduit smaller than 1 1/4" shall have flared bottom with ribbed sides.

d. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.

e. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank coverplates having the same finishes as that of other electrical plates in the room.

f. In trade sizes 2-1/2" to 4" for rigid steel raceway or intermediate metal raceway, contractor may use Allied 'Kwik-Couple' fittings in lieu of individual steel couplings. 'Kwik-Couple' fittings shall not be used in hazardous locations. Where 'Kwik-Couple' fittings are used exterior for vertical risers, install fitting with taper end up.

2. Rigid aluminum conduit fittings:

a. Standard threaded couplings, locknuts, bushings, and elbows: Malleable iron, steel or aluminum alloy materials. Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.

b. Locknuts and bushings: As specified for rigid steel and IMC raceways.

c. Set screw fittings: Not permitted for use with aluminum raceway.

3. Electrical metallic tubing fittings:

a. Fed. Spec. W-F-408, except only material of steel for compression type. Steel or die-cast is acceptable for set screw type. Die-cast compression is not acceptable.

b. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated flared throats. Use gland and ring compression type or set screw type couplings and connectors for conduit smaller than 2 inches. Use set screw type couplings with four set screws each for conduit sizes 2 inches and larger. Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.

c. Indenter type connectors or couplings are prohibited.

4. Flexible steel conduit (greenfield) fittings:

a. Fed. Spec. W-F-406 and UL 5, except only steel or malleable iron material is acceptable.

b. Clamp type, with insulated throat.

5. Liquid-tight flexible metal conduit fittings:

a. Fed. Spec. W-F-406, except only steel or malleable iron material is acceptable.

b. Type incorporating a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.

6. Expansion and deflection couplings:

a. UL 467 and UL 514.

b. Accommodate, 1.9 cm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.

c. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.

d. Shall be watertight, seismically qualified, corrosion-resistant, threaded for and compatible with rigid or intermediate metal conduit.

e. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

D. Raceway Supports:

1. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.

2. Pipe Straps: Fed. Spec. FF-S-760, Type I, Style A or B.

3. Individual Raceway Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.

4. Multiple Raceway (trapeze) hangers: Not less than 1-1/2 by 1-1/2 inch, 12 gage steel, cold formed, lipped channels; with not less than 3/8-inch diameter steel hanger rods.

5. Solid Masonry and Concrete Anchors: Fed. Spec. FF-S-325; Group III self-drilling expansion shields, or machine bolt expansion anchors Group II, Type 2 or 4, or Group VIII.

E. Outlet Boxes:

1. UL-50, UL514A, Fed. Spec. W-C-586 and Fed. Spec. W-J-800.

2. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.

3. Sheet metal boxes: 4" square, galvanized steel, except where otherwise shown.

4. Boxes installed in concrete or masonry and boxes larger than 2 gang shall be masonry type.

F. Wireways: Equip with hinged covers, except where removable covers are shown.

G. Pull and Junction Boxes:

1. Pull and junction boxes shall be code gauge steel boxes with hinged, bolted or screwed covers. Boxes shall be flush or surface mounted as shown or required.

2. Junction and pull box shall be installed where shown on drawings and additional boxes shall be installed if required for pulling of wire provided location and installation is approved by the architect. All boxes shall be code construction with screw type cover and shall be installed in accessible locations.

PART 3 - EXECUTION

3.1 RACEWAY:

A. A ground wire, sized per NEC 250-95 shall be pulled in all conduits containing phase conductor(s).

B. Rigid galvanized steel (RGS) or IMC must be used at all times when exposed to weather or physical abuse and in all NEC classified hazardous locations. EMT may not be used in direct contact with earth, or in concrete slabs on grade.

C. U.L. approved Schedule 40 P.V.C. conduit may be used where feeders or branch circuits are to be run in earth or slabs (3/4" minimum). Use RGS ells and risers W/PVC coating approved for underground use. All conduit risers through concrete floors shall be RGS from below the top of the floor slab. Use conduit adapters when converting from P.V.C. to steel conduit. Use plastic spacers when more than one conduit is installed together. Spacers shall be installed per the NEC table 347-8. See Drawings for areas requiring concrete encasement. All P.V.C. conduits shall be provided with separate ground conductor sized per N.E.C..

3.2 PENETRATIONS:

A. Cutting or Holes:

1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the Structural Engineer prior to drilling through structural sections.

2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Structural Engineer as required by limited working space.

B. Fire Stop:

1. Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases, and maintains specified fire rating. Completely fill and seal clearances between raceways and openings with the fire stop material.

C. Fire Barrier Penetration Seals:

1. Manufacturer: Subject to compliance with requirements, provide fire barrier penetration seals of one of the following:

Electro Products Div./3M
Nelson; Unit of General Signal.

2. Provide seals for any opening through fire-rated walls, floors or ceilings used as passage for components such as conduits or cables.

3. Cracks, voids or holes up to 4" diameter: Use putty or caulking, one-piece intumescent elastomer, non-corrosive to metal, compatible with synthetic cable jackets, and capable of expanding 10 times when exposed to flame or heat and UL-listed.

4. Openings greater than 4" diameter and raceway sleeves thru floors at telephone terminal boards: Use sealing system capable of passing 3-hour fire test in accordance with ASTM E-814, consisting of wall wrap or liner, partitions, and end caps capable of expanding when exposed to temperatures of 250°to 350°F (121 to 177·C), that is UL-listed. KBS "Sealbags" manufactured by P-W Industries will be acceptable.

5. Execution: Fill entire opening with sealing compound. Adhere to manufacturer's installation instructions. All fire barrier seals shall meet the rating of the wall.

6. ENT penetrations shall use through - penetration firestop systems per UL.

D. Waterproofing:

1. At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Section, SEALING AND CAULKING.

3.3 CONDUIT SYSTEMS INSTALLATION, GENERAL:

A. Installation: In accordance with UL, NEC, as shown, and as hereinafter specified.

B. Essential (Emergency) raceway systems: Install entirely independent of other raceway systems. Common supports and hangers may be used.

C. Raceway Burial Depths: (Underground work)

1. 18" minimum, 30" maximum cover to grade or bottom of floor slab.

2. 24" minimum under streets, highways, roads, alleys, driveways and parking lots.

3. 2” below concrete slab inside a building.

D. Install raceways as follows:

1. In complete runs before pulling in cables or wires.

2. Flattened, dented, or deformed raceways is not permitted. Remove and replace the damaged raceways with new undamaged material.

3. Assure raceway installation does not encroach into the ceiling height head room, walkways, or doorways.

4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.

5. Mechanically and electrically continuous.

6. Independently support raceway. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, mechanical piping, or mechanical ducts.). Group raceways with common supports where possible. Conduit shall be supported within 12 inches of connectors.

7. Close ends of empty raceway with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.

8. Raceway installations under fume and vent hoods are prohibited.

9. Secure raceways to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For RGS and IMC raceway installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make raceway connections to junction box covers.

10. Flashing of penetrations of the roof membrane is specified in Section, FLASHING AND SHEET METAL.

11. Raceways shall not be used as a support.

E. Raceway Bends:

1. Make bends with standard raceway bending machines.

2. Raceway hickey may be used for slight offsets, and for straightening stubbed out raceways.

3. Bending of raceways with a pipe tee or vise is prohibited.

3.4 CONCEALED WORK INSTALLATION:

A. General:

1. Raceway and Outlet Boxes Installation: All raceway systems work and outlet boxes shall be installed concealed in walls, floor and roof construction or concealed within furred spaces or above ceilings. In equipment or mechanical rooms exposed work shall include feeders and connections to equipment unless noted otherwise.

B. In Concrete:

1. Raceway: RGS, IMC, PVC or EMT; except do not install EMT in concrete slabs that are in contact with soil, gravel or vapor barriers.

2. Align and run raceways in direct lines.

3. Install raceways through concrete beams only when the following occurs:

a. Where shown on the structural drawings.

b. As approved by the Structural Engineer prior to construction, and after submittal of drawing showing location, size, and position of each penetration.

4. Installation of raceways in concrete that is less than three inches thick is prohibited. All raceways installed in concrete shall be approved by the Structural Engineer.

a. Raceway outside diameter larger than 1/3 of the slab thickness is prohibited.

b. Space between raceways in slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.

c. Install raceways approximately in the center of the slab so that there will be a minimum of 3/4-inch of concrete around the raceways.

5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to insure low resistance ground continuity through the raceways. Tightening set screws with pliers is prohibited.

C. Above Furred or Suspended Ceilings and in Walls:

1. Raceways for conductors 600 volts and below:

a. RGS, IMC, rigid aluminum, or EMT. Types mixed indiscriminately in the same system is prohibited.

b. Do not use aluminum in wet locations or in contact with concrete.

2. Raceways for conductors above 600 volts:

a. RGS or rigid aluminum. Do not use aluminum in wet locations or in contact with concrete.

b. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.

3. Align and run raceways parallel or perpendicular to the building lines.

4. Connect recessed or lay-in lighting fixtures and all other devices installed in a lay-in ceiling to raceway runs with flexible metal conduit extending from a junction box to the fixture. Provide a ground wire in all flexible conduits.

5. Tightening set screws with pliers is prohibited.

3.5 EXPOSED WORK INSTALLATION:

A. Raceways for Conductors 600 volts and below:

1. RGS, IMC, rigid aluminum, or EMT. Types mixed indiscriminately in the system is prohibited.

2. Do not use aluminum in wet locations or in contact with concrete.

3. All raceways exposed to physical abuse and in all industrial pump, treatment plant locations shall be RGS, or IMC.

B. Raceways for conductors above 600 volts:

1. RGS or rigid aluminum. Do not use aluminum in wet locations.

2. Aluminum mixed indiscriminately with other types in the same system is prohibited.

C. Align and run raceways parallel or perpendicular to the building lines.

D. Install horizontal runs close to the ceiling or beams and secure with raceway straps.

E. Surface metal raceways: Use only where shown.

F. Painting:

1. Paint exposed raceways as specified in Section, PAINTING.

2. Paint raceways containing cables rated over 600 volts safety orange as specified in Section, PAINTING. In addition, paint legends, using two inch high black numerals and letters, showing the cable voltage rating. Provide legends where raceways pass through walls and floors and at maximum 20 foot intervals in between.

3.6 WET OR DAMP LOCATIONS:

A. Unless otherwise shown, use raceways of RGS or IMC above grade. Use PVC conduit below grade, except feeders of 1/0 and larger, rigid galvanized steel ells and risers with PVC coating approved for underground use shall be used.

B. Provide sealing fittings, to prevent passage of water vapor, where raceways pass from warm to cold locations, i.e., (refrigerated spaces, constant temperature rooms, air conditioned spaces) or similar spaces.

C. When RGS, IMC conduit or rigid galvanized steel ells and risers are used below concrete building slabs in contact with soil, gravel, or vapor barriers, cover conduit on the outside with a factory coating of 20 mil bonded PVC or field coat with asphaltum before installation. After installation, completely coat damaged areas of coating.

3.7 MOTORS AND VIBRATING EQUIPMENT:

A. Use liquid-tight Type UA flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission. Provide liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, and locations subject to seepage or dripping of oil, grease or water. Provide a green ground wire with flexible metal conduit

3.8 EXPANSION JOINTS:

A. Equip raceways three inches and larger, that are rigidly secured to the building structure on opposite sides of a building expansion joint, with expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.

B. Provide raceways smaller than three inches with junction boxes located 12 inches either side of the expansion joint. Connect junction boxes with 24 inches of slack flexible conduit. Flexible conduit shall have a insulated copper bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for three inches and larger conduits are acceptable.

3.9 RACEWAY SUPPORTS, INSTALLATION:

A. All raceways shall have supports at maximum spacing of 10 feet and within 3 feet of a fitting, elbow, box outlet or enclosure. Safe working load shall not exceed 1/4 of proof test load of fastening devices. This shall apply to both vertical and horizontal conduit runs.

B. Use pipe straps or individual raceway hangers for supporting individual conduits.

C. Support multiple raceway runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the raceways, wires, hanger itself, and 200 pounds. Attach each raceway with U-bolts or other approved fasteners.

D. Support raceways independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.

E. Fasteners and Supports in Solid Masonry and Concrete:

1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete

2. Existing Construction:

a. Steel expansion anchors not less than 1/4-inch bolt size and not less than 1-1/8 inch embedment.

b. Power set fasteners not less than 1/4-inch diameter with depth of penetration not less than three inches.

c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.

F. Hollow Masonry: Toggle bolts are permitted. Bolts supported only by plaster are not acceptable.

G. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

H. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.

I. Chair, wire, or perforated strap shall not be used to support or fasten conduit.

J. Spring steel type supports "caddy clips" that are listed for the intended use are acceptable in appropriate locations.

K. Vertical Supports: Vertical raceway runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.10 BOX INSTALLATION:

A. Boxes for Concealed Raceways:

1. Mount flush. Boxes protruding from the finished wall surface or with more than 1/8" gap between the wall or outlet mounted in the box will be changed out with all wall reconstruction expense paid by the electrical contractor.

2. Provide raised covers for boxes to suit the wall or ceiling, construction and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.

C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

D. Outlet boxes in the same wall mounted back-to-back are prohibited.

E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is four inches square by 2-1/8 inches deep, with device covers for the wall material and thickness involved.

F. Where lighting fixtures and appliance outlets are to be mounted in concrete or in plaster finish on concrete, outlet boxes shall be installed in forms at exact dimensions from bench marks, columns, walls or floors.

G. Where lighting fixtures and appliances outlets are to be mounted on masonry walls and/or plastered furring or other finish, outlet boxes shall be roughed in to general location before installation of wall and furring and shall be reset to exact dimensions before walls and furring are constructed.

H. All outlet boxes shall be set true to horizontal and vertical lines parallel to walls, floors and ceilings and true to finish lines. All boxes shall be secured to ceilings or walls so all installations are solidly mounted.

I. Boxes mounted to wall studs shall be secured to a horizontal box mounting bracket Equal to B-Line Series #BB2 or #BB26. B-Line Series #BB4 or equal one piece support brackets may also be used for mounting boxes. However metal stud clips with farside box supports are not acceptable.

J. Boxes for exterior exposed work (where approved by the engineer) shall be Appleton or Pyle National Type FS or FSC for shallow devices and Type FD or FDC for deep devices. Boxes for ceiling mounted light fixtures shall have approved no-bolt fixture studs. Boxes used as junction boxes shall have beveled edge flat steel blank cover.

K. Where outlet boxes are mounted exposed in unfinished areas, (where approved by the engineer) surface mounted boxes shall be 4" square, have rounded corners and 1/2" raised steel cover plates.

L. Location of outlets on small drawings is approximate and exact dimensions for locations of outlets shall be as taken from large scale plans and details on drawings or as directed by the architect/engineer. Outlets shall be located generally from column centers and finished wall lines or to center of wall or joints between wall

panels. Ceiling outlets shall be installed at elevation of suspended ceiling connected to outlets in ceiling or slab above. Where necessary to fit and center with panel or ceilings and wall spaces, the contractor must at his own expense shift the lighting outlets or other outlets as required by the architect.

M. Boxes for switches at or near door shall be installed on the side opposite the hinge. Verify door swing direction prior to rough-in.

N. To prevent sound from traveling through walls, electrical devices from different rooms shall not be mounted in the same stud place. Through-wall boxes shall not be used. In fire rated walls or partitions, outlet boxes on opposite sides of walls or partitions shall be separated by a horizontal distance of 24 inches. Outlet boxes larger than 4" square shall not be installed in fire rated walls or partitions. Verify location of fire rated walls or partitions with Architectural drawings prior to rough-in.

O. Mark all junction boxes and pull boxes with type and service in permanent, engraved label.

3.11 TELEPHONE, CABLE TV, COMMUNICATIONS, AND OTHER SYSTEMS CONDUIT

A. These specifications include the furnishing of all labor, and materials necessary for the complete installation of a system of conduits, outlets, and boards for use by the system suppliers.

B. This installation must be done according to the requirements of the system suppliers and the general specifications covering "Light and Power" herewith.

C. Provide and install pull boxes at all locations as required by the system suppliers.

D. Provide and install conduit sleeves thru floors and walls as required by the system suppliers.

E. The systems shall be provided with main service conduit sized as indicated on drawings. Each phone, data or TV location requires 3/4" empty conduit with pull rope unless noted otherwise. Conduits shall be routed to nearest associated telephone or data terminal board. Verify conditions of job prior to rough-in.

F. Outlets:

1. All wall outlets shall be installed with standard square box, plates furnished by system suppliers, or as directed. All outlets to be located as directed. Outlet boxes not used shall be provided with blank covers.

G. Provide 8' X 4' X 3/4" fire retardant plywood backboard for each telephone/data terminal board. Paint to match wall.

H. Install the raceway system as shown on drawings.

I. All conduit ends shall be equipped with non-metallic insulated bushings.

J. All 2, 3 & 4 inch conduits within buildings shall include pull boxes after every two 90 degree bends. Size per NEC Article 370.

K. Vertical conduits/sleeves through closets floors shall terminate not less than 3 inches above the floor and not less than 3 inches below the ceiling of the floor below.

L. Terminate conduit runs to/from the associated telephone or data backboard in a closet or designated space at the top or bottom of the backboard. Conduits shall enter closets next to the wall and be flush with the backboard.

M. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.

N. All empty conduits located in equipment closets or on backboards shall be sealed with a standard non-hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.

O. Conduit runs shall contain no more than four quarter turns (90 degree bends) between pull boxes/backboards.

P. Furnish and install nylon pull rope in all empty conduits. (Sleeves through floor/wall are exceptions).

END OF SECTION 16110

SECTION 16120 - WIRES AND CABLES, LOW VOLTAGE (600 VOLTS AND BELOW)

PART 1- GENERAL

1.1 DESCRIPTION:

A. This section includes the furnishing, installation, and connection of the power, lighting, system, and control wiring.

PART 2 - PRODUCTS

2.1 CABLE AND WIRE (POWER AND LIGHTING):

A. Cable and Wire: Fed. Spec. J-C-30, except as hereinafter specified. All conductors shown on plans are sized for copper. UL label required.

All cable and wiring shall be continuous between electrical equipment. Splices shall not be added except as required for taps in branch circuits or as approved by the engineer. No splices will be allowed with-in panelboards and switchboards.

B. Single Conductor:

1. Soft annealed copper.

2. Stranded for sizes No. 8 and larger. Solid for sizes No. 10 and smaller.

3. Minimum size No. 12, except where larger sizes are shown. (Size #14 minimum for controls).

C. Insulation:

1. THHN-THWN, XHHW - Sizes 12, 10, and 8. THHN-THWN, THW, XHHW -Sizes 6 and larger.

D. Install a ground wire sized per NEC 250-95 in each conduit containing phase conductors.

E. Color Code:

1. All conductors shall be identified by circuit number and color coding at all termination points and splices. All conductors shall be identified in all pull and junction boxes by the following method of color coding. Means of identification shall be permanently posted at each branch circuit panel with a nameplate identifying color coding system used in that panelboard.

Phase	208/120 V	480/277 V
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
Neutral	White	Gray*
Ground	Green	Green
Iso. Grd	Green w/Yellow	Green w/Yellow

* or white with colored (other than green) tracer.

2. Use solid color compound or solid color coating for No. 6 and smaller branch circuit conductors and neutral sizes.

3. Phase conductors No. 4 and larger color code using one of the following:

   a. Solid color compound or solid color coating.

   b. Colored as specified using 3/4-inch wide tape. Apply tape in half overlapping turns for a minimum of three inches for terminal points, and in junction boxes, pull boxes, troughs, manholes, and handholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable stating size and insulation type.

   c. Yellow stripe on Iso. Grd. may be 1/4" wide yellow tape on top of green.

4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.

5. Provide plastic engraved color code legend on each panel board and switch board per NEC 210-4 (d).

6. All improperly color coded conductors will be completely replaced at no additional cost to Government.

2.2 SPLICES AND JOINTS:

A. In accordance with UL 486 A, B, D and NEC.

B. Branch circuits (No 10 and smaller):

1. Connectors: Solderless, screw-on, reusable pressure cable type, 600 volt, 105 degree C. with integral insulation, approved for copper and aluminum conductors.

2. The integral insulator shall have a skirt to completely cover the stripped wires.

3. The number, size, and combination of conductors, as listed on the manufacturer's packaging shall be strictly complied with.

C. Feeder Circuits:

1. All feeder conductors shall be the same size and type and be continuous from overcurrent device to panel.

2. Connectors shall be indent type, connectors shall be UL listed for use with the size and type of wire installed of high conductivity and corrosion-resistant material. Do not install more than one conductor per connector unless the connector is UL listed for use with the number of conductors installed.

3. Field installed compression connectors for cable sizes 250 kcmil and larger shall have not less than two clamping elements or compression indents per wire.

4. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Insulation rating shall be not less than that of the conductor that is being joined.

5. Plastic electrical insulating tape: Flame retardant, cold and weather resistant.

2.3 CONTROL WIRING:

A. Unless otherwise specified in other sections of these specifications, size control wiring as specified for power and lighting wiring, except the minimum size shall be not less than No. 14, 90·C. insulation. Where stranded conductors are used, provide with spade type insulated copper terminals.

B. Size wire large enough so that the voltage drop under inrush conditions does not adversely affect operation of the controls.

2.4 COMMUNICATION AND SIGNAL WIRING:

A. Shall conform to the recommendations of the manufacturers of the communication and signal systems; however, not less than what is shown.

B. Wiring shown is for typical systems. Provide wiring as required for the systems being furnished.

C. Multi-conductor cables shall have the conductors color coded.

2.5 WIRE LUBRICATING COMPOUND:

A. The cable pulling lubricant shall be compatible with all cable jackets. The lubricant shall be UL (or CSA) listed. The lubricant shall contain no waxes, greases, silicones, or polyalkylene glycol oils or waxes.

B. A 200-gram sample of the lubricant, when placed in a one-foot, split metal conduit and fully dried for 24 hours at 105°C, shall not spread a flame more than three inches beyond a point of ignition at a continued heat flux of 40 kW/m^2. Total time of test shall be one-half hour.

C. Approved Lubricant is:

Polywater J available from:

American Polywater Corporation

Equal by Quick Slip from Buchanan
CCR Wire Pulling Lube from CRC
Poly-X from American Colloid.

2.6 FIREPROOFING TAPE:

A. The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame-retardant elastomer.

B. The tape shall be self-extinguishing and shall not support combustion. It shall be arcproof and fireproof.

C. The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.

D. The finished application shall withstand a 200 ampere arc for not less than 30 seconds.

E. Securing tape: Glass cloth electrical tape not less than 7 mils thick, and 3/4-inch wide.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERALLY:

A. Install in accordance with the NEC, and as specified.

B. Install all wiring in raceway systems.

C. Splice cables and wires only in outlet boxes, junction boxes, pull boxes, manholes, or handholes. Do not splice cables in panelboards, switchboards, disconnects, etc.

D. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.

E. For panelboards, cabinets, wireways, switches, and equipment assemblies, neatly form, and tie all cables.

F. Seal cable and wire entering a building from underground between the wire and conduit, where the cable exits the conduit, with a non-hardening approved compound.

G. Wire Pulling:

1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.

2. Use ropes made of nonmetallic material for pulling feeders.

3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the engineer.

4. Pull multiple cables into a single conduit with a single continuous pull.

5. Always use wire lubricant per this specification.

3.2 INSTALLATION IN MANHOLES:

A. Install and support cables in manholes on the steel racks with porcelain or equal insulators. Train the cables around the manhole walls, but do not bend to a radius less than six times the overall cable diameter.

Fireproofing:

1. Where low voltage cables are installed in the same manholes with high voltage cables, also cover the low voltage cables with arc proof and fireproof tape.

2. Use tape of the same type as used for the high voltage cables, and apply the tape in a single layer, one-half lapped or as recommended by the manufacturer. Install the tape with the coated side towards the cable and extend it not less than one inch into each duct.

3. Secure the tape in place by a random wrap of glass cloth tape.

3.3 SPLICE INSTALLATION:

A. Splices and terminations shall be mechanically and electrically secure.

B. Where the engineer determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Government.

3.4 CONTROL, COMMUNICATION, AND SIGNAL WIRING INSTALLATION:

A. Unless otherwise specified in other sections of these specifications, install wiring as described below. Wiring shall be connected to perform the functions shown and specified in other sections of this specification.

B. Except where otherwise required, install a separate power supply circuit for each system, or control equipment, or control power. Circuit to nearest 120 volt panel or nearest emergency panel if equipment controlled is connected to emergency system. Use spare 20 Amp breakers in panels where none are designated. Verify all requirements with actual equipment supplied in field.

C. Install a breaker lock-on clip on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.

D. System voltages shall not exceed 120 volts and shall be lower voltages where shown on the drawings or required by the NEC.

E. Wire and cable identification:

1. Install a permanent wire marker on each wire at each termination, outlet box, junction box, panel, and device.

2. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.

3. Wire markers shall retain their markings after cleaning.

4. In each manhole and handhole, install embossed brass tags to identify the system served and function.

3.5 FEEDER IDENTIFICATION:

A. In each, interior pullbox and junction box, install metal tags on each circuits cables and wires to clearly designate their circuit identification and voltage.

B. In manholes and handholes, provide tags of the embossed brass type, that show the cable type and voltage rating. Attach the tags to the cables with slip-free plastic cable lacing units.

3.6 FIELD TESTING:

A. Feeders and branch circuits shall have their insulation tested after installation and before connection to utilization devices such as fixtures, motors, or appliances.

B. Test shall be performed by meggar and conductors shall test free from short-circuits and grounds.

C. Test conductors phase-to-phase and phase-to-ground.

D. Meggar motors after installation but before start-up and test free from grounds.

E. The contractor shall furnish the instruments, materials, and labor for these tests.

END OF SECTION 16120

SECTION 16140 - WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section includes the furnishing, installation, and connection of wiring devices.

PART 2 - PRODUCTS

2.1 RECEPTACLES:

A. LIST OF ACCEPTABLE RECEPTACLE MANUFACTURERS

Manufacturer:	P&S	Hubbell	Eagle	Leviton	G.E.	Bryant
1. Specification Grade: Duplex Receptacle (20 A. 125V.)	5362	5362	5362	5362	GE 5362	5362
2. Ground Fault Circuit Interupter Duplex Receptacle (20A, 125 V.)	2091S	GF 5352	647	6898-HG	GF 5342	GFR53F
3. Isolated Ground Duplex Receptacle (20A. 125 V.)	IG6300	IG5362	IG5362	5362-IG	GF 5362-IG	5362IG SP53TIG SP52TIG

B. Weatherproof duplex receptacles shall be GFCI grounded twin outlet receptacle rated 20 ampere at 125 volts. This receptacle shall be equipped with a single weatherproof, coverplate. Where receptacles are to be in use for specific equipment, provide raintight while in use, NEMA 3R, safety outlet enclosure, with lift cover equal to Taymac #60310 or #20110 or equal by Carlon.

C. See plans for special outlet schedule.

D. Receptacle body shall be formed of high-impact nylon faced thermoplastic or urea and receptacle contacts shall be Bronze.

E. When only one receptacle is connected to a 20 amp circuit by itself, that receptacle must be rated 20 Amp.

F. All receptacles shall be self grounding with ground lug.

G. Install receptacles to clear all cabinets, equipment, etc.

H. Color of receptacles to be verified with Architect prior to ordering.

I. All 120V, 15 or 20A receptacles located, within 6 ft. of a sink, exterior locations, elevator machine rooms, elevator pits, garages, per NEC and as located on the plans shall be ground fault protected. Feed through GFCI receptacles or GFI breakers may be used to protect other receptacles in the same room and on the same circuit if wired per the manufacturer's recommendations. Prior to final inspection, perform ground fault test on each protected receptacle and submit list of all receptacles tested with results to the engineer. Label receptacles that are GFCI protected by another feed through GFCI receptacle or by GFI breaker "GFI protected".

J. Provide duplex receptacle on separate circuit beside each telephone terminal board location and other communications equipment requiring 120V, power.

2.2 TOGGLE SWITCHES:

A. Wall Switches: Wall switches in general, used to control lighting, shall be quiet operating, listed by U.L. and conform to NEMA standards as well as the latest Federal Specification W-S-896e.

B. Switches shall be single pole, two-pole, three-way, four-way, keyed, and with pilot light as called for on the drawings. Groups of switches shall be under one gangplate. Where switches are in fire rated walls groups of switches shall be maximum of 2 gangs under one cover plate.

C. Switches shall be as follows unless specified otherwise.

Single Pole	20 A. 125 V. 277 V.
Two Pole	20 A. 125 V. 277 V.
Three-Way	20 A. 125 V. 277 V.
Four-Way	20 A. 125 V. 277 V.
Pilot Light	20 A. 125 V. 277 V.

D. When only one switch is connected to a 20 amp circuit by itself, it must be rated 20A.

E. All switches shall be self grounding w/ground lugs.

F. LIST OF ACCEPTABLE SWITCH MANUFACTURERS

Manufacturer:	P&S	Hubbell	Eagle	Leviton	G.E.	Bryant
Specification Grade Switches	20AC1 Series	1220 Series	2220 Series	1220 Series	5950 Series	4901
Pilot Light Switches	20AC1-CPL Series	1220-PL Series	2220-PL Series	1221-PLR Series	SP120-8G Series	4801PLR12

G. Pilot light switches shall be illuminated toggle switch lighted red in "on" position.
H. Color of switches to be verified with Architect prior to ordering.

I. Provide barriers between 277V. switches and between 277V. and 120V. switches installed in a common outlet box.

2.3 WALL PLATES:

A. Wall plates shall be flexible (non breakable) nylon or polycarbonate.

B. Color shall be verified with Architect prior to ordering and shall match devices.

C. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.

D. Provide plates for all telephone, cable TV, communication outlets. Provide blank coverplate for outlets not used.

2.4 FUSTATS:

A. Fustats shall be Bussmann "SSY" with fustat and integral toggle switch for motors 1/2 HP 120V. and less. Fustats for 3/4 HP 120V. motors shall be Bussmann "SOY" with fustat and separately mounted 20A. 1P. 120V. toggle switch adjacent to fustat. Mount fustats in housings of equipment served. Fuses for motors shall be sized based on 125% of manufacturer's nameplate full load amperage unless otherwise indicated on drawings. Plug fuses shall be time delay dual element Bussmann Type 'S'.

2.5 MOTION SENSORS

A. General:

1. Shall be the product of a manufacturer with 5 years experience in the manufacture of infrared/ultrasonic motion sensing products for the control of lighting.

2. Shall have an adjustable time delay of 0-15 minutes.

3. Shall have an adjustable sensitivity setting.

4. Shall have a five year warranty.

B. Products:

1. Wall mounted (300SF.)

a. Novitas

b. Watt Stopper WS-120 (120V./800W.)
WS-277 (277V./1200W.)

2. Ceiling mounted (1200SF.)

a. Novitas #01-110 w/#13-031 Switchpack

b. Watt Stopper #CI-205 w/A120-E Power pack (120V.)
A277-E Power pack (277V.)

C. Installation

1. Install per manufacturer's instructions.

2. Provide accessories required for working system.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with the NEC, and as shown on the drawings.

B. Switches shall be located on the latch side of all doors. If switches must be located on the hinge side of a door, they shall be located so that they are not behind the door when it is open. All questionable locations shall be brought to the engineers/architects attention.

C. Verify all outlet locations on the job prior to rough-in. Locations may be altered up to 6'-0" in any direction without additional cost to the Government.

END OF SECTION 16140

SECTION 16400 - DISCONNECT SWITCHES (MOTORS AND CIRCUIT)

PART 1 - GENERAL:

1.1 DESCRIPTION:

A. This section includes all low voltage disconnect switches either stand alone in NEMA enclosures, fusible and non-fused, in panelboards, switchboards, or switchgear.

1.2 APPROVED MANUFACTURERS:

Square 'D'
General Electric
Siemans/ITE
Westinghouse
Cutler Hammer
Allen Bradley
Pringle.

PART 2 - PRODUCTS:

2.1 LOW VOLTAGE FUSIBLE SWITCHES RATED 800 AMPERES AND LESS:

A. Quick-make, quick-break type in accordance with UL 98, NEMA KS 1 and NEC.

B. Shall be capable of accepting UL and NEMA standard fuses.

C. Shall have the following features:

1. Switch mechanism shall be the quick-make, quick-break type.

2. Copper blades, visible in the OFF position.

3. An arc chute for each pole.

4. External operating handle shall indicate ON and OFF position and shall have lock-open padlocking provisions.

5. Mechanical interlock shall permit opening of the door only when the switch is in the OFF position, defeatable by a special tool to permit inspection.

6. Fuse mounting for the size and type of fuses specified. Furnish switches completely fused. Furnish a complete set of spare fuses for each size and type of fuse being installed.

7. Solid neutral for each switch being installed in a circuit which includes a neutral conductor.

8. Enclosures:

a. Shall be NEMA 1 for interior, NEMA 3R for exterior and other types shown on the drawings for the switches.

b. Where the types of switch enclosures are not shown, they shall be the NEMA types which are most suitable for the environmental conditions where the switches are being installed.

9. All fuse holders shall have rejection features to reject all fuses not specified.

D. Unless indicated otherwise, switches shall be heavy duty and horsepower rated for the load served.

2.2 LOW VOLTAGE UNFUSED SWITCHES RATED 800 AMPERES AND LESS:

A. Shall be the same of Low Voltage Fusible Switches rated 800 amperes and less, except it shall not accept fuses.

2.3 TOGGLE TYPE SWITCHES:

A. Provide/install toggle type switches, voltage and horsepower rated for the load served 20 or 30 Amp for all small mechanical equipment as indicated.

2.4 FUSES:

A. This paragraph applies to all fuses provided under Division 16.

1. Cartridge type fuses of proper size and type as required shall be furnished and installed for all switches and panelboards throughout and an additional supply of three spare fuses of each size and type shall be furnished in original packages to the Government. Furnish NEMA 1 enclosure with hinged cover equal to Bussmann Type SFC or Edison ESFC, for storing all spare fuses located adjacent to main service equipment. Fuses for motor and mechanical equipment shall be sized per nameplate data and N.E.C.. All fuses shall be of the Class "L" or "J" time delay and rejection type.

2. Fuses shall be manufactured by Bussmann Mfg. Co., Edison, Littelfuse, or Gould-Shawmut. Fuse types shall be installed as follows:

Main Service and Distribution Feeder Protection:

	Bussmann	Gould Shawmut	Littelfuse	Edison
601 amps and larger 600 volts and less (Class L)	KRP-C	A4BQ	KLPC	LCL
600 amps and less 600 volts and less (Class J)	LPJ	AJT	JTD	JDL

3. Class 'R' fuses will not be accepted.

4. All motors shall be protected by Type 'J' fuses as specified above. Fuse manufacturer must list in shop drawings specifically which fuse to install for each motor and starter required to provide Type '2' no damage protection. The contractor must provide and install the selected fuse and switch.

5. Fuses installed on project shall be by one manufacturer only. (Do not intermix manufacturers.)

2.5 FUSTATS:

1. Fustats shall be Bussmann "SSY" or Edison ESSY, with fustat and integral toggle switch for motors 1/2 HP 120V. and less. Fustats for 3/4 HP 120V. motors shall be Bussmann "SOY"or Edision ESOY, with fustat and separately mounted 20A. 1P. 120V. horsepower rated toggle switch adjacent to fustat. Mount fustats in housings of equipment served. Fuses for motors shall be sized based on 125% of manufacturer's nameplate full load amperage unless otherwise indicated on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with the NEC and as shown on the drawings.

END OF SECTION 16400

SECTION 16450 - GROUNDING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies general grounding and bonding requirements of electrical installations.

PART 2 - PRODUCTS

2.1 GROUNDING WIRES:

A. General Purpose: UL and NEC approved types, copper, with THW, XHHW or dual rated THHN-THWN insulation color identified green.

B. Size wire not less than what is shown and not less than required by the NEC.

2.2 GROUND RODS:

A. Copperclad steel, 3/4-inch diameter by 20 feet long.

2.3 SPLICES:

A. All splices and grounding electrode connections shall be made with exothermic welds.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERALLY:

A. Ground in accordance with the NEC as shown, and as hereinafter specified. All equipment ground conductors shall be terminated on a ground bus or ground lug attached to equipment can.

B. System Grounding:

1. Secondary service neutrals ground at the supply side of the secondary disconnecting means and at the related transformers.

2. Separately derived systems (transformers downstream from the service entrance) ground the secondary neutral.

3. Individual Buildings: Bond Main Disconnect ground bus to building steel, 20' re-bar in foundation, water pipe, driven ground, and ground ring.

C. Equipment Grounding:

1. Metallic structures, enclosures, raceways, junction boxes, outset boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be grounded for personnel safety and to provide a low impedance path for possible ground fault currents.

3.2 PRIMARY EQUIPMENT AND CIRCUITS:

A. Switchgear: Provide a bare grounding electrode conductor from the switchgear ground bus to the grounding electrode system.

B. Duct Banks and Manholes:

1. Provide a bare equipment grounding conductor in each duct bank containing medium or high voltage cables. Connect the grounding conductors to the switchgear ground bus, to all manhole hardware, to the cable shielding of medium or high voltage cable splices and terminations, and equipment enclosures.

2. Provide a grounding conductor having at least 50 percent ampacity of the largest phase conductor in the duct bank.

3. Connect the equipment grounding conductor to the grounding rod.

C. Pad Mounted Transformers:

1. Provide a driven ground rod and connect with a grounding electrode conductor to the grounding facilities at the transformer.

2. Ground the secondary neutral.

3. Connect lighting arrester grounds to the pad ground per NEC.

D. Lightning Arresters: Connect lightning arrester grounds to the equipment ground bus, or ground rods as applicable.

E. Metallic Conduit: Metallic conduits which terminate without mechanical connection to a housing of electrical equipment by means of locknut and bushings or adapters, provided with grounding bushings. Connect bushings with a bare grounding conductor to the equipment ground box.

3.3 SECONDARY EQUIPMENT AND CIRCUITS:

A. Main Bonding Jumper: Connect the secondary service neutral to the ground bus in the service equipment.

B. Water Pipe and Supplemental Electrode:

1. Provide a ground conductor connection between the service equipment ground bus and the metallic water pipe system. Jumper insulating joints in the water pipe.

2. Provide a supplemental ground electrode and bond to the water pipe ground, or connect to the service equipment ground box.

C. Service Disconnect: Provide a ground bar bolted to the enclosure with lugs for connecting the various grounding conductors. Connect the neutral to the ground bus (main bonding jumper).

D. Switchgear, Switchboards, and Unit Substations:

1. Connect the various feeder green grounding conductors to the ground bus in the enclosure with suitable pressure connectors.

2. Connect the grounding electrode conductor to the ground bus.

3. Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and ground wire to the ground bus.

E. Transformers:

1. Exterior: Exterior transformers supplying interior service equipment shall also have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.

2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to the nearest cold water pipe.

F. Conduit Systems:

1. Ground all metallic conduit systems.

2. Non-metallic conduit systems shall contain a grounding conductor.

3. Conduit provided for mechanical protection containing only a grounding conductor, bond to that conductor at the entrance and exit from the conduit.

G. Feeders and Branch Circuits: Install green grounding conductors with feeders and branch circuits in all feeders and branch circuits and in any raceway containing a phase conductor.

H. Isolated Grounds: All isolated grounds must be insulated and must terminate on isolated ground buses in the equipment. No other equipment grounds shall be connected to isolated ground bus where isolated grounds are shown and PVC conduit is used, an additional equipment ground must be installed to ground metallic boxes and mounting straps.

I. Boxes, Cabinets, Enclosures, and Panelboards:

1. Bond the grounding wires to each pullbox, junction box, outlet box, cabinets, and other enclosures through which the ground wires pass (except for special grounding systems for intensive care units and other critical units shown.).

2. Make ground wire connections to ground bus in motor control centers.

J. Receptacles and toggle switches are not approved for grounding through their mounting screws. Ground with a ground wire from green ground terminal on the device to the outlet box ground screw.

K. Ground lighting fixtures to the green grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems. Fixture connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

L. Fixed electrical appliances and equipment shall have a ground lug installed for termination of the green ground conductor.

M. Telephone Terminal Boards: Provide a #6 cu. ground in 3/4" c. from each board to the main service disconnect ground bus.

3.4 CONDUCTIVE PIPING:

A. Bond all conductive piping systems in the building to the electrical system ground. Bonding connections shall be made as close as practical to the water pipe ground or service equipment ground bus.

3.5 GROUNDING RESISTANCE:

A. Grounding system ground resistance must not exceed 5 ohms. Final tests shall assure that this requirement is met. Submit to the engineer.

B. Where permanently ground connections are required, make the connections by the exothermic process to form solid metal joints.

C. Where rock prevents the driving of vertical ground rods, install grounding electrodes in horizontal trenches to achieve the specified resistance.

D. Where more than one ground rod is required to meet the specified resistance, they shall be located at least 10 feet apart.

END OF SECTION 16450

SECTION 16510 - BUILDING LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section includes the furnishings, installation of and connection of all building lighting.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES:

A. Shall conform to the detail drawings, NEC Article 410 and UL-57.

B. Sheet Metal:

1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved), and parallel to each other as designed.

2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.

3. Where lighting fixture types are detailed with minimum 20 gauge (0.035 inch) housing, minimum 22 gauge (0.029 inch) housings will be acceptable provided they have strengthening embossed rib and break formations, and meet the rigidity test requirements of Fed. Spec. W-F-1662.

4. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.

5. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, and latches shall function easily by finger action without the use of tools.

C. Ballasts shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified.

D. Lamp Sockets:

1. Fluorescent: Lampholder contacts shall be the biting edge type or phosphorous-bronze with silver flash contact surface type and shall conform to the applicable requirements of UL 542 and ANSI C-81. Contacts for recessed double contact lampholders and for slimline lampholders shall be silver plated. Lampholders for bi-pin lamps, with the exception of those for "U" type lamps, shall be of the telescoping compression type, or of the single slot entry type requiring a one quarter turn of the lamp after insertion.

2. High Intensity Discharge (H.I.D.): Shall have porcelain enclosures and conform to the applicable requirements of ANSI C-81.

3. Incandescent: Shall have porcelain enclosures and conform to the applicable requirements of UL 496.

E. Recessed incandescent fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.

F. Fluorescent fixtures with louvers or light transmitting panels shall have doors with hinges, latches and safety catches to facilitate safe, convenient cleaning and relamping. Vaportight fixtures shall have pressure clamping devices in lieu of the latches.

G. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by screws, chains, captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.

H. Metal Finishes:

1. The manufacturer shall apply his standard finish (unless otherwise specified) over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking.

2. Fluorescent fixtures shall be completely post painted with electrostatically applied and baked enamel. No exceptions.

3. Interior light reflecting finishes shall be white with not less than 85 percent reflectances, except where otherwise shown on the drawing.

4. Exterior finishes shall be as shown on the drawings.

I. Ballasts for Fluorescent Fixtures:

1. All ballasts serving straight or "U" type lamps, nominal three feet (socket to socket) or longer in tube length, shall be securely mounted by nonturning studs (or captive bolts) equipped with lockwashers and nuts or locking type nuts, or by thread cutting (TC) sheet metal screws which are firmly secured against the fixture body (or wireway) to maximize dissipation of heat and minimize noise.

2. Ballasts shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified.

3. To facilitate multi-level lamp switching, lamps within fixture shall be wired with the outermost lamp at both sides of the fixture on the same ballast, the next inward pair on another ballast and so on to the innermost lamp (or pair of lamps). Within a given room, each switch shall uniformly control the same corresponding lamp (or lamp pairs) in all fixture units that are being controlled.

4. Where three-lamp fixtures are indicated, unless switching arrangements dictate otherwise, utilize a common two-lamp ballast to operate the center lamp in pairs of adjacent units. The ballast fixture and slave lamp fixture shall be factory wired with leads or plug devices to facilitate this circuiting. Individually mounted fixtures and the odd fixture in a row shall utilize a single lamp ballast for operation of the center lamp.

5. Core and coil ballasts :

a. Shall be rapid starting type or instant start for //T8 T12// lamps.

b. Shall be UL Class P with automatic resetting, internal, thermal protection.

c. Shall conform to ETL-CBM label requirements.

d. Power factors shall be not less than 90 percent. Capacitors in ballasts shall not contain PCB (Polychlorinated Biphenyl) fluids or other fluids recognized as hazardous when discharged into the environment.

e. Sound ratings shall be A, except for ballast sizes which are not available with A ratings, as standard products from any manufacturer. Ballasts which are not available with A ratings shall have the quietest ratings available.

f. One and two lamp ballasts shall be energy-saving type, UL listed to operate the specified lamps. Lamp output shall be within 5 percent of nominal rating. When operating two energy-saving lamps, the input watts to the ballast shall not exceed 78 watts at 120 V.A.C. or 79 watts at 277 V.A.C. Energy-saving type ballasts should not be used in ambient temperatures below manufacturer's recommendations. Low temperature -0· ballasts shall be used in all exterior and unheated spaces.

6. High-Frequency electronic ballasts (for operation only of the specified lamps):

a. Ballasts shall operate the lamps at a frequency between 20 and 40 KHz from an input frequency of 60Hz.

b. Ballast package:

1) Size: The ballast case shall be sized to be physically interchangeable with standard core and coil ballasts and suitable for standard mounting in new or existing lighting fixtures.

2) Case marking: Mark the ballast to indicate the required supply voltage, frequency, RMS current, current surge during starting, input watts, and power factor at the design center voltage, open circuit voltage, crest factor and efficacy.

c. Performance:

1) Light output:

a) At the design voltage, the light output shall be at least equal to that obtained by a core-and coil ballasted system meeting ANSI and CBM standards. The comparison test shall be measured in the same fixture at 25 degrees C (plus or minus one degree) ambient room temperature.

b) Tests shall be made in fixtures designed only for the number of lamps being tested.

c) For other applications (higher ambients, etc.) the tests should be operated with equivalent lamp wall temperatures plus or minus 4 degrees C.

2) Efficacy: The efficacy of the high-frequency, electronically ballasted system shall be at least 15 percent greater than the equivalent CBM core-and-coil ballasted system (see "Light output" above).

3) Starting: The ballast shall be capable of starting the specified lamps at an ambient temperature of 50 degree F or more for an input voltage of plus or minus 10 percent about the center design voltage. The ballast shall never be started in the instant start mode at any temperature. Provide 0· ballasts where indicated on the drawings.

4) Operation:

a) The ballast shall safely and reliably operate in a room ambient temperature from 50 degree F to 105 degree F.

b) The light output shall not vary by more than plus or minus 15 percent for a plus or minus 10 percent variation of the input voltage about the center design voltage.

c) The ballast shall operate the lamps in a manner that will not adversely curtail the normal life of the lamp.

5) Surge withstand capability: The ballast shall be able to withstand a single input surge of 6,000 volts from a 50 ohm 50 KHz damped sinewave source.

6) Flicker: The flicker shall be less than 5 percent.

7) Noise: The audible noise levels should be equivalent to the Class A rating of CBM certified ballasts.

8) Electromagnetic interference (EMI): The EMI, conducted and radiated, shall meet the Federal Communication Commission's Part 18 Subsection H.

9) Rated life: The ballast shall have a rated life of 10 years or 30,000 hours (based on a 10 hour day).

10) Rated No. of Lamps: For 3 and 4 lamp fixtures, use 3 and 4 lamp ballasts wherever possible.

11) Power factor: Not less than 90 percent.

d. Reliability:

1) Labels: Ballasts must be labeled or listed by UL or ETL.

2) Submit, simultaneously with shop drawings, a certified test report by an independent testing laboratory showing that the electronic ballasts meet or exceed all the performance requirements in this specification.

J. Ballasts for High Intensity Discharge Fixtures:

1. Shall have individual overcurrent protection sized in accordance with the manufacturer's recommendations.

2. Shall have integral thermal protection where the fixture is recessed in an interior ceiling.

3. Shall be the constant wattage, high power factor type or the reactor high power factor type. Capacitors shall not contain PCB (Polychlorinated Biphenyl) fluids or other fluids recognized as hazardous when discharged into the environment.

4. Shall have not less than B sound ratings for interior fixtures, when available. Ballasts which are not available with B ratings shall be of the highest available rating.

K. Provide all lighting fixtures with a specific means for grounding their metallic wireways and housings to an equipment grounding conductor.

L. Lighting Transmitting Components for Fluorescent Fixtures:

1. Shall be 100 percent virgin acrylic plastic and nominal .125 inch thick. Styrene lenses shall not be provided for any fixture.

2. Unless otherwise specified lenses and diffusers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction of the lens without distortion or cracking. At final inspection, all lens that sag or do not lay down flat and lens that sag shall be replaced by the manufacturer.

2.2 LAMPS:

A. Fluorescent Lamps:

1. Except as indicated below or on the drawings, standard lamps shall be T8 or T12 as specified on the drawings; by Sylvania, General Electric or Phillips; having a color temperature 3500 degrees Kelvin as specified on the drawings, a color rendering index (CRI) not less than 69 and an initial lumen output not less than 2900. Type F "U" tube lamps shall have the same color temperature and CRI limits as the above.

B. High Intensity Discharge Lamps:

1. In all cases, provide lamps that are approved by and designed for by the fixture manufacturer. Typically lamps for interior down lights shall be coated, those for exterior and industrial fixtures shall be clear.

2. Metal halide lamps for interior use shall be Metalarc/c coated. Metal halide lamps for exterior use shall be clear.

3. High pressure sodium lamps shall be as defined on the drawings.

C. Incandescent lamps shall be the general service, inside frosted type rated 125 volts except where otherwise shown on the drawings.

2.3 LIGHTING CONTROL EQUIPMENT:

A. See the drawings for the arrangement and method of control. Controls shall operate at 120 volt. Connect to the nearest 120 volt panel or as shown on the drawings.

B. Contactors And Relays:

1. Shall be as manufactured by Cutler-Hammer, Allen Bradley, G.E., Westinghouse or Square 'D'. They shall be as sized on the drawings.

2 All contactors and relays shall be Tungsten rated.

C. Time Switches:

1. Time switches by Tork, Intermatic, and Paragon equal to those listed on the drawings or indicated below and approved by the engineer will be acceptable.

2. Exterior lighting or interior time switches shall be Paragon EC 7000 Series 7 day 20A., SPDT.

3. All time switches shall be provided with momentary contacts if required.

4. All time switches shall be provided with manual bypass switches and spring wound carry over mechanisms.

5. Astronomical time clocks shall be used in all cases when a photo cell is not used and exterior lights or lights in a skylight are controlled. Equal to Intermatic #V45471CR.

D. Photo Electric Controls:

1. Photo Electric Controls by Tork, Intermatic and Paragon equal to those indicated below and approved by the engineer will be acceptable.

2. Photo Electric Controls (Photo switches; Photo cells) shall be Intermatic #K4133 rated at 3000W, 277 volts, or #K4121 rated at 1800W, 120 volts, weatherproof. Mount on roof and orient photo electric controls to the north. Photo-electric controls supplied as a part of a fixture assembly shall be as provided by fixture manufacturer.

E. When a photo cell and time clock are specified for combination control, they shall be connected in series. The time clock to be on during the day, the photo cell will turn the lights on during the day if a storm passes over and at dusk. Set the time clock to turn the lights off in the evening and back on before sunrise per the Governments requirements. At sunrise, the photo cell will turn the light off.

2.4 EMERGENCY LIGHTING AND POWER:

A. When emergency battery power packs are optional to the specified exit signs and emergency fixtures and are not included in the model number in the light fixture schedule, the emergency battery power packs shall be included as part of the specified fixture when they are not connected to an emergency generator system. Verify on drawings.

B. Emergency operation of fluorescent fixtures:

1. Fluorescent fixtures shown in the fixture schedule or lighting plans as an emergency fixture shall be supplied with a factory installed sealed replaceable nickel cadmium battery and a solid state inverter charger and switch systems.

2. Other lamps not on emergency system in same fixture will be switched with area lights. Lamp sockets in emergency fluorescent fixtures shall be in the exact same position as lamp sockets in non-emergency fixtures of the same type and number of lamps. All components shall be contained within the fixture. The emergency battery system shall operate two lamp (1100 lumen minimum) for a minimum of 90 minutes. Battery charger shall be capable of recharging batteries to full charge within 24 hours after complete discharge. Fixture shall contain pilot light to indicate charger condition and a test switch to simulate power failure. Systems shall be unconditionally guaranteed for three (3) years by the factory. Unit to be Underwriters Laboratory listed and labeled as an emergency unit. Units shall be manufactured by Bodine, Universal or approved by engineer.

C. Exit Signs And Other Emergency Fixtures:

1. Provide emergency battery power packs on all exit signs and emergency fixtures that are not connected to an emergency generator.

2. Batteries shall be lead calcium, pure lead, or nickel cadmium. Lead acid will not be accepted. Batteries shall be unconditionally guaranteed for 5 years with a 10 year prorated warranty from the factory. Units shall be Underwriter's Laboratory listed an labeled as an emergency unit. Batteries shall be provided as standard or as optional equipment of the same series of the specified fixtures.

3. The emergency Battery Section shall be connected on the same circuit as the light ahead of any switches or contactors controlling area lights so that emergency lighting is maintained at all times.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with the NEC, and as shown on the drawings.

B. Align, mount and level the lighting fixtures uniformly.

C. Avoid interference with and provide clearance for equipment. Where the indicated locations for the lighting fixtures conflict with the locations for equipment, change the locations for the lighting fixtures by the minimum distances necessary as approved by the engineer.

D. For suspended lighting fixtures, the mounting heights shall provide the clearances between the bottoms of the fixtures and the finished floors as shown on the drawings. Verify all heights with the architect prior to mounting.

E. Lighting Fixture Supports:

1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.

2. Shall maintain the fixture positions after cleaning and relamping.

3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.

4. Hardware for recessed fluorescent fixtures:

a. Where the suspended ceiling system is supported at the four corners of the fixture opening, hardware devices shall clamp the fixture to the ceiling system structural members, or plaster frame at not less than four points in such a manner as to resist spreading of the support members and safely lock the fixture into the ceiling system.

b. Where the suspended ceiling system is not supported at the four corners of the fixture opening, hardware devices shall independently support the fixture from the building structure at four points.

c. In all cases, four NEC approved clips shall be installed to firmly attach the fixture to the ceiling.

5. Hardware for surface mounting fluorescent fixtures to suspended ceilings:

a. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 1/4-inch secured to channel members attached to and spanning the tops of the ceiling structural grid members. Nonturning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.

b. In addition to being secured to any required outlet box, fixtures shall be bolted to a plaster ceiling at four points spaced near the corners of each fixture. Prepositioned 1/4-inch studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 1/4-inch toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.

F. Provide and install new lamps for each new lighting fixture installed and for each existing lighting fixture reinstalled.

G. Contractor shall coordinate between the electrical and ceiling trades to ascertain approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed. Lay-in type fixture installed in sheet rock ceilings shall be provided with a flange and bolted to the ceiling.

H. Connection to all fixtures mounted in lay-in ceilings shall be as follows: Provide J-Box supported from structure at 12" above fixtures for connections. Install UL listed 1/2" flexible conduit whip down to each fixture. Each whip shall be field cut to length to allow fixture to be relocated 4'-0" in any direction. Whips shall include 2 or 3 #12 Cu. THHN/THWN conductors (numbers as indicated) and a #12 ground. Fixtures supplied with UL listed whip shall be supplied with ground conductors. Tandem fluorescent fixtures shall have a factory supplied UL listed whip with conductors as required to interconnect fixtures. Length shall allow mounting fixtures 12'-0" on center in any direction.

END OF SECTION 16510

SECTION 16741- SITE TELECOMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: Extent of telephone system work is indicated by drawings and details, and is hereby defined to include, but not by way of limitation, telephone wiring/cabling, terminals, connecting blocks, data wiring/cabling, telephone/data outlets and other associated equipment and hardware.

B. Related Sections: Refer to other Division 16 sections for the following:

1. Basic Methods and Requirements - Section 16050

2. Fire Stop - Section 16110-3B & C

3. Underground Electrical Construction - Section 16119

C. Provide submittals on all products specified with this section.

1.2. QUALITY ASSURANCE

A. Installers Qualifications: Firms with at least 5 years successful installation experience with projects utilizing telephone and data systems and wiring similar to that required for this project. To ensure data distribution system is Category 5 certified, installer must be a Building Industry Consulting Service International (BICSI) member.

B. Codes and Standards:

The standards, specifications and codes listed are the basis of the state Premise Distribution System standards and shall be used to provide base guidelines for this project. Any applicable code, guideline or specification that requires a higher degree of safety or performance shall take precedence over a more lenient requirement whether stated here or not.

Conform to the following:

1. National Electrical Code (NEC): comply with applicable local code requirements of the authority having jurisdiction and NEC, including 725, 770, 800, 820 and OFNR Series articles as applicable to installation and construction of telephone and data systems.

2. Federal Communications Commission (FCC): Comply with part 68 and Subpart J of part 15, Federal Communications Commission Rules, pertaining to telephone equipment and Class A computer registration by manufacturer.

3. Institute of Electrical and Electronics Engineers (IEEE): Comply with Std 241 and 802, IEEE Recommended Practice for electric Power Systems in Commercial Buildings: pertaining to communication systems and Local Area Networks.

4. National Electrical Manufacturers Association (NEMA): Comply with NEMA's Pub No. 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)."

5. Rural Electrification Administration (REA): Comply with Rural Electrification Administration specifications pertaining to construction and installation of telephone cabling.

6. Electronic Industries Association (EIA): Comply with EIA Standards RS-453, 455, 464 and EIA/TIA (Telecommunications Industries Association) Standards 568, 569, 570, 606, 607 and Technical Systems Bulletin 36,40, and 53 of the Commercial Building Telecommunication Wiring Standards pertaining to categorizing and installation of telephone and data systems.

7. Underwriters Laboratories (UL): Comply with, specifically, subjects 444 and 13 (STP) as referenced UL ratings and/or classifications as mentioned in the above standards.

8. Building Industry Consulting Service International (BICSI): Comply with telecommunication industry's recognized standards as published in the Telecommunications Distribution Methods Manual pertaining to the installation practice of voice and data systems.

9. OSHA

1.3. DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver telephone equipment and components in factory-fabricated containers or wrappings, which properly protect equipment from damage.

B. Storage: Store telephone equipment and components in original packaging. Store inside in a well-ventilated space protected from weather, moisture, soiling, humidity, and extreme temperatures.

C. Handling Handle telephone equipment and components carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new.

1.4. COORDINATING AND SEQUENCING

A. Coordinating: Coordinate with other electrical work and mechanical work to include wires/cables, electrical boxes and fittings, duct work, and raceways, to properly interface installation of telephone system with other work.

B. Sequencing: Sequence installation of telephone system with other work to minimize possibility of damage and soiling during remainder of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Telephone/Data/Video Cable and Cable Connectors: Provide copper Telephone/Data/Video cable, and cable connectors, except where video coaxial and Fiber is specified, in sizes and types indicated, and as recommended by telephone equipment manufacturer for indicated safety and applications. Mate and match connector materials to factory-installed equipment connectors.

1. Cable (Horizontal-Underground):

a. <u>VOICE</u> Telephone Exchange Cable. Solid, annealed, 24 or 26 AWG solid copper conductors. Polyethylene or polypropylene conductor insulation color coded to telephone industry standards. Insulated conductors are twisted into pairs of varying lengths of lay to minimize cross-talk. Pairs are stranded into units and the resultant cable core is covered with a non-hygroscopic tape.

The cable sheath consists of a 0.008 inch corrugated, co-polymer coated aluminum shield and a black polyethylene jacket. The jacket is sequentially printed wth a footage marker at regualr intervals. Meets or exceeds the EIA/TIA 568 Commercial Building Wiring Standard.

b. LAN/DATA (Fiber Optic) Composite Non-Metalic Fiber Optic Campus Backbone Cable has a core consisting of multimode 62.5/125μm fibers and singlemode 9.3/125μm fibers. Fiber count as shown in following paragraphs per location. The fibers are separated into color-coded binder groups surrounded by polyethylene core tube. The core is covered by a nonmetallic crossply sheath that consists of fiberglass strength strands embedded in polyethylene. It must also comply with Bellcore, FDDI, EIA/TIA-568, and ICEA standards. Length as specified in drawings. Install each in 1, 1" interduct from termination point to termination point in buildings and pedestal. Continuous, length as required.

2. Cable (Horizontal-Indoor): Telephone & Data

a. VOICE AT&T Category 3 telephone plenum cable. (4) twisted pairs of 24 gauge bare solid copper conductors insulated with ECTFE and twisted into pairs. The twisted pairs are assembled into a core and jacketed with WHITE plenum ECTFE. Underwriters Laboratories Listed Type MMP/CMP. Continuous, length as required. (AT&T Product Code 2010 004 AWH or equivalent with submital approval).

b. LAN/DATA AT&T Category 5 data plenum cable. 100 Ohm high performance cables composed of (4) twisted pairs of 24 gauge bare solid copper conductors insulated with Teflon and twisted into pairs. The twisted pairs are assembled into a core and jacketed with BLUE flouropolymer. This cable to conform to the requirements specified in ICEA publication S-80 (Revision 10) - 576 that are applicable to pair inside wiring cable for plenum within a building. Underwriters Laboratories Listed Type CMP. Continuous, length as required..(AT&T Product Code 2061 004 ABL or equivalent with submittal approval).

3. Terminal Blocks:

a. VOICE T 66 Block Connector System.

(1) S66M Series Connecting Blocks: These are quick connect blocks used for field termination and interconnection made of a molded, self-extinguishing plastic block containing phosphor bronze tin-plated quick clips for making connections. 50 pair size recommended with two-prong clips used. RED clips for data if needed. These Blocks can be mounted on S89D Stand-Off brackets. (Siemon Company Part # S66M1-50 or equivalent with submittal approval)

(2) Connecting Wires: CCW-F Hook-Up Wire to have solid annealed copper conductors individually insulated with PVC. The insulation is to be marked at regular intervals with additional code for color (White-Blue, Blue-White). CCW-F Hook-UP Wire is 24 AWG. containing 1 twisted pair. DC Resistance: 52 ohms/1000 feet. Mutual Capacitance: 0.015μF/1000 feet (maximum). Continuous length of cable as specified in details - must be long enough to reach the two farthest points of connecting blocks being connected plus an additional 12 inches on each end. This cable is to meet or exceed Category 3 requirements. (AT&T Product Code CCW-F 1/24 or equivalent with submittal approval)

b. DATA - Fiber : The Siecor Fiber Distribution Cabinet - Wall mountable. 24 fiber capacity minimum. Panels for splicing and cross-connect are required. Submittal required for approval.

(1) ST Connectors (Multimode & SingleMode) Loss: μ = 0.5dB, σ = 0.3dB. Complete connection, concatenated statistics. 62.5/125 fiber for multimode and 9.3/125 for singlemode, 0.29 numeric aperture, ovality and concentricity equivalent to 1860A (AT&T) Cable. Dry connection. Fiber OD, nominal: 125 μm. Cable OD, nominal: 2.4 and 3.0 mm. Loss Repeat < 0.2dB per 200 reconnects. Materials: Tip, cap, and body - reinforced engineering plastic. Vendor Submittal required for approval.

c. DATA - Copper: AT&T 110 Patch Panel System Terminal Blocks (Category 5). Must exceed the Category 5 requirements specified in EIA/TIA TSB_40. Made up of prewired 50-pair sizes and consist of 110 Wiring Blocks with direct field termination of building cables and special horizontal and vertical jumper troughs for arranging patch cords. Wiring Blocks and troughs are mounted on a metal back panel that has an express trough at the bottom.. (At&T or equivalent with submittal approval)

(1) Patch Cords: 110 Patch Cords. All cords manufactured with AT&T data grade 1064 cordage. The round 1064 cordage consists of 4 pair 24 gauge tinned copper, stranded conductors insulated with high density polyethylene. The insulated conductors are tightly twisted into individual pairs and jacketed with BLUE flame retardant PVC. Must meet EIA/TIA TSB-36 Category 5 transmission requirements. Lengths shall be 9 feet. Provide and install quantity of 1600. (At&T or equivalent with submittal approval)

4. Outlets to consist of the following:

a. Each jack shall be configured to accommodate up to two ports. If less that two ports are installed there shall be blanks or covers to install in the face plate. The finished design shall not allow openings in the face plate. The jack and two ports shall be sized to fit in a singe gang box. one of the ports shall be category three, RJ-11, 6-pin, 110 style termination, or equivalent. One of the ports shall be category 5, RJ-45, 8-pin, 110 style termination. There shall be colored tabs or bezels with Icons or language that state or indicate DATA, or VOICE. Face plates shall be ivory or beige colored.

(1) VOICE/DATA/LAN Connector: modular information outlet. Requiring one modular 6-position/6-conductor jacks and one modular 8-position/8-conductor jack. Insulation displacement adapters used. Must have one voice jack, label "VOICE", non keyed and, one LAN category 5 jack labeled "DATA". The wire insertion caps supplied shall be used to install the horizontal wire and should be left in place to provide protection from contamination and to secure the wire connections per Category 5 requirements for the LAN jack. (AT&T Product Code M11CH1 or equivalent with submittal approval)

(2) Face Plate: DUPLEX face plate (AT&T Product Code M12A or equivalent with submittal approval).

(3) VIDEO/Coaxial Wall Outlet: Smooth Finnish F-connector wall plates with one F-connector for use with RG6 Coaxial for CATV or other video applications. Quantity as needed. (AT&T COMCODE 105 414 783 or equivalent with submittal approval)

5. Telephone Accessories:

a. Backboards: Supply and install in telephone closets shall be 3/4"x 8' x 4' plywood painted with 2 coats of high fire resistant, non conductive white paint.. Verify exact location with Engineer.

b. Closures: Inline Splice Closure to consist of two reinforced plastic covers that fit over the cable end plates and are held together by snap-catch fasteners and reusable rubber seals. An alignment bar, sheath retension clamps, sealing washers, sealing tape and a bonding and grounding system to be included. Must pass both vertical and horizontal tests for flammability as specified in PUB 55006. Cylinder size and endplate types as required to terminate incoming service cable. Splice Closure provided in new Allied Health Science Building in earlier telecom phase. AT&T 2000 Series (Indoor) or equivalent with submittal approval.

c. Protector Panel: AT&T 188 Multipair Building Entrance Protector Panel to provide service protection to 100 incoming service pairs per unit. Over-voltage and sneak current protection is mandatory. Will serve as a terminating field, consists of a metal housing containing mountings for 3B Gas Protector Units (AT&T Product Code 3B1-EW) One each per incoming service pair. The

input option is a 25 foot long, 26 AWG swivel cable stub with top or bottom feeds available and used as per indicated on drawings. Output option to include 66-Type connecting block. (AT&T Product Code 188B1-100 or equivalent with submittal approval)

(1). Protector Unit, 3B-EW Series Individual. A wide-gap gas-tube arrestor to provide over voltage protection for each incoming service pair. Unit to be molded of glass-reinforced, high heat distortion plastic. Line pins are to be gold plated and ground pins are to be solder plated. Two colors for circuit application; black for standard service and green for circuit not presently in use.
DC breakdown Voltage (at 2kV/sec): 265-424V.
Surge breakdown Voltage (at 100V/μsec):200-800V.
Insulation Resistance (PE-80): 100Mohms
DC Holdover Current (ANSI C62.31): 150V
Vented Breakdown Voltage(surpasses UL requirements):<1000V
DC Arc Voltage: 20 V
Glow-to-Arc Transition Current (ANSI C62.31): 0.5 A
Capacitance (PE-80): < 10 pF
AC Discharge (pe-80): > 65 A (11 cycles at 60 Hz)
Max. Impulse Discharge (PE-80):20kA (8 x 20μsec wave form)

6. Cable Supports: All cables above ceilings (Data, Voice & VIDEO) are to be supported by "D" Rings and/or J-Hooks.

a. J-Hooks: J-Hooks are to be steel with insulation material covering the hook and supported from structure above. J-Hook must be sized to support all cable plus 15% room for additional cable in the future.

b. "D" Rings: "D" rings are to be provided to support all voice and data cables in telephone communications rooms, 6" maximum centers with distribution rings Numbers 13A,B, and C. Size as required to support all cable plus 15% room for additional cable in the future.

c. Tie-Wraps: Thomas & Betts, TY-RAPS© brand. Will be plastic, heavy duty, and flame retardant (Must meet UL 94V-O flammability rating). Size as required. (Thomas & Betts Bulk Pkg. Cat. Number TY28MFR)

d. Cable Labels: A quality grade general purpose vinyl-impregnated waterproof tape. Resistant to moderate amounts of oil, dirt, and temperature ranges from -30°F to 200°F. (Thomas & Betts, E-Z-Code© WBC vinyl cloth, standard Cat. No. WM-A-Z)

7. Tightening: Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturers' torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A and B, and the National Electrical Code.

2.2 GROUNDING

A. Provide for the installation of a common telecommunications ground that will extend form the building ground to the telecommunications spaces including the MDF. The contractor shall ensure that all aspects of telecommunications installations are ground in accordance with the NEC and EIA/TIA specifications.

1. Provide #6 CU. equipment grounding connections for Data/Voice Wiring Blocks, patch panels, racks, metal troughs, protectors, etc. to grounding bus. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding. Horizontal cabling shall be grounded in compliance with ANSI/NFPA 70 requirements and practices, except where superseded by other authorities or codes. In addition to horizontal cables, these grounding requirements apply to all cross-connect frames, patch panel racks, active telecommunications equipment and test apparatus used for maintenance and testing.

2.3 ADJUSTING AND CLEANING

A. Cleaning: Clean telephone equipment and components of dirt and construction debris upon completion of installation.

B. Touch-up: Touch-up scratched or marred enclosure surfaces to match original finishes.

C. Protection: Protect installed equipment and components from damage during remainder of construction period.

2.4. DEMONSTRATION / TESTING

A. Minimum testing requirements for UTP is divided into the following conditions, keeping in mind that Attenuation and NEXT are the two most important factors and must be strictly adhered to by the installer. Record all tests and test results for all items specifically documenting the item tested and submit for engineers review.:

1. Open/Short Test.

2. Polarity Test (reversals).

3. Pair transpositions (crosses).

4. DC loop resistance test: Loop resistance can be tested with a multimeter. Will be used to confirm distance as well as continuity. The DC resistance of all categories for this installation is 28.6 ohms per 1000 feet.

5. Time Domain Reflectometer (TDR) test:..TDR is to be used to give the exact length where an impedance discontinuity is encountered (i.e., open circuit, short circuit, bridge tap, mismatch, etc.).

6. Attenuation/crosstalk analyzer test:

(a) Attenuation for the horizontal UTP cables, with maximum attenuation in dB per 305m (1000 feet) at 20°C.

(1) Voice cable at 1.0 MHz must have a maximum attenuation <= (less than or equal to) 6.25 dB.(25 pair) per 305m (1000 feet) at 20°C.

(2) VIDEO/Coaxial cable at 100.0 MHz must have a maximum attenuation <= (less than or equal to) 3.16 dB per 100 feet. at 20° C.

B. Testing of fiber is mandatory and recommended to be performed with an HP-8140A Optic Loss Test Set or equivalent. The light loss on each fiber tested from end to end through port to port at both 850nm and 1300 nm shall not exceed 2.0 dB per fiber path.

C. General: Upon completion of installation of telephone and Data systems, and after telephone/data wire circuitry has been energized, demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with

new units, and proceed with testing. Demonstrate to Government that requirements for basic output signal levels, and values for attenuation and signal-to-noise rations, have been achieved. Compliance is to recorded in written form and given to Government prior to considering job complete.

1. Equipment such as patch panels and information outlets shall be tested with no failures or replaced.

2. Each horizontal or station wire shall have each pair pass testing or be replaced.

3. Each copper cable shall not have more than one pair per hundred that is unrepairable or it shall be replaced.

PART 3 - EXECUTION

3.1 PROJECT OVERVIEW – Not used.

3.2 EXAMINATION

A. General: Examination areas and Conditions under which telephone systems are to be installed. Notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.3 INSTALLATION OF TELEPHONE / DATA SYSTEMS

A. Installation: Install systems as indicated, in accordance with manufacturer's written instructions and with recognized industry practices (BICSI); ensure systems comply with installation and operational requirements of EIA/TIA, NEC and the Federal Communications Commission.

B. Cable Labels: The specified labels will be placed at both ends of all horizontal cables (voice, data, and video) at no farther than 2 feet from the termination point unless visibility or access determines the label be placed at the closest visible point to the termination contact. Labeling system to be used as specified in plans and drawings. Labels are not to be placed under bracing points such as D rings or cable ties.

C. Labeling of the Premisis Distribution System Elements: Contractor shall be responsible for providing any labeling or identification of the feeder cables and demark and the Main Distribution Frame.

1. The contractor shall label the riser cables and pairs. In addition, the feeder cables shall be tagged at both ends near the termination points and the pair count shall be marked on the wire blocks with indelible ink or equivalent.

2. In the main distribution frame, and the telecommunication jacks the cable pairs shall be laid down on the blocks according to standard telephone industry color code starting with pair one on the blocks. The blocks shall also be labeled with cable and pair counts.

3.5 INSTALLATION OF J-HOOKS

A. Provide J-Hook supports from the structure above for all horizontal runs except where cables are run in cable trays. Spacing shall be a maximum of 4 feet 0 inches. Cables shall be located just above the ceiling. Cable shall not hot contact the ceilings, piping, light fixtures, ducts, etc. All cables must be suspended independently.

3.6 INSTALLATION OF TIE-WRAPS

A. Tie-Wrap all cables (except patch cords) together between the J-Hooks, in the cable trays, and in the communications rooms. Spacing shall be a maximum of 4 feet 0 inches. No tie-wraps shall be placed over cable labels. The Tie-wraps shall be plastic, heavy duty, and flame retardant.

3.7 INTERIOR WALL PENETRATIONS

A. When cables pass through walls, install 2 inch conduit sleeve through wall with bushed ends at both sides of wall. Provide fire barrier around conduit and seal conduit with fire barrier after cable installation. Seal cable tray penetrations through walls with fire barrier after cable installation.

3.8 DATA CONNECTOR TERMINATION PRACTICES

A. For Category 5 (Data) Cables; minimize the amount of untwisting in a pair as a result of connecting to hardware for all terminations. For Category 5 cabling the amount of untwisting must not exceed the requirements for TIA/EIA TSB-40 (no greater than 13mm [0.5 inches])

3.9 DOCUMENTATION / RECORDS

A. The Contractor shall provide, to client, two complete sets of as built blue prints upon completion of the project to show all PDS facilities. All cable and fiber routes, cable and fiber lengths, splices, cross connects, terminations and pair counts shall be documented on the prints as well as location of the MDF and telecommunications spaces and telecommunication cable routes on each floor. Computer CAD drawing files of the telecommunications drawings are available from the bid package. Verify associated costs prior to bidding

END OF SECTION 16741