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DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION SPECIFICATION

AUTOMATION WING BUILDING
SIZE 100 CONSTRUCTION, FOR ARTCC'S

Information Handling Services, 1999
August 12, 1999 05:44:57

9003329 0131639 646

TABLE OF CONTENTS

(By Sections)

Division 1 - General Requirements

Section 1A	Special Conditions
Section 1B	Samples, Tests, Reports
Section 1C	Temporary Facilities Protection and Clean Up
Section 1D	Summary of the Work

Division 2 - Sitework

Section 2A	Site Preparation
Section 2B	Excavating, Filling, Backfilling and Grading
Section 2C	Demolition
Section 2D	Paving (Bituminous)
Section 2E	Paving (Concrete)
Section 2F	Topsoil, Sodding, Seeding and Planting

Division 3 - Concrete

Section 3A	Poured in Place Concrete
Section 3B	Precast Concrete Units

Division 4 - Masonry

Section 4A	Brickwork and Concrete Masonry Work
Section 4B	Mortar
Section 4C	Structural Facing Tile

Information Handling Services, 1999
August 12, 1999 05:44:57

9003329 0131640 368

TABLE OF CONTENTS

Division 5 - Metals

Section 5A	Structural Steel
Section 5B	Miscellaneous Metal
Section 5C	Steel Decking
Section 5D	Not Required
Section 5E	Protected Metal Siding

Division 6 - Carpentry and Millwork

Section 6A	Rough Carpentry
Section 6B	Finish Carpentry
Section 6C	Millwork

Division 7 - Moisture Protection

Section 7A	Dampproofing Foundation
Section 7B	Caulking
Section 7C	Thermal Insulation (Roof)
Section 7D	Dampproofing Floor Slabs on Grade
Section 7E	Neoprene-Hypalon Roof Coating
Section 7F	Sheet Metal
Section 7G	Thermal Insulation (Other than Roof)

Division 8 - Doors, Windows and Glass

Section 8A	Hollow Metal Frames

Information Handling Services, 1999
August 12, 1999 05:44:57

TABLE OF CONTENTS

Section 8B Hollow Metal Doors

Section 8C Wood Doors

Section 8D Glass and Glazing

Division 9 - Finishes

Section 9A Lathing, Plastering, Furring, etc.

Section 9B Not Required

Section 9C Resilient Tile and Base

Section 9D Ceramic Tile

Section 9E Suspended Acoustic Tile Ceiling

Section 9F Painting of Structures

Division 10 - Specialities

Section 10A Finish Hardware

Section 10B Metal Toilet Compartments

Section 10C Not Required

Section 10D Not Required

Section 10E Movable Partitions

Section 10F Not Required

Section 10G Not Required

Section 10H Telephone Booth

Section 10I Toilet Room Accessories

Section 10J Folding Partitions (Vinyl Finish)

Information Handling Services, 1999
August 12, 1999 05:44:57

TABLE OF CONTENTS

Division 11 - Equipment

Section 11A Not Required

Section 11B Not Required

Section 11C Not Required

Section 11D Chalkboard Unit

Division 12 - Special Construction

Section 12A Folding Partition

Section 12B Raised Floor

Section 12C Not Required

Section 12D Acoustic Metal Panels

Section 12E Fireproofing

Section 12F Lead Protective Shielding

Section 12G Acoustic Wall Treatment

Section 12H Cork Wall Covering

Division 13 - Furnishings

Section 13A Carpeting

Division 14 - NOT REQUIRED

Division 15 - Mechanical

Section 15A General Requirements for Mechanical and Electrical Work

Section 15B Plumbing

Section 15C Heating, Ventilating, Air Conditioning

Division 16 - Electrical

Section 16A Electric Wiring and Lighting

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 1 GENERAL REQUIREMENTS

SECTION 1A

SPECIAL CONDITIONS

1-A.1 GENERAL The work to be done hereunder includes the furnishings of all plant, labor, equipment and materials and in performing all work required for the construction at the location stated in the Contract Schedule on the drawings, and the applicable Details on the drawings and as specified herein.

1-A.2 SITE Any special conditions that pertain to the specific site for which this specification is used will be provided in the form of an addendum or an appendix to this Specification.

1-A.3 LANDSCAPING New landscaping and planting of trees and shrubs will be done under separate contract. Relocation of existing shrubs and trees shall be performed under this specification.

1-A.4 MODIFICATION ON STANDARD DETAILS All articles, materials and equipment shall be furnished and installed by the Contractor, unless specific exception is made in these Specifications. This provision does not apply to any articles, materials and equipment that are noted to be furnished and installed by the Government, or under a separate contract.

1-A.5 SHOP DRAWINGS

(a) General Shop drawings shall be submitted where called for in this Specification.

(b) Submittal The Contractor shall submit to the Resident -Engineer or to the Government Representative as defined in the Contract, for approval, one reproducible drawing and one print thereof for all required shop drawings. The drawings shall contain all required and detailed information.

If drawings are approved, copies so identified will be returned to the Contractor. If drawings are not approved or approved in part only, the Contractor shall make any correction or corrections required and re-submit if requested to do so. Two prints will be returned to the Contractor.

Information Handling Services, 1999
August 12, 1999 05:44:57

The Contractor shall be responsible for dimensions and design of adequate connections and details, and the satisfactory assembly of all work. Shop drawings also include, but are not limited to, setting drawings and bills of material.

1-A.6 FEDERAL SPECIFICATIONS All statements in this Specification that Federal Specifications are available through the Federal Aviation Administration are hereby rescinded. Federal Specifications may be obtained from the Superintendent of Documents, Washington, D.C. or from sources indicated in the Contract Schedule.

CONTRACTING OFFICER Where reference is made in this Specification to "Architect", "Federal Aviation Administration", "Government", "Government Representative", "Construction Engineer", "Resident Engineer" or the like, this shall mean the Contracting Officer or his authorized representative.

1-A.7 SAMPLES AND CERTIFICATE

(a) See Division 1, Section 1B of the specifications.

1-A.8 GUARANTEE OF WORK

(a) All references to a guarantee in this Specification shall be modified to mean, in all cases, a manufacturer's guarantee against defective material design or workmanship for the period stated. The guarantee shall apply to (1) component parts of equipment or of a meterial assembly or (2) the entire item of equipment or the material assembly where such has been furnished by the manufacturer. A guarantee document shall be furnished the Government prior to final acceptance of the work.

1-A.9 GENERAL CONTRACTOR

(a) Any references in this Specification to "Heating Contractor," "Electrical Contractor" or the like shall be understood in all cases to mean the Prime Contractor.

1-A.10 PROTECTIVE CONCRETE WALLS

(a) The 18-inch precast or cast-in-place protective concrete walls shall not be penetrated at any point other than where shown on the drawings, nor shall pipe, conduits, receptables, etc., be recessed into these walls.

Information Handling Services, 1999
August 12, 1999 05:44:57

1-A.11 INSTRUCTION MANUALS All instruction books or manuals required by this Specification shall contain sufficient information so that a reasonably well experienced mechanic or technician may be able to operate, repair and maintain the equipment with its use. They shall be delivered in sufficient time to permit a 30 day review period by the Government for completeness and adequacy before final acceptance of the work.

1-A.12 SECURITY

(a) The Contracting Officer may, at any time under this Contract, require a security investigation of Contractor personnel. When notified of such a requirement the Contractor shall complete for each employee having a requirement to visit/or work at the F.A.A. facility such security forms as are furnished by the Contracting Officer.

(b) Identification Badges shall be worn by all Contractor personnel and shall be visible at all times.

1-A.13 CONSTRUCTION LIMITS The Contractor in cooperation with the Resident Engineer shall define the construction limit lines and approach route to the site. Limit lines shall indicate boundries for storage areas, drives, temporary fencing and structures, walks and parking.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 1 GENERAL REQUIREMENTS

SECTION 1B

SAMPLES, TESTS AND REPORTS

1-B.1 PURPOSE

(a) General This section covers the requirement for furnishing samples, certificates of compliance tests, shop drawings, as-built drawings, manuals, utility survey, and related items to the Resident Engineer for testing, selection and approval.

1-B.2 SAMPLES

(a) Approval Samples, certificates, test reports, and shop drawings shall be submitted, prepared in ample time for proper action by the Resident Engineer before materials, which samples, certificates and reports represent, are delivered to the site. The maximum time necessary for Resident Engineer approval of samples, certificates, test reports, and shop drawings is 30 calendar days after receipt of them. All materials installed in the work shall match the approved submittals. After a submission by the Contractor has been approved, no substitution will be permitted without written approval by the Resident Engineer.

(b) Samples, Certificates, Test Reports and Shop Drawings Unless otherwise directed by the Resident Engineer, in writing, the Contractor shall submit samples in triplicate, or the number stated in the Sections in sufficient size and/or quantity as required to perform the tests called for. Each sample shall be accompanied by the manufacturer's certificate of compliance or certified test reports, in triplicate.

Each sample shall be properly labeled with name and quality of material, manufacturer's name and brand, name of project, Contractor's name and date of submission. Samples submitted are for Resident Engineer selection of color, texture, finishes and approval of the items proposed to be furnished for the work.

Information Handling Services, 1999
August 12, 1999 05:44:57

Drawings and schedules shall be checked and coordinated with the work of any other trade involved before they are submitted for approval, and shall bear the Contractor's stamp of approval as evidence of such checking and coordination. Drawings shall be complete, assembled in sets and shall bear:

(1) Date
(2) Number of drawing or revision
(3) Name of project or facility
(4) Name of Contractor and Subcontractor
(5) Clear identity of contents and location of work

(c) Submission Samples, certificates of compliance, tests, and test reports, shop drawings and performance data shall be submitted as follows:

Division 1 General Requirements

Section 1A Special Conditions

Shop Drawings	1-A.5
Instruction Manuals	1-A.12

Section 1D Summary of the Work

Activity Work Plan	1-D.9

Division 2 Sitework

Section 2B Excavating, Filling, Backfilling and Grading

Compaction Test Report	2-B.15

Section 2E Paving

Concrete Tests (when requested by the Resident Engineer)	2-E.9

Section 2F Topsoil, Sodding, Seeding and Planting

Certificate of Specification Compliance	2-F.1

Division 3 Concrete

Section 3A Poured In Place Concrete

Mill Test Reports	3-A.2
Test Reports on Concrete	3-A.5
Shop Drawings	3-A.7

Information Handling Services, 1999
August 12, 1999 05:44:57

Section 3B Pre-Cast Concrete Units

Shop Drawings	3-B.5

Division 4 Masonry

Section 4A Brickwork and Concrete Masonry Work

Text Report	4-A.2
Sample Panel	4-A.16

Division 5 Metals

Section 5A Structural Steel

Mill Test Reports	5-A.3
Shop Drawings	5-A.3
Equipment Schedule	5-A.17

Section 5B Miscellaneous Metal

Shop Drawings	5-B.3
Shop Drawings	5-B.4
Shop Drawings	5-B.5
Shop Drawings	5-B.6
Shop Drawings	5-B.7
Shop Drawings	5-B.9
Grating Sample	5-B.9
Shop Drawings	5-B.10
Grating Sample	5-B.10
Shop Drawings	5-B.11

Section 5C Steel Decking

Shop Drawings	5-C.4
Samples of Sheets	5-C.4
Certifications	5-C.4

Section 5D Protected Metal Siding

Shop Drawings	5-D.3
Test Reports	5-D.8
Certificate of Compliance	5-D.9

Division 6 Carpentry and Millwork

Section 6A Rough Carpentry

Certificate of Grade	6-A.7
Certificate of Compliance	6-A.14

Information Handling Services, 1999
August 12, 1999 05:44:57

Division 7 Moisture Protection

Section 7F Sheet Metal

Shop Drawings	7-F.7

Division 8 Doors, Windows and Glass

Section 8A Hollow Metal Frames

Shop Drawings	8-A.9
Sample Sections	8-A.10

Section 8B Hollow Metal Doors

Shop Drawings	8-B.7
Sample Section	8-B.8

Section 8C Wood Doors

Shop Drawings	8-C.3

Section 8D Glass and Glazing

Shop Drawings	8-D.6
Samples of Materials	8-D.6

Division 9 Finishes

Section 9A Lathing, Plastering and Furring

Applicable Documents	9-A.3
Certificate of Compliance	9-A.7(g)

Section 9C Resilient Tile and Base

Test Report	9-C.2(c)
Samples of Materials	9-C.5

Section 9D Ceramic Tile

Samples	9-D.10
Layout Plan	9-D.10

Section 9E Suspended Acoustical Tile Ceiling

Samples of Materials	9-E.5
Layout Plan	9-E.5

Information Handling Services, 1999
August 12, 1999 05:44:57

Section 9F Painting of Structures

Finish Schedule	9-F.3

Division 10 Specialties

Section 10A Finish Hardware

Sample of All Items	10-A.7

Section 10B Metal Toilet Compartments

Shop Drawings	10-B.3
Samples	10-B.4
Color Samples	10-B.4

Section 10E Movable Partitions

Shop Drawings	10-E.5
Sample of Parts	10-E.6

Section 10H Telephone Booth

Shop Drawings	10-H.3
Samples	10-H.4

Section 10I Toilet Room Accessories

Catalogue Sheets	10-I.4
Samples When Required	10-I.4

Section 10J Folding Partitions (Vinyl Finish)

Shop Drawings	10-J.7
Samples	10-J.8

Division 11 Equipment

Section 11D Chalkboard Units

Guarantee	11-D.7

Division 12 Special Construction

Section 12A Folding Partitions

Guarantee	12-A.4

Section 12D Acoustical Metal Panels

Samples of Material	12-D.2

Information Handling Services, 1999
August 12, 1999 05:44:57

Section 12E Fireproofing

Certification	12-E.10

Section 12G Acoustical Wall Treatment

Samples	12-G.5

Section 12H Cork Wall Covering

Samples	12-H.3

Division 13 Furnishings

Section 13A Carpeting

Division 15 General Requirements for Mechanical and Electrical Work

Section 15A

Identification Schedule	15-A.32
Guarantees	15-A.34
Certificates of Approval	15-A.6
Test Reports	15-A.27
Guarantees	15-A.34
Demolition Schedule	15-A.36
Utility Verification	15-B.3
Field Tests	15-B.22
Field Tests	15-B.25
Test Reports	15-B.27
Certificate of Compliance	15-C.26
Operation Manuals	15-C.47
Shop Drawings - Equipment Installation	
Catalogue Sheets - Equipment Accessories	

Division 16 Electrical

Section 16A Electrical Wiring and Lighting

Certification	16-A.18
Test Report	16-A.24
Test Report	16-A.32

1-B.4 AS-BUILT DRAWINGS, MAINTENANCE MANUALS, UTILITY SURVEYS

(a) As-Built Drawings During the progress of the work, the Contractor shall keep on file two complete and separate sets of Black line prints on which shall be accurately and promptly noted, as the work progresses, any changes, revisions or additions to the following:

Information Handling Services, 1999
August 12, 1999 05:44:57

(1) General Construction Work
(2) Mechanical Work
(3) Electrical Work

At the completion of the work, the Contractor shall submit two complete sets of "as-built" drawings to the Resident Engineer.

(b) Maintenance Manuals The Contractor shall prepare a maintenance manual which shall consist of a complete set of manufacturer's catalogues, instructions and other similar data including the necessary photographic cuts, diagrams, value charts, and the like covering all mechanical and manually operated devices and appliances furnished and/or installed in the building. This manual is intended to serve to instruct and assist the maintenance men in the care, operation maintenance and repair of all such devices.

The Contractor shall amend and update the Mechanical and Electrical Systems Description Manual to show actual operating conditions of the Mechanical and Electrical system as installed.

Bound copies of the above manuals in triplicate, shall be submitted to the Resident Engineer not later than one month prior to the scheduled completion date.

Each bound manual shall consist of a durable cover and one copy each of every item called for herein. The information and instruction materials bound in manual shall be new, clean and readily legible.

(c) Utilities Survey Upon completion of the contract, the Contractor shall furnish to the Resident Engineer an accurately dimensioned survey, showing the location and elevation of all utility lines (water, gas, electric, sewer, steam, etc.) including valves, connections and changes in direction, installed under the contract within the contract limits and outside the building walls.

Valves, connections, special fittings, etc. shall be denoted in the drawing by direct note or by a symbol recognized and approved for use by the applicable trade affected. Identification shall show type, size and function of each item.

The point where the utility lines emerge from the building shall be located from the building corners. The points where the utility lines leave the property shall be located from lot monuments. The survey shall be made to scale, as approved by the Resident Engineer and drawn with waterproof ink on tracing

Information Handling Services, 1999
August 12, 1999 05:44:57

cloth, or by other method approved by the Resident Engineer which will provide a permanent reproducible record.

1-B.5 PAYMENT OF TESTS

Cost of all tests required in these specifications will be paid by the Contractor.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 1 GENERAL REQUIREMENTS

SECTION 1C

TEMPORARY FACILITIES, PROTECTION, AND CLEAN UP

1-C.1 TEMPORARY TOILETS

(a) Requirements The Contractor shall provide adequate temporary accomodations, including water supply if required, for all persons employed on the work, and located where directed by the Resident Engineer. The accomodations furnished shall be proper enclosures and shall be maintained in proper, safe and sanitary condition in accordance with local codes and be suitably heated and lighted when required.

1-C.2 TEMPORARY WATER SUPPLY

(a) Source. The Contractor shall make his own arrangements for the use of water during the construction. Cost for use of water shall be borne by the Contractor.

(b) Distribution From the source of supply, the Contractor shall arrange for all temporary connections, including piping, fittings and all types of valves required. The Contractor shall provide all necessary hose, water barrels and similar equipment as required for use by the various trades.

1-C.3 TEMPORARY LIGHT AND POWER

(a) Source The Contractor shall arrange for, provide and maintain all temporary electric light and power as required throughout the work. He shall pay all costs for the installation of such temporary light and power.

(b) Distribution The Contractor shall provide all supply lines for light and power, extension outlets, extension cords, trailers, receptacles, bulbs, fuses, distribution panels and switches, and the other equipment required for safety and for proper execution of the work, and for inspection purposes.

Information Handling Services, 1999
August 12, 1999 05:44:57

1-C.4 TEMPORARY HEAT

(a) Requirements The Contractor shall provide sufficient temporary heat as follows:

(1) All necessary heat to protect all work, materials, and equipment against damage from dampness and cold.

(2) At all times during placing, setting and curing of concrete, to insure the heating of the spaces involved to not less than 55 degrees F.

(3) From the beginning of the application of expanded polystyrene insulation and/or plaster and during the setting and curing period, to produce a temperature in the spaces involved of not less than 55 degrees F.

(4) For a period of 10 days previous to the placing of interior finishes and until the completion of the building, to produce a temperature of not less than 70 degrees f.

(b) Heaters The Contractor may use smokeless unit heaters (Underwriters Factory Mutual and Fire Marshall approved) of type approved by the Resident Engineer until the structure is enclosed. Kerosene, fuel oil or coke burning salamanders shall not be permitted.

(c) Temporary Radiation System After the structure is enclosed, provide a complete temporary system of heat radiation approved by the Resident Engineer, to protect the enclosed structure from freezing and to expedite the construction work of all trades.

(d) Use of Permanent System The Contractor may use, with written permission of the Resident Engineer, the permanent heating system as necessary for the proper execution, protection and drying out of the work and shall maintain all apparatus in a condition acceptable to the Resident Engineer.

(e) Costs All costs in connection of heating, including equipment, installation, operation, attendance, fuel, electricity, etc., shall be paid for by the Contractor.

Information Handling Services, 1999
August 12, 1999 05:44:57

1-C.5 TEMPORARY HOISTS, CHUTES, DERRICKS, SCAFFOLDS, ETC.

(a) Requirements The Contractor shall furnish and maintain all equipment, such as temporary hoists, chutes, derricks, scaffolds, stairs, ramps, runways, ladders, and similar items required for the safe and proper execution of the work.

(b) Vertical Transportation No materials, rubbish, or debris shall be permitted to drop free, but shall be moved by the use of the materials hoist, chutes, or other methods approved by the Resident Engineer. Hoists, towers and chutes shall be erected so as to prevent damage, staining or marring of any permanent work.

1-C.6 CONSTRUCTION SIGNS

(a) Requirements The Contractor shall furnish and install a construction sign in accordance with the drawings, when required.

When a construction sign is required, it shall be erected at commencement of work and be located where directed by the Resident Engineer. The Contractor shall maintain construction sign in good condition throughout the construction period and shall remove it at the conclusion of his contract, or, when directed to do so.

1-C.7 PROTECTION OF WORK

(a) General The Contractor shall have the responsibility for the performance and enforcement of all forms of protection against weather and he shall be responsible for repairs and replacements of new or existing materials or equipment damaged as a result of inadequate protection. The Contractor shall sod and completely restore to original condition grass areas damaged by his operation and shall promptly repair any damaged parking surfaces, walks, curbs, roads, aprons, and other areas caused by his subcontractors operation, other than those scheduled for demolition.

(b) Care of Materials The Contractor shall be responsible for the proper care and protection of all materials delivered and work performed until completion and final

Information Handling Services, 1999
August 12, 1999 05:44:57

acceptance, whether or not the same has been covered by partial payments made by the Government or whether or not damage to his work was caused by the Contractor or by any subcontractor or by others, except for damage caused by employees of the Government acting in the course and scope of their employment.

(c) Repairs and Replacement Materials and surfaces shown to remain exposed in the final construction which are damaged in the course of contract work shall be repaired or replaced to the satisfaction of the Resident Engineer. All repairs and replacement work necessary shall be done by the Contractor at his own expense.

(d) Temporary Doors and Frames

(1) Temporary doors and frames shall be erected where required to isolate the work area, and to protect and prevent all persons not directly employed in the work, from coming in contact with the work operations or trespassing into Federal Aviation Administration property.

(2) Watertight doors and frames shall be provided as required to maintain the existing building in a watertight condition.

(3) Doors and frames shall be substantially constructed and erected in a manner so as to effectively guard and close openings, without damage to existing work.

(4) Doors shall be hung and locked with suitable approved hardware. The number of keys requested by the Resident Engineer shall be furnished and delivered to him by the Contractor.

(5) Installation of temporary doors, frames and hardware shall be approved by the Resident Engineer.

(6) Upon completion of the Contract work, or when directed, the temporary doors and frames shall be demolished and removed from the premises. All surfaces defaced or damaged as a result of the erections, installing or removal of the temporary doors and frames or enclosures, shall be restored as directed and to the satisfaction of the Resident Engineer.

Information Handling Services, 1999
August 12, 1999 05:44:57

1-C.8 FIELD OFFICE

(a) Requirements On the site, or immediately adjacent to the site, the Contractor shall provide a temporary office of approximately 300 square feet (minimum), rectangular in shape and having a minimum nominal width of 10 feet, all on one floor for the sole use of the Resident Engineer for the entire life of the contract. The building, including all interior fittings, and furnishings shall remain the property of the Contractor and shall be removed by him when directed by the Resident Engineer to do so.

The structure shall be weathertight and provided with ample heat, light, air conditioning, sanitary facilities, drinking water and a minimum of six electrical convenience outlets. Doors and windows shall be secured with locks. Heating equipment shall maintain an inside temperature of 70°F. and cooling equipment an inside temperature of 80°F. at the local outside design temperature.

(b) Furnishings The Contractor shall supply interior furnishings including a minimum of (2) 2'-10" x 5'-0" desks with locks on drawers, (6) six chairs, (2) two legal size 4-drawer filing cabinets with locks, (1) one legal size 2-drawer filing cabinet with locks, (1) one plan rack with sticks to hold minimum of ten sets of plans, (1) one 3'-6" x 8'-0" drawing board, (1) one 3'-6" x 8'-0" reference table, sample shelves, drinking facilities and (2) two wastepaper baskets.

Phone service and other office equipment and supplies shall not be furnished by the Contractor herein.

(c) Lighting Provide three 2 tube 48 inch. industrial fluorescent light fixtures surface mounted on ceiling. Four convenience outlets shall be provided where directed by the Resident Engineer.

(d) Janitorial Service All janitor service, sanitation facilities, electricity, heat and air conditioning with associated service connections shall be furnished and maintained by the Contractor during the entire life of the contract, or, until the removal of all facilities is requested by the Resident Engineer. The field office shall be kept clean and neat, windows washed periodically by the Contractor.

Information Handling Services, 1999
August 12, 1999 05:44:57

1-C.9 CONTRACTOR'S FIELD STRUCTURES

(a) Field Office The Contractor shall provide a construction field office. Field office shall be provided with adequate facilities necessary in the proper administration of the contract work.

(b) Storage Structures The Contractor shall provide storage structures type of construction and size as may be necessary to protect materials that would become damaged if stored in contact with the ground surface or exposed to the elements.

(c) Location The Contractor shall in cooperation with the Resident Engineer establish construction limit lines, location of temporary construction field structures and storage areas.

(d) Removal Construction field structures shall remain the property of the Contractor and shall be removed from the site by him when directed to do so by the Resident Engineer.

1-C.10 CLEANING AND PROTECTION

(a) General The Contractor shall require each subcontractor engaged upon the work to clean up his area of work during and immediately upon completion of his work and shall remove all rubbish, waste, tools, equipment and other appartus caused by or used in the execution of his work; but this shall in no be construed to relieve the Contractor of his primary responsibility for maintaining the building and site clean and free of debris, maintaining all work in a clean and proper condition acceptable to the Resident Engineer. The Contractor shall remove all debris from the center premises.

(b) Rubbish Removal Immediately after unpacking materials, all packing materials, case lumber, excelsior wrappings, or other rubbish, flammable or otherwise, the Contractor shall collect and remove from the building and the premises.

(c) Cleaning When directed, and before final inspection, the Contractor shall thoroughly clean the entire exterior and interior of the building (and the surrounding areas) affected by this work, including the following:

(1) All construction facilities, debris and rubbish shall be removed from the building and the site.

Information Handling Services, 1999
August 12, 1999 05:44:57

(2) All finished surfaces within the building shall be swept, dusted, washed and polished as required.

(3) All resilient flooring shall be thoroughly cleaned, ready for occupancy use.

(4) All glass shall be washed clean on both sides.

(5) All ceramic tile surfaces shall be washed clean.

1-C.11 FINAL CLEANING

(a) After final inspection, but before final acceptance of the work, where directed, all ceilings, wall surfaces, floors, doorframes, hardware, metal work, glass and the like in areas affected under this contract, shall be cleaned by the Contractor.

1-C.12 TEMPORARY FENCING

(a) Included under this Section is the providing, installation and maintenance of all temporary chain link fencing where required on the drawings. The Contractor shall maintain fencing in good repair during the term of his contract. The temporary fencing is the property of the Contractor and he shall remove it in its entirety, at his own expense, when notified it is no longer required.

(b) The Contractor shall examine all temporary fence requirements that are indicated on the drawings and shall verify all locations on the site for the approval of the Resident Engineer.

(c) Fence fabric shall be 2 inch by 2 inch mesh of No. 9 galvanized wire 8 feet high. Provide one main gate full length and width as directed. Gate post and corner posts shall be properly braced to sustain the stress of the fabric installation. Line post shall be set at 10 feet on centers. All corner post and line post shall be full height of fabric plus minimum 30 inches for ground setting.

Information Handling Services, 1999
August 12, 1999 05:44:57

(d) Gate shall be provided with top and bottom hinge, yoke drop latch, case hardened 3/8 inch diameter link chain and equivalent security pin tumbler pad lock with two keys. Upon completion of fencing both keys shall be submitted to the Resident Engineer.

(e) Temporary fencing shall remain in place until written notice ordering its removal has been issued by the Resident Engineer. When removal order has been received by the Contractor, he shall immediately dismantle, and remove all temporary fencing from the site. The Contractor shall restore to its original condition any surface, ground, grass or planting damage caused by construction of or the removal of temporary fencing. This work shall be completed before final inspection.

1-C.13 PROTECTION OF FEDERAL AVIATION ADMINISTRATION PERSONNEL AND PROPERTY

(a) The Contractor is directed herewith that the time schedule for the demolition and construction work required under this contract within the Air Traffic Control Room shall be prearranged and coordinated with the Resident Engineer and the Federal Aviation Administration. Safety of Air Traffic Controllers, Air Traffic Control Operations and Air Traffic Control equipment shall be maintained at all times.

(b) Unless otherwise permitted in writing by the Resident Engineer, the work in (a) above, shall be performed during non-peak air traffic hours. The Contractor shall be required to perform all work that interferes, in the opinion of the Resident Engineer, with the air traffic control operations after normal working hours. The Federal Aviation Administration will not entertain any premium wages for this work and any additional cost incurred by the Contractor in performing the work in non-peak air traffic hours shall be included in the lump sum bid for the Contract.

(c) The Contractor shall exercise extreme care in performing this work to prevent any falling objects, debris, noise and vibration in the Air Traffic Control Room. Prior to beginning any demolition or construction work, the Contractor shall submit to the Resident Engineer, for his approval, his method of work and safety measures to protect Federal Aviation Administration personnel and equipment and to insure continuous air traffic control operations. No demolition or construction

Information Handling Services, 1999
August 12, 1999 05:44:57

work will be permitted to begin until such matters have been approved by the Resident Engineer and the approved protective measures have been installed by the Contractor to the satisfaction of the Resident Engineer.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 1 GENERAL REQUIREMENTS

SECTION 1D

SUMMARY OF THE WORK

1-D.1 GENERAL

(a) This specification covers the work requirements for the construction of a new addition to the existing facility indicated in the applicable drawings.

(b) The new space consists of various floor levels: below grade and above grade as indicated in the various drawings and as specified.

(c) Demolition of portions of the existing structure will be required to receive new work.

(d) Site work primarily consists of repair and replacing of paved areas, walks, curbs, sod, etc. in the area affected by new construction.

(e) The enumeration of work in (a) through (d) above is a general summary of work included herein and shall not be construed to be complete listing or index of work.

1-D.2 DRAWINGS

(a) Drawings prepared, properly entitled and numbered indicate the work affected by this specification.

(b) Index of drawings include the following:

Architectural

A-0	Index sheet
A-1L	Site Plan
A-2R/A-2L	Lower Level Floor Plan
A-3RL	Lower Level - Room Finish and Door Schedules
A-4RL/A-4L	First Floor Plan

Information Handling Services, 1999
August 12, 1999 05:44:57

A-5RL	First Floor - Room Finish and Door Schedules
A-6R/A-6L	Second Floor Plan
A-7RL	Second Floor - Room Finish and Door Schedules
A-8R/A-8L	Attic and Roof Plans
A-9R/A-9L	Reflected Ceiling Plans Lower Level and First Floor
A-10R/A-10L	Reflected Ceiling Plan Second Floor and Ceiling Details
A-30R/A-30L	Detail Plans and Room Elevations
A-31R/A-31L	Detail Plans and Room Elevations
A-32R/A-32L	Detail Plans and Room Elevations
A-33R/A-33L	Detail Plans and Room Elevations
A-34RL	Door Types, Frame Types, Door and Frame Details, Movable partition Types and Details
A-35R/A-35L	Bridge Plans and Elevations
A-36RL	Bridge Details
A-40R/A-40L	Stair Sections
A-41R/A-41L	Stair Sections
A-42RL	Stair Details
A-50RL	Exterior Building Details
A-51RL	Interior Building Details
A-52RL	Interior Building Details

Information Handling Services, 1999
August 12, 1999 05:44:57

A-60RL	Color Schedule
A-61RL	Soil Borings

Structural

5-1R/5-1L	Lower Level Plan
5-2R/5-2L	First Floor Framing Plan
5-3R/5-3L	Second Floor Framing Plan
5-4R/5-4L	Attic Framing Plan
5-5R/5-5L	Roof Framing Plan
5-6R/5-6L	Building Sections
5-7R/5-7L	Building Sections
5-8R/5-8L	Building Sections
5-9R/5-9L	Building Section
5-10R/5-10L	Control Room Bridge Detail
5-11RL	First Level Reinforcing
5-12RL	Column and Beam Schedule
5-13RL	Miscellaneous Details
5-14R/5-14L	Miscellaneous Details
5-15RL	Miscellaneous Details

Mechanical

ME-1L	Mechanical-Electrical Site Plan
M-1R/M-1L	Lower Level Floor Plan-Plumbing
M-2R/M-2L	First Floor Plan-Plumbing
M-3R/M-3L	Second Floor Plan-Plumbing

Information Handling Services, 1999
August 12, 1999 05:44:57

M-4R/M-4L	Attic Plan-Plumbing
M-5R/M-5L	Roof Plan-Plumbing
M-6RL	Details-Plumbing
M-7R/M-7L	Lower Level Floor Plan H.V.A.C.
M-8R/M-8L	First Floor Plan H.V.A.C.
M-9R/M-9L	Second Floor Plan H.V.A.C.
M-10R/M-10L	Attic Plan H.V.A.C.
M-11R/M-11L	Large Scale Mechanical Equipment Room H.V.A.C.
M-12RL	Equipment Schedule H.V.A.C.
M-13RL	Details H.V.A.C.
M-14RL	Flow Diagram

Electrical

E-1R/E-1L	Lower Level Floor Plan Electrical
E-2R/E-2L	First Floor Plan Electrical
E-3R/E-3L	Second Floor Plan Electrical
E-4R/E-4L	Attic Floor Plan Electrical
E-5RL	Details Electrical
E-6RL	Details Electrical
E-7RL	Details Electrical

1-D.3 SPECIFICATIONS

(a) This specification consists of several Divisions and Sections listed under Table of Contents (By Sections).

1-D.4 STANDARD REFERENCES

Military, Federal, Society, Institutes, and Associations, Standards, Specifications and Codes, of the issues in effect on the date of the invitation for bids, form a part of this specification and are applicable to the extent specified herein.

Information Handling Services, 1999
August 12, 1999 05:44:57

1-D.5 REQUIREMENTS

(a) WORK TO BE ACCOMPLISHED BY THE CONTRACTOR The contractor shall furnish all plant, labor, material as required to construct the facility at the location of the type and size indicated on the drawings and specified in the invitation for bids and in accordance with the requirements of this specification. All material not specifically indicated as furnished by the Government in the invitation for bids shall be furnished by the Contractor.

(b) The Contractor shall examine all contract documents, determine the extent of all work required to be performed by him and cost thereof, before preparing his bid.

(c) The Contractor shall recognize that the work under this Section of the Specification must be performed in connection with a facility that is in operation on a "round-the-clock" basis; that he is required to complete his work in a manner not to interfere with, disrupt, or interrupt the operation of the existing plant.

(d) The Contractor shall prepare a detailed schedule of all activities, under this contract, that will indicate the distribution of the work to be completed within regular work hours as well as work that must be performed during hours other than regular scheduled working day hours. Extra compensation for premium time will not be allowed. The prepared schedule shall be submitted to the Resident Engineer for his approval and comments.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 2 SITEWORK

SECTION 2A

SITE PREPARATION

2-A.1 REQUIREMENTS The work covered by this Section consists of furnishing all labor, materials, tools, equipment, appliances, and services necessary to properly prepare the site as specified herein and required in the applicable drawings.

2-A.2 EXISTING CONDITIONS Removal in part of some of the existing site structures and modifications of the site required in the drawings and the Specifications are included in this Section.

2-A.3 TOPSOIL Shall be stripped and stockpiled on the site, as directed, before the other work in this Section is started. Stockpile shall be of highest practical height and smallest ground perimeter. Generally topsoil shall be stripped to a minimum depth of 6" within the contract limit area. However, all topsoil regardless of quantity shall be stripped from paved areas, walks and approaches.

2-A.4 PAVING REMOVAL Existing paving interfering with the new work shall be removed as indicated on the drawings. Where only a part, or portion of existing work shall be removed the removal shall be done to a straight saw cut line to protect the edge of the existing work that shall remain.

2-A.5 WALKS AND CURBS Walks and curbs shall be removed as required in the drawings to provide space for new construction. Removal of walks and curbs shall be done in a manner that will not damage adjacent construction that is to remain. Staggered or offset cutting is not acceptable.

2-A.6 RELOCATION Existing microwave towers which must be relocated will be relocated by others. If the microwave towers are noted on the drawings to remain at their present location the Contractor shall make provision to protect the tower foundation during construction. The Contractor shall submit shop drawings proving his design and method of protecting the tower foundation.

2-A.7 OTHER TRADES The Contractor shall notify and make provisions for other trades to install their work that is required herein. Notice shall be given to allow other trades ample time to arrange for the necessary materials and installation.

Information Handling Services, 1999
August 12, 1999 05:44:57

2-A.8 SITE UTILITIES Upon entering the site the Contractor shall notify the Mechanical trades and coordinate their work with his activity as their work is affected herein.

2-A.9 ACTIVITY PLAN The Contractor shall submit to the Resident Engineer a site plan, in duplicate, indicating activity locations and storage areas, for his approval and comments. After a finally approved site activity plan has been received by the Contractor it shall be his responsibility to enforce compliance thereto by all sub-contractors, tradesmen, and others who will be actively involved in the work that follows.

2-A.10 TIMING The Contractor shall allow time and space required by the mechanical and electrical trades to make all necessary temporary or permanent changes in existing utilities as they are affected herein. Furthermore, the Contractor shall examine all existing utilities as they affect his work and to determine the extent of and procedures necessary to prevent shut down of services required for the existing operation.

2-A.11 SITE CLEAN UP After all work covered under this Section of the Specifications, indicated on the drawings and incidental thereto is completed the Site shall be cleaned up. This Contractor shall, at his own expense, remove from the site and dispose of all waste materials, rubbish and debris caused by the work herein. All equipment, tools, appliances and accessories used in this work shall be removed from the site when they are no longer needed.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 2 SITEWORK

SECTION 2B

EXCAVATING, FILLING, BACKFILLING AND GRADING

2-B.1 REQUIREMENTS The work covered by this Section consists of furnishing all labor, materials, tools, equipment, applicances, and services necessary and incidental to complete the excavating, filling, backfilling, and grading required in the drawings and specified herein.

2-B.2 PROTECTION OF ADJACENT AREAS All banks, slopes, and adjacent areas, not specifically excavated or graded, walls and surfaces of existing construction, shall be fully protected against damage.

2-B.3 GENERAL EXCAVATION All materials now in place, natural or artificial, including rocks, boulders, existing structures and foundations, debris and rubbish shall be removed as necessary for performance of all work under this contract. Excavation shall be unclassified and the Contractor shall include in his job bid price the cost of removing all of the materials encountered.

Test borings have been made on the site and a copy of boring log and test report is shown on the drawings.

However, the bidder is required to examine the location of the work and determine for himself the nature of the conditions including sub soil conditions affecting the cost of the work. On written request the Contractor may obtain permission to make his own soil borings and/or probing .

All excavations shall be kept free from water, regardless of the elevation at which ground or flood water may be encountered. Sufficient working space shall be provided to permit construction, pumping operations, inspection and completion of all work under the contract.

Excavated materials, unsuitable or not required for filling, backfilling, or grading, shall be removed from the site. The disposal of this material shall be the responsibility of the Contractor.

All materials, natural or artificial, the removal of which is deemed necessary by the Resident Engineer, for the performance of the contract, shall be removed to a minimum depth of one foot below finish grades, for placement of select materials for slabs on grade.

Information Handling Services, 1999
August 12, 1999 05:44:57

2-B.4 PITS, TRENCHES AND DRILLED HOLES Footing pits and trenches may be excavated to permit forming of concrete or may be excavated to exact size of concrete member. If footing trenches are excavated to the exact size of the concrete, the sides shall be maintained to withstand sloughing during the placing of the concrete. Undercutting will not be permitted.

If excavations are carried below required levels, they shall be backfilled with concrete of Class A specified for footings, or the foundation shall be laid at the excavated level as directed by the Resident Engineer at no additional cost to the Government.

All footings shall bear on undisturbed soil unless foundation material is rock. Where rock occurs and footings are indicated to rest on same, the rock shall be leveled to a clean, even, hard surface. Sloping rock for bearings shall be stepped and treated in the same manner. No footing shall be permitted to rest partly on soil and partly on rock. In the event excavation reveals potential foundation bearing surfaces of part rock and part soil, the Contractor shall remove the soil and fill the voids with concrete as specified, above, to the elevations required.

Holes for drilled-in shafts shall be drilled to the foundation material specified on the Drawings. Foundation bearing areas shall be cut to an approximate level surface. The diameter of holes shall be as indicated on the Drawings. If material is encountered which is not sufficiently cohesive to maintain the proper diameter of the hole, or if water is encountered in the hole which will prevent pouring of the concrete in the dry, then a temporary casing shall be used. Temporary casing shall be required for holes adjacent to the existing building for protection of the existing structure. Casings may be pulled, by the Contractor, after concrete is poured subject to the approval of the Resident Engineer. Under no circumstances shall the pulling of casing disturb the freshly placed concrete.

2-B.5 SOIL BORINGS When excavations for foundations (except in rock) have reached the required depth, at least 12 borings 8 inches in diameter and 3 feet deep shall be made where directed. If the material disclosed is satisfactory to the Resident Engineer, the holes shall be filled with concrete of the class specified for footings. If the material disclosed is unsatisfactory the excavation shall be carried to new depth as directed and new borings made if deemed necessary, by the Resident Engineer. Additional excavation shall be performed by the Contractor in accordance with requirements for Item 3 of "General Provisions" titled "Changes".

Information Handling Services, 1999
August 12, 1999 05:44:57

2-B.6 INSPECTION OF EXCAVATED SURFACES When excavations have reached the required elevations, the surfaces shall be inspected and approved by the Resident Engineer before proceeding with further construction.

The material at the required footing elevation shall be free from bentonite, alkali salts or organic silt. When the type of soil at the footing elevation will disintegrate due to exposure to the air, and the concrete for the footings cannot be immediately placed, a minimum of two inches of concrete cover shall be placed to protect the soil from contact with the air. Allowance in the depth of the excavation shall be made in order not to reduce the thickness of the nominal footing. The covering concrete shall be of the same class specified for the footings.

2-B.7 TEMPORARY SUPPORT AND CAPPING Any utility lines, piping, conduits, etc., encountered, that are not to be removed herein, shall be temporarily supported and maintained until permanent support has been provided, or until removed, cut off or capped in accordance with the requirements indicated on the Drawings, called for in the Specifications; in compliance with the regulations of the city, county, state or utility company involved, and at the Contractor's expense.

2-B.8 FREEZING When freezing weather is expected, excavations shall not be made to the full depth, unless the footing concrete can be placed immediately. If excavation is already at full depth, the excavation shall be protected from frost.

2-B.9 CRUMBING Immediately ahead of concrete being placed into footing excavation the bottom of trench shall be cleaned by hand to remove all loose earth and debris that may have fallen into the excavation.

2-B.10 FILL AND BACKFILLING Before any fill or backfilling operations, excavated and fill areas shall be cleared entirely of concrete form work, debris and material not suitable for stable, satisfactory fill.

Fill and backfill shall be clean earth, free from perishable materials placed in evenly distributed layers of thickness specified herein over the entire areas; properly moistened and thoroughly consolidated by power operated mechanical equipment to prevent subsequent settlement. All fill and backfill shall be well graded coarse granular material free of organic, frozen expanding or shrinking material.

Information Handling Services, 1999
August 12, 1999 05:44:57

Fill for seeded and sodded areas, shall be brought to within 6 inches of the finally finished grades to allow for topsoil placement.

2-B.11 ROCKS, STONES AND BOULDERS Rocks, stones and boulders up to 2 cubic feet in size may be incorporated in fill areas (except within 10 feet of any structure or 5 feet of utility line) except that earth only containing stones not over 2", largest diameter, shall be used for the top 12 inches of fill. Rocks, stones and boulders, where used, shall be well distributed to eliminate any voids that may cause undue settlement or prevent proper consolidation of the filled areas.

2-B.12 DRAINAGE FILL Coarse fill under concrete floor slabs and exterior concrete equipment slabs shall be clean, hard gravel or crushed rock, and shall comply with Federal Specifications SS-A-281b, Class 2 sized from #3 to 1-1/2 inches.

All drainage fill shall be protected against infiltration of soil or concrete by a layer of reinforced paper UU-P-264a unless otherwise specified or indicated.

2-B.13 OLD EXCAVATIONS Any old wells, cisterns, catch basins, existing voids or cavities and the like that is shown on the drawings and encountered in proximity to the footings or which come within the assumed pyramid of pressure, shall be cleaned out and filled with Class A concrete. Any other old excavations, within the limits of the work under the contract shall be cleaned out and filled with bankrun gravel, that passes a 3 inch mesh, well tamped into place, up to existing grade, or within 2 feet of finished grade in seeded and sodded areas. The balance of the fill in seeded areas shall be earth.

2-B.14 SOIL CONDITIONS Cohesive soils that have become hard or lumpy, or that have been piled and become dry, shall be broken up and properly reconditioned for moisture content immediately before use in filling or backfilling.

2-B.15 COMPACTION OF FILL AND BACKFILL Compact each layer of fill and backfill to the maximum density at optimum moisture content in accordance with the current AASHO-T99 Standard Specifications for Highway Materials and Methods for Testing as follows:

Information Handling Services, 1999
August 12, 1999 05:44:57

(a) Fill under floor slabs and on both sides of the foundation wall: 6 inch layers compacted to 95%. Prior to installing fill under floor slabs, the original soil shall be removed to provide a minimum of 12 inches of fill under the slabs. The surface of the remaining original soil shall be compacted to 95% maximum density at optimum moisture content before the fill material is placed and compacted. The compacted fill surfaces shall be carefully checked for the correct elevations and profiles.

(b) Fill under paved areas: 12 inch layers compacted to 90%.

(c) Fill under pavement and sidewalks: 8 inch layers compacted to 95%.

(d) Backfill: 6 inch to 8 inch maximum layers compacted to 95%.

(e) Percentages indicated herein are in reference to the Standard Specification specified in 2-B.15 above.

(f) Compaction equipment shall be subject to approval of the Resident Engineer. Heavy equipment for spreading and compacting fill and backfill shall not be operated closer to walls than a distance equal to the depth of the wall below the current top of the fill. Power operated mechanical hand tampers or vibrators shall be used between this point and the wall.

(g) Backfilling shall not be placed against foundation walls until the first floor construction is in place, tied in and permanently set.

(h) Backfilling against waterproofed walls shall not be placed until waterproofing treatment is completed, inspected and approved by the Resident Engineer. Should waterproofing treatment become damaged by the backfilling operation this work shall be interrupted until the damaged surfaces have been properly repaired, inspected and approved. Repairing or replacing of damaged work shall be done by the Contractor at his own expense.

2-B.16 GRADING All grading shall be done to bring the ground to the base elevations required allowing for placing and spreading of topsoil, sodding and seeding.

The grades shall be uniformly level and sloped between points as indicated on the drawings, properly compacted and finished to receive topsoil.

Information Handling Services, 1999
August 12, 1999 05:44:57

2-B.17 EXISTING STRUCTURE Extreme care shall be exercised in excavating adjacent to the existing wall of the control wing. No excavation deeper than the existing footings of the control wing will be permitted as bulk machine excavation.

In the event it becomes necessary to extend excavation for new work below existing footings only hand work will be permitted within a distance 2-1/2 times difference in existing and new elevation, and in sections 8 feet maximum length in clay soil. Excavating shall be done in 8 foot skip sections. Immediately after a section is excavated, formwork reinforcement and concrete shall be placed. After concrete has been placed and cured in all the alternate skip sections, the alternate earth sections shall be removed and concrete placed to complete the retainage of bearing for existing work.

Horizontal reinforcing bars, in first sections placed, shall be not less than 4 feet longer than concrete section poured to provide 2 foot long extended dowels at each end to tie into the fill-in section poured later.

If excavated material other than clay soil is encountered, the length of skip sections shall be adjusted to the behavior of that material.

The Contractor shall prepare a trial section for the approval of the Resident Engineer regardless of the type of excavated materials encountered.

2-B.18 SUBGRADE PREPARATION

(a) Prior to placing granular base course materials and drainage fill course under areas to receive paving, drains, walks and approaches, the subgrade shall be cleaned of all foreign substances. The upper 16 inches of subgrade shall be compacted to not less than 95% of the maximum density of optimum moisture as determined by AASHO-T99 Compaction test.

(b) The finished compacted surface shall be constructed to such trueness that when tested with a 16-foot long straightedge it shall not show any deviation in excess of 1/2 inch. Any ruts or soft-yielding spots that may appear in the subgrade, any areas having inadequate compaction, and deviation of the surface from the requirements specified shall be corrected by loosening, removing and adding approved material, reshaping and re-compacting the affected areas to line and grade, and to the specified density requirements.

(c) Borrow material approved by the Resident Engineer shall be furnished and installed in lieu of any "on-site" material encountered that cannot be compacted to the specified density. Unsuitable "on-site" material shall be removed and replaced with approved borrow materials in all compacted subgrade areas.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 2 SITEWORK

SECTION 2C

DEMOLITION

2-C.1 REQUIREMENTS The work covered by this Section of the Specifications consists of furnishing all material, labor, tools, equipment, plant, appliances and services necessary to complete all Demolition work required in the Drawings and specified herein. The Contractor shall examine the various drawings, visit the site and determine for himself the extent of this work, and all conditions under which he is required to perform the various operations.

The Contractor shall examine the Mechanical and Electrical drawings and specifications as well as those covering the General Construction to determine the extent of work affected therein.

2-C.2 SITE STRUCTURES

(a) Existing site structures affected herein are indicated generally on the Site Layout Plan. The site structures include walks, drives, curbs, platforms, stoops, paving, fencing, etc., that are required to be removed to allow space for new construction.

(b) Site structures do not include parts of buildings or construction that is modified, altered and addition of new construction under this Contract.

(c) Trees that are not scheduled for transplanting shall be taken down and removed from the site herein. Roots of trees taken down shall be grubbed out to a depth of 36 inches below finish grade. Trees scheduled for removal from the site are so indicated in the drawings. Backfilling where tree roots are removed is included herein and shall be filled and compacted as specified in 2-B.15 of the specifications.

(d) Transplanting of existing trees, shrubs, and planting is included under Section 2F of the specifications.

(e) Excavating, grading and earthwork in general is included in Section 2B of the specifications.

2-C.3 GENERAL DEMOLITION

(a) General demolition consists of the removal of various parts and sections of existing building to provide space for new and additional construction in accordance with the requirements on the drawings and details, and these specifications.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) Combustible demolished materials and debris shall at no time be burned within the site limits, nor, buried under fill or backfill. All such materials shall be removed from the site as they accumulate. Piling up and storing of waste materials on the site will not be permitted and shall be limited to a maximum accumulated volume equal in bulk amount to the normal pay load of a standard 1-½ ton rated dump truck.

(c) All work herein shall be performed by only workmen experienced in the type of work required herein; familiar with safety standards, rules and requirements for this class of work.

(d) The Contractor shall be held responsible for spillage of waste materials and debris onto public streets, walks and thoroughfares from vehicles used in this work for transportation thereof. He shall also be held responsible for any damage attributed to such spillage including personal harm and property damage caused thereby.

(e) The Contractor shall coordinate the work under this Section with the work of other trades to prevent any undue delay in their performance, improper installation, substitute or inferior materials and workmanship.

The Contractor shall at no time allow his work, or the work of others, to interrupt or prevent the normal operation of the facility. He shall submit to the Resident Engineer for his approval copies of revised schedules if changes are necessary.

(f) Demolition of walls, floors, ceilings, cutting, drilling and similar work causing air-borne dust shall be isolated from facility operation areas by installing temporary dust-proof barriers. Dustproof barriers are included in the work under Section 6 A Rough Carpentry.

2-C.4 EXISTING EXTERIOR METAL WALL PANELS

(a) Exterior metal wall panels of the existing building shall be removed, in part, to provide for space and construction of the new work that follows. Metal panels, struts, girts, anchors and accessories shall be removed in accordance with these sections and the requirements in the drawings.

Removing of panels shall be done to provide for "build-back" and weather proof joint where existing and new work abut. Where a part of a panel section only is removed cutting shall be done with a rotary, metal cutting, power driven saw. Rough, ragged or ruffled cut edge shall be cause for rejection of the part of panel intended for

Information Handling Services, 1999
August 12, 1999 05:44:57

remaining in the finally finished work. Precaution shall be taken to insure no interference with Air Traffic Control operations.

2-C.5 EXISTING ATTACHED WORK

(a) Existing concrete walls, slabs, and similar structures attached to or part of existing construction, but indicated in the drawings to be removed, are included herein.

(b) Demolition methods and equipment shall not interfere with the normal operation of the facility. If interference occurs during the 8:00 A.M. to 8:00 P.M. period, demolition activities shall be conducted during the 8:00 P.M. to 8:00 A.M. period. Vibrations and excessive noise that is transmitted audibly into the Air Traffic Control Center will not be permitted.

2-C.6 COORDINATION

(a) The Contractor shall schedule and coordinate the work of the various trades to establish a continuous flow of activities following a general direction in order to minimize the "work-idle-work" pattern.

(b) The Contractor shall not use jack hammers or other similar impact tools in this work. Impact tools, accessories and equipment shall not be delivered to or stored on the site.

(c) The Contractor is permitted to use oxygen cutting equipment for cutting of concrete ledges and openings through existing concrete walls. Equipment shall be oxygen fueled Burning Bar of the East, Park Ridge, New Jersey 07656. Proper safety shielding shall be provided in accord with the recommendations of the Manufacturer's Instructions.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 2 SITEWORK

SECTION 2D

PAVING (BITUMINOUS)
(When Required)

2-D.1 REQUIREMENTS The work covered by this Section consists of furnishing all labor, materials, tools, plant, appliances and services necessary to properly install the Paving (Bituminous) as required in the drawings and specified in these specifications.

When the drawings require bituminous type paving to be furnished this Section of the specifications shall apply.

When bituminous type paving is furnished, in accordance with the requirements in the drawings, portland cement curbs, approaches, gutters and aprons specified under Section 2E shall be furnished under this Section.

2-D.2 MATERIALS

(a) Rolled Stone Base Course All aggregate used in this course shall be hard, durable particles or fragments of stone, free from excess flat, elongated, soft, weathered or disintegrated pieces, dirt, or other objectionable matter. Crushed stone for coarse aggregate and screenings shall conform to the gradations, in percentages by weight, passing through a square mesh sieve in accordance with Table I

TABLE I

SIEVE DESIGNATION	PERCENTAGE
1-½ inch	-100
1 inch	-85-100
½ inch	-55-75
No. 4	-35-55
No. 40	-10-25

(b) Prime Coat Rapid-curing cut-back asphalt.

(c) Asphaltic Concrete Asphaltic concrete shall consist of a mixture of asphaltic cement, aggregate and a mineral filler specified below:

Information Handling Services, 1999
August 12, 1999 05:44:57

1. Asphaltic Cement Asphaltic cement shall be 60 to 100 penetration, homogenous, free from water, produced by distillation of petroleum, or refined solid native lake asphalt fluxed with suitable oil asphalt.

   Proportion in mix shall be four percent (4%) to seven percent (7%) by weight.

2. Aggregate Aggregate shall conform to the gradations, in percentages by weight in accordance with the requirements in Table II.

TABLE II

SIEVE DESIGNATION	PERCENTAGE
Passing 3/4 inch	100
Passing 3/4 inch, retained on 1/2 inch	0- 3
Passing 1/2 inch, retained on 3/8 inch	0-25
Passing 3/8 inch, retained on No. 4	20-45
Passing No. 4, retained on No. 10	7-20
Passing No. 10, retained on No. 40	7-20
Passing No. 40, retained on No. 80	5-20
Passing No. 80, retained on No. 200	5-18

3. Mineral Filler Mineral filler shall conform to the standards set forth in ASTM D-242.

4. Asphaltic Concrete Asphaltic concrete shall be thoroughly mixed, in a suitable and approved mechanical mixing plant. All aggregate particles shall be completely coated with asphaltic cement. Asphaltic concrete shall be delivered and deposited at a temperature of not less than 250 degrees F., nor more than 325 degrees F.

   Overheated and carbonized mixes, or a mixture that foams or shows indications of moisture, will be rejected and shall be removed from the site.

5. Silicone Additive Silicone additive shall be DC-200, mix one pint of silicone in four gallons of diesel fuel oil, mix thoroughly to assure complete suspension of the silicone in the oil base.

Information Handling Services, 1999
August 12, 1999 05:44:57

To each 4750 gallons of asphalt add two pints of silicone/oil mixture. Operate pump in asphalt tank during and thirty minutes after silicone additive mixture has been added.

2-D.3 CONSTRUCTION METHODS

(a) Base Course

1. Only the amount of water necessary for proper compaction and to prevent segregation shall be added at the mixing plant, mixed to provide a uniform and workable bulk material. Sufficient water shall be added during placing and compacting of base course to insure proper density and uniform surface without segregation of aggregate. Excess water resulting in run-off shall be cause for stoppage of the work.

2. Depositing and spreading of the base course bulk materials shall commence at a point farthest from truck entrance and shall progress continuously without break or stoppage.

3. Base course bulk material shall not be placed or spread on a muddy, frosted or uneven sub-grade.

4. Base course bulk material shall be uniformly spread to provide a six inches deep finally compacted and finished base.

5. Care shall be taken to prevent segregation of the aggregate bulk material. Any large area of segregated base shall be removed and replaced with a suitable repair acceptable to the Resident Engineer. Small segregated areas may be patched using crushed stone screenings. Screenings shall be wetted and rolled in place to a density equal to the adjacent base.

6. Initial compaction shall be secured by use of pneumatic-tired rollers. Final finish of the compacted base course shall be made with smooth-wheel rollers, weighing not less than ten tons total. Rolling shall progress gradually from sides to center, of each strip or area worked. Rolling shall continue until no wave or creeping movement can be detected ahead of roller. Finish surface shall have no irregularity that exceeds 1/2 inch when tested with a ten foot straight-edge. The base course shall be compacted to 95% of Standard Proctor as set forth in ASTM Designation D-698.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) Prime Coat Prime coat of bituminous material shall be applied to the finally compacted base course surface immediately after base has dried out. Prime coat shall be applied with a pressure distributor, at a rate of 0.25 to 0.50 gallon per square yard.

The exact rate shall be determined by trial and no more shall be applied than can be abosrbed by the base course. The primed surface shall be allowed to dry for not less than 24 hours without being disturbed. The primed surface shall be approved by the Resident Engineer before any further work shall be installed. Prime coat shall not be applied when the atmospheric temperature is below 60 degrees F. When primed surface is dry a tack coat of diluted SS-1 asphalt emulsion at a rate of not more than 0.1 gallon per square yard uniform coverage, shall be applied just preceeding the hot mixed asphaltic material application.

(c) Hot Mixed Asphaltic Material

(1) Before and during the placing of the hot mixed asphaltic material any weakness or faulty sub-grade or base condition that may develop shall be corrected by replacing those areas with suitable material by methods satisfactory to the Resident Engineer. Any plastic and cohesive soil or other foreign material that may have lodged on the base course shall be removed before work progresses.

(2) After any necessary base repairs are made, the entire area shall be cleaned by a power driven rotary sweeper to remove dust, dirt and all loose and foreign material.

(3) Hot mixed asphaltic material shall not be placed when atmospheric temperature is below 50 degrees F., if there is any frost on the base course, or under any other unsuitable weather conditions that in the opinion of the Resident Engineer is not conducive to proper work.

(4) Placing the hot mixed asphaltic material shall be done with a power operated spreading and finishing machine. The hot mix shall be dumped directly into the spreader from the delivery trucks. Spreader shall be adjusted to lay down a uniform layer that will have a minimum finally compressed thickness of two inches. For working temperatures of hot mixed asphaltic material see 2-D.2(c)4. above, and verify all conditions with the approval of the Resident Engineer.

Information Handling Services, 1999
August 12, 1999 05:44:57

5. Compacting the hot mixed asphaltic material shall be done with smooth-wheeled rollers weighing not less than ten tons. Rolling shall commence as soon as possible after spreading of the hot mix. Rolling shall be done in a longitudinal direction, beginning at the outer edges of each strip or area and working toward the center, each pass overlapping the prior pass by one-half the width of the rear roll. Laps shall be finally rolled out. Areas not accessible to roller shall be compacted with hot hand tampers. Any defective area, rough laps or similar surface conditions shall be cut out and replaced with fresh mix, compacted and finished to match adjacent surfaces. "Skin patching" will not be acceptable as finally approved work.

6. The Contractor shall mask out adjacent structures that would be damaged by displaced bituminous materials. Exposed surface of curbs, walks, walls, etc., shall be protected by properly covering or masking.

7. Completed paved surface shall be dense, smooth without rough or segregated area, irregular joints or overlapping of material. Surface shall be free from "honey-comb" loose materials or depressions which will retain more than 1/4 inch of water in any area with a 10 foot radius.

2-D.4 CLEANING UP The Contractor shall remove from the site all equipment, tools, dirt and debris caused by his work when the work under this Section is completed. He shall remove all misplaced material and leave his work area in a condition acceptable to the Resident Engineer.

2-D.5 STANDARDS

(a) Approved State Standards State Road and Highway Construction and Paving Standards or Specifications approved by the Department of Transportation, Federal Highway Administration (U.S. Department of Commerce, Bureau of Public Roads) shall apply. The state in which the facility is being constructed shall determine the particular standard and specification to be used. All reference to method of measurement, Basis of Payment, and lines and grades established by the country, state or government engineer are deleted.

(b) AASHO Standards Current Standard Specifications for Highway Materials and Methods for Testing.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 2 SITEWORK

SECTION 2E

PAVING (Concrete)

(When Required)

2-E.1 REQUIREMENTS The work covered by this Section consists of furnishing all labor, materials, tools, plant, appliances and services necessary to properly install the paving as required on the drawings and specified herein. Concrete curbs and drives are included herein. Concrete walks and curbs are included in Division 3, Section 3A.

2-E.2 SUBGRADE The subgrade shall be prepared by grading to true lines and elevations to provide for the thickness of the work to be placed thereon. The graded subgrade surface shall be examined for soft or unsuitable base material, which shall be cut out and replaced with fill materials. The subgrade shall be compacted as specified in Division 2, Section 2-B.15.

2-E.3 BASE COURSE The base course for concrete drives and parking shall consist of crushed aggregate rolled and compacted as specified. Material for the base course shall be:

A combination of equal parts by weight of either size 5A or size 6 and screenings size 7.

2-E.4 CLIMATE CONDITIONS No work shall be done when the subgrade or base course is wet or frozen, or when the atmospheric temperature is below freezing. No work involving the use of water shall be done when the atmospheric temperature is below 40 degrees F.

2-E.5 DRY CRUSHED STONE OR SLAG BASE Each layer of the double-layer course shall be constructed of coarse aggregate and crushed stone and rolled separately; the bottom layer to be rolled to a compacted thickness equal to one-half the required total thickness which is 6 inches for concrete pavement.

After the coarse aggregate of each layer has been compacted and thoroughly keyed and set by rolling, stone screenings in an amount that will completely fill the interstices shall be applied gradually over the surface and dry rolling shall

Information Handling Services, 1999
August 12, 1999 05:44:57

continue while the screenings are applied and spread. Hand brooms shall be used to sweep the stone screenings into unfilled voids and to distribute the stone evenly where needed. The spreading, sweeping and rolling shall continue until no more stone can be forced into the voids.

2-E.6 FORMS FOR BASE COURSE When stone or concrete curbs, gutters or shoulders are required by the drawings, side forms shall be set and braced to grade and line as guides for the proper depth of loose aggregares. The forms shall be backed up on the firm side to a width of 18 inches with earth shoulder material which shall be compacted by mechanical tampers to the level of the compacted aggregates. These forms shall be removed before the rolling operation begins and the voids left by their removal shall be filled with earth shoulder material to such height as will compact to the finished thickness of the compacted aggregates.

Where walls, curbs, gutters, or concrete shoulders occur adjacent to the pavement, the construction of the pavement shall not be commenced until they are installed and the concrete properly set and cured. Provide suitable bearing plates to protect the masonry, stone or concrete during rolling operation.

2-E.7 PLACING AND SPREADING BASE COURSE All base course material shall be placed on the prepared subgrade and compacted in separate layers of the thickness specified. The materials of each layer shall be deposited and spread uniformly and without segregation of size to such loose depth that when compacted, the layer shall have the required thickness.

Spreading of aggregates shall be from dump boards, spreader boxes or mechanical spreaders. Dumping in piles or windrows so as to require handling will not be permitted.

The construction procedure described herein shall apply to each layer of the base course.

2-E.8 ROLLING OF BASE COURSE The aggregates of each layer shall be rolled separately with a 3-wheel power roller weighing not less than ten (10) tons until it is compacted to a firm even surface and to the thickness specified. On depressed areas (if any), a trench roller shall be used or cleated compression strips may be used under the roller to transmit compression to the depressed areas.

Information Handling Services, 1999
August 12, 1999 05:44:57

The rolling shall begin at the sides and proceed to the center parallel with the center of the pavement strip worked. Each preceeding pass shall be overlapped one half the width of the rear wheel with passes continuing until the material ceases to creep or wave ahead of the roller. At edges with earth shoulders (if any), the outside rear wheel of the roller shall cover equal portions of the spread aggregate and the shoulder.

Any irregularities or depressions that develop in the layers under rolling operations shall be corrected by loosening the material at those places and removing or adding aggregates and rerolling. The rolling shall continue until the surface is shown to be smooth and uniform at the required grade or grades when tested with a straightedge 10 feet long laid parallel to the centerline of pavement strip being worked, and true to the contour shown on the drawings when tested with a template which shall be furnished by the Contractor.

At all places not accessible to the roller and along walls, curbs, gutters or shoulders of masonry, stone or concrete, the coarse material and filler aggregate shall be tamped separately and compacted to grade and line with mechanical tampers.

2-E.9 PORTLAND CEMENT CONCRETE APPROACH WORK Concrete for approaches shall conform to 4,000 p.s.i. Class AA (AE) (Section 3-A.3) requirements, for concrete. Any metal work required in connection therewith shall be accurately placed and built in as the concrete is placed. For location and extent of work, see drawings.

Construction, control and expansion joints shall be located where shown or specified and made in accordance with applicable Standard Details.

Base courses and seepage beds and a foundation for approach work shall be provided as follows and as specified in Paragraph 2-E.3 through 2-E.8.

(a) Concrete Driveways A layer of sand 2 inches thick placed on the prepared subbase.

(b) For Concrete Parking Areas: A layer of sand 1 inch thick placed on the prepared subbase.

Information Handling Services, 1999
August 12, 1999 05:44:57

(c) Forms Forms shall have a height equal to the slab thickness. Built-up, battered, bent, twisted or broken forms shall be removed from the work. All forms shall be cleaned and oiled each time they are used. Forms shall be so constructed and set as to resist without springing or settlement the full pressure of the concrete and the operation of the finishing machines.

Steel forms shall be at least 10 feet long for tangents and curves and shall have a base of at least 8 inches wide. Steel forms shall be made of metal not less than 3/16 inches thick. The form shall be true to a straight line with a tolerance of 1/8 inch in loft for the top surface and 1/4 inch in loft for the upstanding leg. They shall have square ends connected with a ridgid lock joint. Flexible forms shall be used for curves with 150 foot radius or less. Wooden forms shall be 2 inches thick dressed on four sides. They shall be securely staked and braced to assure displacement will not occur during placing and finishing of the concrete.

2-E.10 REINFORCEMENT Reinforcement, not otherwise specified, shall be square mesh, welded steel wire fabric with wires of the same size in both directions. Adjacent sheets shall be lapped at joints; each lap to include not less than two cross wires of both sheets. Wire fabric shall be as follows:

(a) For Concrete Driveways and Parking Areas: Either 6"x6" mesh of No. 6 wires, or 4" x 4" of No. 8 wires, at the option of the Contractor.

(b) Dowels and Tiebars QQ-S-632, Type 1, Grade C conforming to ASTM 615. Shall be plain steel bars. For dimensions, locations and spacing, see Structural Details. Slip dowels shall be coated with flake lubrication graphite, SS-G-659. Dowels in expansion joints shall be bonded at one end only and free and shall be provided with a close fitting, closed and sleeve of ample strength and purpose. Tiebars shall have both ends bonded.

The dowels in each joint shall be exactly parallel to the surface and centerline of the slab or curb. They shall be positioned and held in place with metal devices that will be left in the concrete so firmly set that their positions cannot be altered by the concreting operations.

Information Handling Services, 1999
August 12, 1999 05:44:57

2-E.11 PLACING OF CONCRETE Placing of concrete shall not commence or continue at any time unless forms are set, subbase thoroughly wetted and prepared in advance of concreting. Reinforced concrete shall be accomplished in two layers. The time allowed between the first and second layer shall not exceed 45 minutes. The first layer of concrete shall be placed and consolidated to the elevation of the reinforcement. The reinforcing units shall then be placed and properly installed and the top layer of concrete immediately deposited. Concrete, adjacent to forms and joints, shall be thoroughly spaded or vibrated. Over vibration or manipulation causing segregation will not be permitted. Concrete shall be Class AA (AE) as specified in Table I, Division 3, Section 3A.

2-E.12 JOINT FILLER Materials shall comply with the following Federal Specifications, designated by symbols:

(a) Poured: SS-S-164, For expansion and control joints

(b) Preformed: HH-F-341a, For expansion joints.

(c) Coal-tar felt: HH-K-595., a double thickness in construction joints.

2-E.13. CONCRETE DRIVEWAYS AND PARKING AREAS Concrete driveways and parking areas shall be 6 inches thick and reinforced; formed to the required contours; with construction joints where shown and at intercepting gutter, separate curbs and combined curb and gutter; with 3/4 inch expansion joints not over 90 feet apart, at property line in driveway entrance and at contacts with building walls, walks, steps; and marked off with control joints into areas not over 225 square feet between joints.

2-E.14 CEMENT FINISH Exposed concrete surfaces shall have an integral, floated finish. The work shall proceed without interruption so that exposed concrete will be finished the same day it is poured in place. Formed surfaces that are exposed after the forms are removed shall be given a rubbed finish. At grade lines, the finish shall extend 2 inches below grade. All edges at joints and margins shall be finished to true, continuous lines with jointing and edging tools.

Information Handling Services, 1999
August 12, 1999 05:44:57

Driveways and Parking areas shall be floated to uniform surfaces after surface water has receded and a matte surface appears on top surface of the slab. As soon as practicable after floating is finished the surface shall be coarse broomed at right angles to the direction of traffic.

The finished work shall permit drainage of water from its surfaces at all points.

2-E.15 CONCRETE CURING All concrete shall be protected against rapid drying and allowed to cure for a minimum of 6 days. As soon as the work between expansion joints or similar suitable limits is finished it shall be covered with paper (UU-P-264a), or pure polyethelene plastic sheet. .004 inch thick, lapped 3 to 4 inches at joints and held in place with a layer of sand 2 inches thick. During the curing period the sand shall be kept damp enough to prevent dusting. At the end of the curing period the covering and any sand not otherwise used in the work shall be removed from the site.

2-E.16 PROTECTION No traffic shall be permitted on the paved surfaces for a period of 14 days after curing period is completed.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 2 SITEWORK

SECTION 2F

TOPSOIL, SODDING, SEEDING AND PLANTING

2-F.1 REQUIREMENTS The work covered by this Section consists of furnishing all labor, materials, tools, equipment, plant and services necessary to complete the portion of Sitework including Topsoil placement, Sodding and Planting specified herein and indicated on the drawings.

2-F.2 TOPSOIL Topsoil stripping and stockpiling on the site shall be completed under Division 2 Section 2A. Under the Section final preparation of subgrade that may be necessary to properly receive topsoil shall be completed before placing topsoil is commenced.

Topsoil shall be properly conditioned at or near stockpiled area before placing and spreading. Conditioning shall consist of adding water in only such quantities that will yeild a uniform smooth workable mass. Any dried and hardened lumps shall be pulverized and mixed into the prepared fill.

After grading, filling and other contract work and operations have been completed to the point where these areas will not be distrubed by any subsequent work, the subgrade shall be cleaned free from waste materials of all kinds, then scarified and pulverized to a depth of 4 inches and graded to remove surface inequalities. The topsoil shall then be placed and spread in a uniform 6" layer and properly graded.

Rolling of topsoil for compaction shall be done with a roller weighing not less than 50 pounds, nor, more than 100 pounds per foot of roller width to the lines, grades and levels required on the drawings and to the minimum thickness specified in this specification.

The subgrade preparation and the placing of topsoil shall be done with damp materials free from trash, rocks and free from frost when the work under this section is done. The work shall be performed by methods recommended and with equipment used in accordance with accepted practice for the work specified in this specification. No work in this section shall be performed under dusty, muddy or freezing conditions.

2-F.3 FERTILIZER AND LIMESTONE Fertilizer shall be spread at a rate per thousand square feet of area of 30 pounds of commerical fertilizer 5-10-5.

Ground limestone at a rate of 400 pounds to 500 pounds per thousand square feet shall be uniformly spread if required by soil condition.

Information Handling Services, 1999
August 12, 1999 05:44:57

Fertilizer and limestone shall be placed over all areas to be finished with sod or seeded and shall be mixed into the pulverized soil to a depth of 2 inches before sod is placed and seeding is commenced.

2-F.4 SODDING Sod shall be obtained from areas having growing conditions similar to areas to be covered. Sod shall have a clean growth of same grass mixture as called for in Seeding, reasonably free from weeds, with not less than 1-1/2 inches of soil firmly adhering ot the root system. Cutting shall be in rectangular strips, of equal width and size to permit being lifted, placed and rolled without breaking. If the soil is dry, sod shall be watered sufficiently to moisten the soil to the depth at which the sod is to be cut.

Immediately before sod is to be placed the work area shall be well watered. Sod shall be laid without voids with strips tightly abutted and rolled firmly in place. After rolling is completed a layer of screened clean topsoil shall be spread over the entire sodded area. The topsoil layer shall be broomed to fill all joints between strips and minor openings and then thoroughly watered.

Sod shall be laid on all areas which are distrubed by construction.

2-F.5 TRANSPLANTING The Contractor shall move existing trees and shrubs designated on Drawings for utilization elsewhere on project from original location prior to construction operation. If such plants cannot be set in final locations, ball securely, platform, and store temporarily in a protected location; protect balls from drying winds and sun by packing in peat moss or leaf mold; individual tree balls shall be performed in accordance with standard nursery practices, including watering, and prevention of loss of essential feeding roots or injuries to bark, branches or roots.

2-F.6 EXISTING TREES TO REMAIN Where existing trees are designated on Drawings as trees to remain; they shall be protected by fencing around the area beneath the spread of branches, defining the area for tree root protection. No material shall be stored and no activity is permitted within the fenced area, except as may be necessary to facilitate work of seeding, or the installation of utility lines. Water shall not be permitted to pond within the fenced areas. Infected existing trees shall be sprayed to prevent spread of disease or insect pests to new plantings. Materials and methods used shall not cause injury to persons or structures.

2-F.7 PRUNING AND REPAIR Upon completion of work under this contract. the contractor shall prune all trees and repair all injuries. The amount of pruning shall be limited to the minimum necessary to remove dead or injured twigs and branches and to compensate for loss of roots as a result of transplanting operations. Pruning shall be done in such a manner as not to change the natural habit ot shape of plant. All cuts shall be flush, leaving no stubs. On all cuts over 3/4 inch in diameter and bruises or scars on bark,

Information Handling Services, 1999
August 12, 1999 05:44:57

the injured cambium shall be traced back to living tissue and removed; wounds shall be smoothed and shaped so as not to retain water; the treated area shall be coated with an approved tree paint.

2-F.8 SEEDING (When required)

(a) The area to be seeded shall be pulverized to a depth of not less than 6 inches and raked to remove all hard lumps of soil that cannot be raked into the fines of the top surface. Pulverizing shall be done with adjusted soil moisture content to allow proper shaping and a suitable planting surface. No work under this heading shall be done under dusty, muddy or freezing conditions.

(b) Soil conditioning shall consist of spreading 30 pounds of commercial fertilizer, 5-10-5, per thousand square feet of area. Ground agricultural limestone at a rate of three hundred to four hundred pounds per on thousand square feet of area, evenly spread after fertilizer is applied.

(c) Fertilizer and limestone shall be raked and mixed in the top two inches of the pulverized surface immediately before seeding is started.

(d) When area to be seeded is prepared as above a seed mixture of 95 percent (95%) Kentucky Blue grass and 5 percent (5%) white clover nurse crop shall be uniformily distributed at a rate of not less than 8 pounds of the seed mixture per thousand square feet of area; fifty percent sown in one direction and the remainder in the opposite direction and right angles to the first sowing. Cover seed lightly by raking and compacting soil bed by rolling with a water ballast hand roller.

(e) Seed quality of mixture specified above shall meet the requirements of the Federal Seed Act if carried by interstate commerce, or the requirements of the State Seed Laws if procured locally. Containers shall be labeled by the supplier that all requirements applicable have been complied with.

Label shall state the maximum percentage, by weight, of pure seed and germination, and the maximum percentage of weed seed of the contents of each container.

Seed which fails to equal or exceed the minimum requirements listed below shall be rejected and removed from the site:

1. Kentucky Blue Grass

Pure Seed	80.50 percent
Germination	72.0 percent
Weed Seed	1.49 percent

Information Handling Services, 1999
August 12, 1999 05:44:57

2. White Clover

Pure Seed	94.0	percent
Germination	83.0	percent
Weed Seed	1.49	percent

The above requirements shall apply whether seed is used alone or as a mixture in the proportion specified above.

2-F.9 MAINTENANCE

(a) General The Contractor shall be held responsible for the maintenance of all work and parts thereof, under this Section, prior to the issuance of the Certificate of Final acceptance, or, until a time when he would be relieved of that responsibility by the Resident Engineer, in writing. No trees or shrubs, new plants, relocated or transplanted existing plants, sod or planted areas will be accepted unless they show a healthy growth and satisfactory foliage and bark condition.

(b) Requirements Maintenance shall include watering, cultivations, pruning, weeding, spraying, mowing, cleaning up and other work necessary to proper and thorough maintenance.

Maintenance work shall be performed by workmen familiar with the recommended practices of the American Association of Nurserymen as they apply to the work herein.

2-F.10 REPLACEMENTS

(a) General Any trees, shrubs, sod or other planting, affected by the work under this section, that are found not to be in a healthy conditon during the normal growing period following the planting thereof shall be removed from the site by the Contractor.

(b) Any trees, shrubs, sod or other planting removed from the site in accordance with (a) above shall be replaced by healthy plants of same kind as those removed.

(c) Replacements shall be made during the next available planting season upon a written notification by the Contracting Officer or his Resident Engineer.

2-F.11 CLEANING UP

(a) The Contractor shall remove from the site subsoil excavated as a result of his work and all other debris, including but not limited to branches, rocks, paper and rubbish in all work areas affected herein.

(b) All work areas shall be kept in a neat and orderly condition by the Contractor to the satisfaction of the Resident Engineer.

Information Handling Services, 1999
August 12, 1999 05:44:57

2-F.12 COORDINATION No part of the final work under this Section shall be commenced until all utilities, curbs, walks and all other trades have completed their work as affected herein.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 3 CONCRETE

SECTION 3A

POURED IN PLACE CONCRETE

3-A.1 REQUIREMENTS The work covered by this Section consists of furnishing all labor, materials, plant, tools, equipment, accessories and services ncessary to complete the poured in place concrete work required by the drawings and specified herein.

Concrete driveways, paving and curbs are in Division 2, Section 2-E of the Specifications.

Full cooperation shall be given other trades to install embedded items. Suitable templates or full instructions, or both, shall be provided for setting items placed in the forms. Embedded items shall have been inspected, and approved, tests for concrete and other materials and for mechanical operation shall have been approved by the Resident Engineer before the concrete is placed.

Where standards such as ACI, ASTM or Federal Specifications are referred to hereinafter, the edition in effect on the date of the invitation for bids shall govern this project in accordance with paragraph 1-D.4 of these Specifications.

All concrete construction, except where otherwise specified hereinafter shall comply with the American Concrete Institutes' "Building Code Requirements for Reinforced Concrete" (ACI-318-63) with proposed revisions and amendments.

Concrete may be either ready-mixed or job mixed. All ready-mixed concrete shall be in strict accordance with "Specifications for Ready-Mixed Concrete", ASTM Designation C94, except as hereinafter modified and specified. The use of non-agitating type of transportation equipment shall be used only upon written permission of the Resident Engineer.

No concrete shall be placed before conduits, sleeves, inserts, etc., are in place, nor before forms, reinforcing and affected work of other trades have been approved by the Resident Engineer. The Contractor shall give due notice to the Resident Engineer and to all contractors affected as to when concrete will be placed and shall allow adequate time for installation of all necessary parts.

Information Handling Services, 1999
August 12, 1999 05:44:57

No concrete shall be placed except when the Resident Engineer or his staff is present. This requirement may be waived by the Resident Engineer on pours of non-structural nature. Waiver shall be issued by the Resident Engineer in writing.

3-A.2 MATERIALS

(a) Cement may be either Type I or III Portland Cement meeting the requirements of ASTM Designation C150. Air entraining agent conforming to the requirements of ASTM Designation C260 shall be added to normal Portland cement at the mixer when air entrained concrete is required. Air entraining agent used shall be compatible with the cement used. The temperature of cement shall be not over 170 degrees F. at the time of use. The Contractor shall furnish certificates of mill tests of cement he proposes in the work to the Resident Engineer.

The total amount of entrained air produced in the concrete by air entraining agent shall be between 5% and 7% by volume of concrete when measured by the Methods of Test for Air Content of Freshly Mixed Concrete, ASTM Designation C173 (Volumetric) or ASTM Designation C231 (Pressure). Contractor shall make air content tests when requested by the Resident Engineer.

All concrete work which will be exposed to freezing and thawing shall be constructed of air-entraining concrete.

(b) Fine aggregate shall conform to Federal Specification SS-A-281b, Class 1, Natural sand, stone sand or slag sand. Sand for applied cement finish, cement base, coves, thresholds and similar cement work shall all pass a No. 4 screen and shall meet the following screen analysis:

Retained on a No. 8 screen	-	0 to 5 percent
Retained on a No. 16 screen	-	5 to 30 percent
Retained on a No. 30 screen	-	30 to 60 percent
Retained on a No. 50 screen	-	65 to 85 percent
Retained on a No. 100 screen	-	95 to 99 percent

(c) Coarse aggregate shall conform to Federal Specification SS-A-281b, Class 2, unless otherwise specified. Sizes shall be as follows:

All concrete not otherwise specified: 3/4 inch to No. 4

Fill under structural slabs: 1/2 inch to No. 4

Information Handling Services, 1999
August 12, 1999 05:44:57

(d) Tests Three copies of each test report on aggregates made by an approved testing laboratory employed by the Contractor shall be sent to the Resident Engineer.

(e) Water used shall be clean and free from organic matter and from detrimental amounts of alkalies, acids, or other deleterious substances.

(f) Admixtures, except air-entraining agents, to be used to alter the normal properties of concrete, either for densifying, cement dispersion, retarding, accelerating, plasticizing, coloring or water-proofing, shall be used only upon the written permission of the Resident Engineer. Acceptable evidence may be presented on the material proposed for use, showing that the material will perform in the manner claimed and that no adverse effect to concrete as to strength, coloring, appearance and durability will result.

(g) A water reducing, retarding admixture will be required in the concrete for the floor and roof slabs when the air temperature at the time of placing is 80 degrees F. or above. The following requirments must be met as compared to reference concrete without retarding admixture.

1. For equal slump, the compressive strength at 28 days shall be higher.

2. Initial set shall be delayed at least 20 percent at temperatures of 70-75 degrees F. Initial time of set shall be considered as the time required for the concrete mortar to reach a penetration resistance of 500 p.s.i. determined in accordance with ASTM Designation C403.

3. The durability factor for the freezing and thawing test shall be not less than 80.

On the basis of data furnished by the manufacturer, indicated relationship between temperature of mix, quantities of admixture, and time of initial set shall be satisfactory to the Resident Engineer.

The Contractor shall be responsible for providing the Resident Engineer with manufacturer's data required for evaluations as indicated above and determination of quantities of admixture for job conditions.

Information Handling Services, 1999
August 12, 1999 05:44:57

(h) Reinforcing steel shall be billet steel, conforming with the requirements of Designation A-615 Grade 60. All bars larger than 1/4" diameter shall be deformed. Contractor shall provide mill tests of all reinforcing steel proposed for use in the work.

(i) Welded wire fabric or cold-drawn wire for concrete reinforcement shall conform with the requirements of ASTM Designation A185 (welded wire fabric) or A82 (cold drawn wire).

(j) Storage Cement and other concrete materials stored at the site or batching plant shall be stored in such manner as to prevent deteriorations, intermixing, segregation, or the intrusion of foreign matter. Provide for free drainage. Any material which has deteriorated or has been adulterated or damaged in any way shall not be used for concrete.

3-A.3 CONCRETE MIX DESIGN

(a) All concrete shall be designed in accordance with the ACI "Recommended Practice for the Design of Concrete Mixes" (ACI-613) to produce the strength for each class of concrete called for on the plans and with slumps in accordance with the requirements hereinafter specified.

(b) Strength

TABLE I

Class	Compressive strength at 28 days - lbs./sq. inch
A	3,000
A(AE)*	3,000
AA	4,000
AA(AE)*	4,000

*(AE) Air-Entraining Concrete

(c) Maximum Slumps for Various Types of Construction:

Type of Construction	High Frequency Vibrator used - Maximum
Exterior Walls, Footings, floor slabs, and retaining walls	3" ± 1"

Information Handling Services, 1999
August 12, 1999 05:44:57

Type of Construction	High Frequency Vibrator used - Maximum
Other slabs, walls, beams and miscellaneous items	4" ± 1"
Building Columns	4" ± 1"
Pavements	3" ± 1"

Slump shall be determined in accordance with the ASTM Designation C143. Slump cone shall be furnished by the Contractor. Slump tests may be ordered by the Resident Engineer at any time during the progress of the work.

(d) The Determination of the proportions of cement, aggregate and water to attain the 28 day design strengths of the different classes listed above shall be made by an approved independent laboratory, concrete engineer or technician employed by the Contractor. Prior to the beginning of concrete work, a statement of the proportions proposed for the concrete mixture shall be submitted. This shall be accompanied by a certified test report from an approved testing laboratory, showing for the 7 and 28 day concrete strengths obtained when using the materials approved for the work. The strength determinations shall be based on not less than three concrete test specimens for each age and for each water content. The maximum allowable water content for concrete of each class shall correspond to a strength which shall be at least 15% greater than the specified strength. No concrete shall be placed in the work until all information has been furnished to the Resident Engineer including 28 day concrete strengths for the different mixes which are to be used on the job.

(e) In the event that the Contractor furnishes adequate certified test records showing slumps and strengths of concrete made with materials from the same sources as the approved materials and of the same quality as specified in connection with other work, the strength determination tests required in Paragraph (d) above may be waived by the Resident Engineer.

(f) If, during the progress of the work, the Contractor desires to use materials other than those originally approved, or if the materials from the sources originally approved change in characteristics, he shall submit evidence satisfactory to the Resident Engineer that the new combination of materials will produce concrete meeting the strength requirements and will not bring about objectionable changes in the color or appearance of the structure.

Information Handling Services, 1999
August 12, 1999 05:44:57

(g) The proportions of aggregates to cement for all concrete shall be such as to produce a mixture which will work readily into corners and angles of the forms and around reinforcement without permitting the materials to segregate, or free water to collect on the surface.

(h) Method of measurement for concrete materials, except water, shall be by weight. The accuracy of all weighing or measuring devices shall be such that successive quantities can be measured to within 1% of the desired amount.

3-A.4 TESTS ON CONCRETE

(a) At least one set of test specimens for each class of concrete shall be taken from each 150 cubic yards of concrete or fraction thereof placed each day. One set of specimens shall consist of six cylinders, of which three cylinders shall be tested at 7 days and three at 28 days. The exact location of the concrete in the work represented by each set of specimens shall be recorded and shown on the test reports.

(b) Samples of concrete for test specimens, unless otherwise directed by the Resident Engineer, shall be taken at the mixer or in the case of ready-mixed concrete, from the transportation vehicle during discharge. Sampling shall be in accordance with ASTM Designation C172.

(c) All sampling, molding, and sealing of all test specimens shall be performed in the presence of the Resident Engineer or his representative, except when the Resident Engineer specifically authorizes their making at another time. They shall be made by a representative of an approved laboratory, a concrete engineer or technician, or other qualified person employed by the Contractor responsible for the strength of the concrete. Test specimens shall be made in accordance with ASTM Designation C31.

(d) The Resident Engineer reserves the right to order test specimens made at any time during the progress of the work.

(e) Specimens shall be placed in a protected box or container furnished by the Contractor and kept 24 hours under moist curing conditions at approximately 70 degrees F. then transported or shipped by the Contractor to the testing laboratory where they shall be kept under moist curing conditions until of the age required for testing.

Information Handling Services, 1999
August 12, 1999 05:44:57

(f) A strength test value shall be of the average value of three specimens of each set for each test age being considered. If one specimen in a test shows manifest evidence of damage, improper sampling, molding or testing, it shall be discarded and the remaining two strengths averaged. Tests shall be performed by the approved laboratory in accordance with ASTM Designation C39.

(g) Upon establishment of relationship between 7 day and 28 day strengths, the 7 day test results may be used as an indication of probable 28 day strengths. In cases where strength tests of the 7 day cylinders fall below the strength as determined by this relationship, the Resident Engineer shall have the right to order changes in proportions or materials or both as may be necessary to secure the desired properties of strength and workability. Any changes so ordered shall be made at the Contractor's expense and no extra compensation will be allowed.

(h) To conform to the requirements of these specifications, the average of all of the 28 day strength tests representing each class of concrete, as well as the average of any five consecutive strength tests representing each class, shall be equal to or greater than the strength specified for the class of concrete being tested and no one strength test shall test below 85% of the strength being specified for the class of concrete under test.

(i) In the event that the concrete fails to meet the requirements of these specifications in any respect, the Resident Engineer may require:

(1) Core samples be drilled in that portion of the structures represented by low strength cylinders and tested in accordance with ASTM Designation C42.

(2) Load test made by an approved testing laboratory on that portion of the structure represented by low strength cylinders.

(j) The Resident Engineer shall have the right to require strengthening or removal and replacement of that portion of the structure failing to pass the load test or tests made on the core samples. Any additional testing, replacement, or strengthening, so ordered for this reason shall be made at the Contractor's expense and no extra compensation will be allowed.

Information Handling Services, 1999
August 12, 1999 05:44:57

3-A.5 FORMS

(a) Forms shall conform to the shape, lines and dimensions of the members as called for on the plans, and shall be substantial and sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together so as to maintain position and shape. Shores shall rest on pairs of wedges or shall be made otherwise adjustable so that settlement during pouring may be taken up at once.

(b) Form ties shall be subject to the approval of the Resident Engineer. Twisted wire ties will not be permitted. Metal wall ties shall be of a type that will permit removal to a distance approximately 1-1/2" from the face of the wall, free from spalling, allowing patching immediately after removal of forms.

(c) The inside of forms shall be coated with non-staining mineral oil or other approved material, or in case of wood forms, they shall be thoroughly wetted (except in freezing weather). Where oil is used, it shall be applied before the reinforcement is placed.

(d) Forms in direct contact with concrete surfaces permanently exposed to view shall be five ply waterproof plywood, or pressed fiber board, unwarped, undamaged and free from other defects, which shall give a uniform pattern and texture to the surface.

(e) Forms, or shores shall be removed at the Contractor's risk and in such a manner as to insure the complete safety of the structure. Forms on vertical faces may be removed as soon as the concrete has hardened sufficiently that it will not be injured, in order to facilitate surface finishing.

(f) Pans shall be an approved type metal or fiber glass reinforced plastic. Fiberglass pans shall be molded under pressure with matched metal dies. Pans shall be in first class condition and sufficiently rigid to prevent accidental crushing or loss of grout. The material used shall insure joists that are straight and of uniform width. Form header joists with end pans shall be used for floor hinge boxes and ceiling electric outlets. Pans shall be removed after expiration of the curing period but no sooner than 7 days after concrete has been placed.

Information Handling Services, 1999
August 12, 1999 05:44:57

(g) The Contractor shall submit to the Resident Engineer for approval a complete layout of concrete pans. This layout shall form the basis for detailing the reinforcing steel as described below.

(h) Forms shall be thoroughly cleaned and repaired before being re-used.

(i) Except as otherwise indicated on the drawings, forms for beams, girders, columns, pilasters and spandrels shall provide for a one inch chamfer on exposed external corners. Chamfers on columns and pilasters and exposed external corners shall finish with a cove or bevel about 8 inches above finish floor and 2 inches above wainscot or steel corner guards.

3-A.6 MIXING AND PLACING

(a) All concrete shall be machine mixed in a batch mixer or other mixing equipment capable of combining aggregates, cement and water into a thoroughly mixed and uniform mass. The concrete shall be mixed at least two full minutes per batch after the last ingredient, including water, has entered the mixer.

(b) Concrete transported in a truck mixer shall be discharged at the job within 1 hour after the water has been added to the cement and aggregate. When high-early strength cement is used, in hot weather, or under conditions contributing to quick stiffening of the concrete, this time may be reduced by the Resident Engineer.

(c) Bottom of excavation shall be level and free from extraneous matter, cave-ins, mud, water, ice, frost etc., immediately previous to pouring. All drains in the area affected shall be made grout-tight with packings.

(d) Before mixing and placing any concrete, all mixing and conveying equipment shall be cleaned and all hardened concrete and foreign materials removed from them.

(e) Placing of concrete shall be done in such a manner as to exclude maximum amount of air and water voids and to work the coarse aggregate into the body of the mass, leaving the surfaces smooth and dense.

(f) Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. No concrete that has partially hardened or been contaminated by foreign material shall be depostied on the work, nor shall retempered concrete be used.

Information Handling Services, 1999
August 12, 1999 05:44:57

(g) All concrete shall be thoroughly compacted by suitable means during the operation of placing, and shall be thoroughly worked around reinforcement, embedded fixtures and into corners of forms.

(h) Concrete in slabs shall be placed to accurately set screeds, grades or levels, so as to insure level or accurately sloped slabs of proper thickness, at the proper elevations.

(i) Vibrators shall be subject to approval by the Resident Engineer and shall be operated by experienced operators.

(j) Concrete deposited in cold weather (40 degrees F. or below), shall have a temperature of not less than 60 degrees F., nor more than 80 degrees F. immediately after placing the forms. Forms shall be free from frost and ice when concrete is placed. After concrete is placed, it shall be protected on all exposed sides by straw, tarpaulins, or other means. Adequate means shall be provided for maintaining a temperature of not less than 50 degrees F. nor more than 75 degrees F. for the duration of the curing period. Methods of heating materials and protecting the concrete shall be approved by the Resident Engineer.

Protection shall continue for a period of at least seven days. Salts or other chemicals shall not be mixed with the concrete for the purpose of preventing freezing. No frozen materials or materials containing ice shall be used. Cooling of the concrete to outside temperature shall be at a rate not faster than one degree per hour for the first day and two degrees per hour thereafter until the outside temperature is reached. Any concrete injured or destroyed by reason of freezing or cold weather shall be replaced by the Contractor at his own expense. This expense shall include the cost of replacing any work embedded in the concrete.

(k) The Contractor shall use tremies to pour the concrete in the drilled-in shafts. Tremies shall consist of steel tube sections not less than 10 inches in diameter. Couplings in tremie tubes shall be screw type joints or companion flange couplings. Tremie construction shall be approved by the Resident Engineer. The top of each tremie shall consist of a sheet steel watertight hopper securely connected to tremie tube. Tremie tube shall be of sufficient length that when set on bottom of excavation where concrete is to be deposited, the hopper shall extend above the ground.

Information Handling Services, 1999
August 12, 1999 05:44:57

Tremie shall be supported to permit the proper filling of the hopper and that the tremie can be raised vertically with a slow movement and lowered rapidly to retard the flow of concrete when required. Concrete shall be placed in the dry. The discharge end of the tremie shall be entirely sealed at all times by being set on the bottom of the excavation or upon deposited concrete with the tremie tube filled with concrete to bottom of the hopper.

When a batch of concrete is dumped into the hopper, the tremie shall be slowly raised but not out of the concrete at the bottom of the tube, and until the batch discharges to the bottom of the hopper; the tremie shall then be quickly lowered to stop the flow of concrete.

If it proves to be unfeasible to keep the bottom of the drilled-in shaft completely free from water, the Contractor will be permitted to pour several inches of concrete seal through standing water. When the seal has hardened, any water standing above it shall be removed and the pouring of the concrete shaft shall proceed immediately.

3-A.7 REINFORCEMENT

(a) The drawings show typical details of all reinforced concrete construction. Detailed drawings showing number and location of bars, including complete bar lists and bending diagrams, shall be prepared by the Contractor and submitted to the Resident Engineer for approval. After sam have been approved, quadruplicate copies shall be furnished to the Resident Engineer for his distribution. Bar bends, supports and accessories not otherwise provided for shall be in accordance with the ACI Detailing Manual (ACI 315).

(b) Oil, scale, rust, dirt, or other coatings that would destroy or reduce the bond shall be removed.

(c) Metal reinforcements shall be accurately placed in accordance with the plans and shall be adequately secured in position by approved metal chairs and spacers. All parts of metal supports within 3/4" of a surface shall be galvanized or plastic coated.

(d) The metal reinforcements shall be protected by the thickness of concrete indicated on the plans.

Information Handling Services, 1999
August 12, 1999 05:44:57

(e) When it is necessary to splice reinforcements at points other than shown on the plans, the character of the splice shall conform to ACI code requirements and approved by the Resident Engineer. Wherever possible, splices of adjacent bars shall be staggered. Adjacent sheets of mesh reinforcement shall be spliced by lapping not less than six inches.

3-A.8 CONSTRUCTION JOINTS Footings shall have no horizontal construction joints; vertical construction joints are permitted only at junctions of wide and narrow sections or midway between concentrated loads or on center lines of structural division.

(a) Walls, Columns and Piers Unless otherwise shown on the drawings, horizontal construction joints in walls, columns and piers shall be one inch below the column head or the deepest horizontal member (including any drop panels and slabs) supported thereby.

(b) Slabs, Joists, Beams and Girders Construction joints in reinforced slabs, joists, beams, girders, etc., shall be perpendicular to the axis or surface of the member, jointed and at the center of the span. If an intersecting member occurs at that point, the joint shall be off-set twice the depth of the intersecting member.

(c) Location Construction joints and control joints that permanently reduce the effective cross section area of the concrete shall be located where required by the drawings and constructed as shown.

(d) Metal Strips Where metal strips other than steel are required in the joints, they shall be of corrosion-resisting steel or of non-ferrous metal other than aluminum.

(e) Sealing Materials Materials for caulking and filling the joints shall comply with the following applicable Federal Specifications: Preformed (premolded) Filler; HH-F-341a. Poured Fillers: SS-S-164. Plastic Caulking Compound: TT-C-598. Coal Tar Felt: HH-R-595 (Construction joints).

3-A.9 BONDING NEW CONCRETE TO OLD

(a) Wherever new concrete is to be bonded to old concrete, the Contractor shall coat the old concrete with a polysulfide epoxy adhesive just prior to placement of the new concrete.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) The adhesive shall consist of a two-component liquid polysulfide/epoxy compound of one of the following: Resiweld 7680, manufactured by H.B. Fuller Company, Linden, New Jersey; Thiobond, manufactured by Steelcote, St. Louis, Missouri; Thiopoxy 63-Grout, manufactured by A.C. Horn Products Division, W.R. Grace & Company, Cambridge, Massachusetts, or equal.

(c) The old concrete surface to be bonded shall be cleaned, using brush hammers, or wire brushes, sandblasting or other methods recommended by the manufacturer of the adhesive. All loose or unsound concrete shall be removed. Any grease or oil present shall be removed by washing with a detergent such as tridodium phosphate, followed by thorough rinsing with clean water. If the detergent is not required, washing will be required only to the extent necessary to remove dust and small particles not removed by other cleaning methods.

(d) The adhesive shall be applied in strict accordance with the recommendations of the manufacturer. New concrete shall be placed while the adhesive is still tacky.

3-A.10 SLABS ON GRADE The elevations of the tops of the structural slabs in relation to the finished floor levels shall vary with the kind of floor finish as shown on the drawings or specified.

(a) Finish Concrete slabs or fill required to be finished as cement finish floor, or which are to receive applied finish flooring materials, shall be struck off to a true and even plane, using screeds of the proper depth and spaced not more than 8 feet apart. The slab shall slope to floor drains where required. The concrete shall be finished as specified below.

(b) Clay Tile Concrete under clay tile set in mortar shall be well tamped and struck off to a true, even surface 2 inches below the finished floor level.

(c) Resilient Floor Tile Concrete under resilient floor tile shall have a steel trowel integral cement finish which shall be finished true, level, cured and allowed to become dry before the tile covering is laid. The surface shall be at the finished floor level.

Information Handling Services, 1999
August 12, 1999 05:44:57

(d) Concrete Mud Sill A concrete mud sill slab shall be provided over the coarse fill under interior concrete slabs on grade in accordance to the requirements on the Drawings and specified in these Specifications.

Coarse fill shall be checked for correct elevation, adequate compaction and level surface. Coarse fill shall be saturated with water without ponding immediately before concrete is placed.

Temporary screeds shall be provided at not more than 8 feet on centers and at a height to provide a uniform concrete slab 2 inches in thickness. Remove temporary screeds and fill voids when each section is poured.

Concrete shall be Class A(AE) finished with a float finish suitable to receive membrane waterproofing specified under Section 7D of these Specifications.

3-A.11 FINISHES Cement finishes shall bond perfectly with the underlying concrete and be finished to true, even lines and surfaces and left free from defects. Joints and edges shall be straight and true to a line, finished with jointing and edging tools. Finish in connection with safety treads, corner bars, frames, etc. shall be flush with the metal unless shown otherwise. Interior cement finish shall be troweled smooth and exterior cement finish shall be floated, except vertical surfaces shall be finished smooth after the forms are removed, unless shown otherwise on the drawings.

3-A.12 EXTERIOR ARCHITECTURAL (Smooth Finish) All exposed concrete surfaces on the outside of the building shall be of uniform color and shall have a smooth finish treated as specified herein:

(a) Cleaning After the concrete has hardened, it shall be scrubbed with wire brushes and washed with a 10 percent solution of commercial muriatic acid. When effervescing ceases, rinse with a hose to remove all traces of acid. Allow excess water to dry from the surface.

(b) Finish After cleaning the surface to be finished apply a grout composed of 1 part of Portland cement and 1 part of clean, fine sand; the grout to be worked into the surface of the concrete with cork floats or fiber brushes until all pits, and honeycomb recesses and other indentations are filled. After the grout has hardened slightly, but while still soft enough to do so, it shall be scraped off with the edge of a steel trowel or similar tool and,

Information Handling Services, 1999
August 12, 1999 05:44:57

about one hour later, the concrete shall be rubbed vigorously with burlap to remove any excess grout remaining on the surface.

(c) Non-Slip The platforms and treads of cement steps and stairs with or without safety treads, both interior and exterior, shall be made non-slip by embedding in the surface an abrasive aggregate of aluminum oxide Al_2O_3 applied uniformly at the minimum rate of 2-1/2 pounds per square yard. The aggregate shall pass a 1/8 inch mesh and be retained on a 1/32 inch mesh.

(d) Grade Cement finish at grade shall extend 2 inches below finish grade. Horizontal surfaces shall grade uniformly to drain all surface water away from building walls.

(e) Integral Finish Integral finish shall be produced without a separate topping or finish coat. The concrete shall be struck off to true surfaces at the proper elevations. As soon as any excess water has disappeared from the surface, the concrete shall be thoroughly compacted with floats or tampers to force the coarse aggregates below the surface, the concrete shall then be finished as specified. The work shall proceed without interruption so that all concrete will be finished the same day that it is placed. Except where applied finish is indicated on the drawings or required on the specifications, interior cement finish shall be integral. The exposed horizontal surfaces of exterior concrete shall not change the over-all thickness or other dimensions of the work as required by the drawings.

(f) Imperfections Imperfections, on exposed concrete, that require filling, pointing, or patching, or the restoration of broken corners on arises, shall first be inspected and passed upon by the Resident Engineer, then be corrected to conform with the contract requirements.

Holes left by tie rods shall be filled solid with cement mortar to a depth of at least 1-1/4 inches; the mortar to be struck off slightly higher than the face of the concrete. The mortar mix shall be determined by trial and error method and white Portland cement shall be mixed with the grey Portland cement as necessary to produce the required color. After the mortar has attained its initial set, the patch shall be scraped or rubbed flush with the concrete and shall match the color and texture of the adjacent cement surface.

Information Handling Services, 1999
August 12, 1999 05:44:57

Fins and burrs shall be removed by mechanical means or rubbed out with corborundum stones.

3-A.13 CURING Protect all concrete and cement work against frost and rapid drying and keep moist for at least six days after placing. Concrete from which forms are removed and the cement finish on vertical and overhead surfaces, shall be sprayed during the curing period as frequently as drying conditions may require and, if necessary, protected by suitable temporary covering.

(a) Covering Cement finish on horizontal surfaces shall be covered with mats (DDD-M-148), or paper (UU-P-264a), or reinforced polyethylene, .006 minimum thickness, within 24 hours after finishing. The covering shall be lapped at joints and taped to remain in position for at least 10 days after finishing. On interior floors the protection shall be maintained in good condition until the installation of the permanent floor covering.

(b) Protection Against Rain In case of inclement weather, freshly placed concrete shall be protected against infiltration of external water. The placing of concrete shall terminate against the nearest bulkhead at a construction joint and covered with tarpaulins until concrete is set.

(c) Protection from Cold When placing concrete at or below a temperature of 40 degrees F., or whenever in the opinion of the Resident Engineer atmospheric temperatures will probably fall below this limit within 24 hours after placing concrete, either the mixing water or aggregates or both shall be heated and the freshly placed concrete protected by adequate housing or covering and heating.

The concrete shall have a temperature of not less than 70 degrees F., nor more than 100 degrees F., when placed and shall be maintained above 50 degrees F., for at least 4 days after placing. The use of salts, chemicals or other foregin materials in the mix to lower the freezing point of the concrete is prohibited.

When stripping during cold weather, concrete must not be submitted to thermal shock with maximum temperature drop as specified in "Recommended Practice for Winter Concreting" ACl-604 and ACl-306.

Information Handling Services, 1999
August 12, 1999 05:44:57

When temporary space heaters are used strict fire prevention methods and safety rules shall be enforced. Full time attendant shall be provided during the periods when heating is required on a 24 hour day basis, at the Contractor's own expense.

Space heaters shall be spaced in a manner that a uniform temperature is maintained in the areas to be protected. No heating unit shall be so located that blast of excessive temperature will overheat or dry out the concrete abnormally. When dry heat is used, means of maintaining atmospheric moisture shall be provided. When tarpaulins are used to enclose the work, during heating periods, the top should be arranged to allow ballooning at the top in a manner that will provide free circulation of heated air on all sides of concrete.

(d) Protection From Hot Weather Hot weather protection for all concrete shall be in accordance with ACI-605, "Recommended Practice for Hot Weather Concreting". When site temperature and atmospheric humidity become adverse to proper curing of the concrete, the Contractor shall provide the necessary means and provisions required by the above named document until the concrete has reached a safe stage in the curing process.

3-A.14 HARDENER After the specified curing period and as soon as practicable after the concrete and cement finish have become dry, all interior concrete floors shall be treated with an aqueous solution containing not less than 2 pounds of magnesium fluosilicate and zinc fluosilicate crystaline salts per gallon of solution. Not less than 0.5 pound of salt content shall be zinc fluosilicate. The liquid shall be delivered ready for use and in the original containers bearing the manufacturer's registered brand and trademark.

(a) Application The surface to be treated shall be clean and dry. Apply hardener evenly and freely in three coats, allowing at least 24 hours between coats. For the first coat, one part hardener to 3 parts water; second coat, one part hardener to 2 parts water; third coat, one part hardener to one part water. Apply at the rate of one gallon to each 100 square feet of floor surface for each coat.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) Clean-up After the final action is completed, any surplus material shall be removed from the surface by scrubbing or mopping with clear water, leaving the cement work clean and without discoloration.

3-A.15 CONCRETE WALKS AND CURBS All concrete walks and curbs shown on the drawings are included herein. Concrete materials shall be same as specified herein; Class AA(AE) concrete Table I of this Section of the Specifications.

(a) Subgrade Subgrade for exterior concrete walks and curbs shall be graded and compacted parallel to the lines of the finish grades and lines. Any soft spots shall be dug out, filled with suitable subgrade material and compacted same as prepared adjacent subgrade.

(b) Base-Courses On the subgrade a foundation base course shall be provided as follows:

(1) Street Curbs: A course of Class A concrete 12 inches wide and 6 inches thick, so placed as to center on the curbs.

(2) For Separate Curbs: A layer of crushed rock backfill 12 inches wide and 8 inches thick, tamped and graded; the back-fill to center on the curbs.

(3) For Concrete Walks and Gutter: A layer of crushed rock backfill 4 inches thick compacted by tamping or rolling and accurately graded to the required elevations.

(c) Reinforcement For concrete walks and any steps in connection therewith; 6" x 6" mesh of No. 10 wires, 4" x 4" mesh of No. 12 wire, welded steel wire fabric, unless shown otherwise on the drawings.

(d) Dowels and Tiebars Dowels and tiebars shall be plain steel bars. For dimensions, locations and spacing, see the applicable drawings. Slip dowels shall be coated with flake lubricating graphite, SS-G-659. Dowels in expansion joints shall be bonded at one end only and the free end shall be provided with a close fitting, closed end sleeve of ample strength for the purpose. Tie bars shall have both ends fixed and bonded.

Information Handling Services, 1999
August 12, 1999 05:44:57

The dowels in each joint shall be exactly parallel to the surface and center line of the slab or curb. The bars shall be held in position by metal devices and will be left in the concrete and set so firmly that their positions cannot be altered by the concrete placing operations.

3-A.16 CONCRETE SIDEWALKS Unless otherwise shown, on the drawings, walks shall be 4 inches thick; marked off with surface joints into squares or rectangles of approximately 16 square feet; with control joints maximum 16 feet apart; with 1/2 inch thick expansion joints not over 40 feet apart and at intersections with other walks, structures and pavement where indicated on the drawings.

(a) Concrete Curbs and Gutters shall have expansion joints to line up with abutting control joints and expansion joints in driveways, parking areas, and walks, with intermediate construction joints not over 10 feet apart. Integral curb shall be poured with the slab and the slab reinforcement shall extend up into the curb.

(b) Cement Finish Exposed concrete finish shall have an integral, floated finish. The work shall proceed without interruption so that exposed concrete will be finished the same day that it is placed. Formed surfaces that are finally exposed shall be given a rubbed finish after forms are removed. Rubbed surface shall extend 2 inches below finish grade. All edges at joints and margins shall be finished to true, continuous lines with jointing and edging tools. Concrete walks shall be floated to a fine-grained surface, and as soon as practicable, followed by a coarse brooming at right angles to the direction of traffic.

(c) Curing All walks, and curbs shall be protected from rapid dryout and by covering as specified in 3-A.13 with the following items of protective work added thereto: over the covering provide a 2" layer of sand to hold covering in place. The sand layer shall be kept moist by sprinkling for a period of not less than 10 days after placing the concrete.

(d) Clean-Up All forms, stakes, lumps, or hardened concrete spill, and debris shall be removed; all forms and stake voids tamped and compacted same as adjacent surface after the finishing and curing is completed.

Information Handling Services, 1999
August 12, 1999 05:44:57

3-A.17 MISCELLANEOUS REQUIREMENTS

(a) Concrete Delivery

(1) Concrete mixed off site shall be prepared in a mixing plant equipped with automatic measuring or weighing devices that comply with the requirements in the latest edition of: "Recommended Practice for Measuring, Mixing and Placing Concrete" (American Concrete Institute 614) and approved by the Resident Engineer.

(2) Ready Mixed shall be completely prepared at the mixing plant in accordance with the requirements of the design mix prepared for this work and approved by the Resident Engineer. Mixing and delivery of concrete shall comply with the requirements of this specification and in accordance with the latest edition of: "Standard Specifications for Ready Mixed Concrete" (ASTM C-94) and approved by the Resident Engineer.

(3) Transit Mixed Concrete shall be dry mixed at the mixing plant in accordance with the requirements of the design mix prepared for this work and approved by the Resident Engineer. Transporting of dry materials and addition of water in transit, or at the site, shall comply with the requirements of this specification and in accordance with the latest edition of:

"Truck Mixer and Agitator Standard of the Truck Mixer Manufacturers Bureau" (National Concrete Association Ref. 51), and,

"Standards for Operation of Truck Mixers and Agitators" (National Concrete Association Ref. 52), and approved by the Resident Engineer.

(4) Delivery Certificate is required for each unit or load of concrete delivered to the job site. The standard delivery form used by the mixing plant is acceptable if it provides spaces for the following:

A. Name and address of the mixing plant.

B. Date of Delivery

Information Handling Services, 1999
August 12, 1999 05:44:57

C. Time leaving plant

D. Time arrival at site

E. Time water added

F. Time load discharged

G. Truck or unit number

H. Signature of driver

I. Class of mix

J. Size of batch

K. Proportion of ingredients per cubic yard

L. Type of admixture (if any is used)

(b) Floor Slab Surface Control

1. Where interior partitions and walls are constructed on top of concrete floor slab, plane tolerance is limited to 1/4 inches on 16 feet. Strike-off screeds shall be set to a line offset not more than 16 inches from face line of partition.

(c) Floor Slab Topping

(1) Second floor concrete slab shall be placed over steel decking as indicated in the drawings. Slab shall be 2-1/2 inches thick and reinforced with 6 x 6 - 10/10 welded wire mesh. Integral steel trowel finish.

(2) Bridge floor concrete slab shall be placed over steel decking as indicated on the drawings. Slab shall be 2-1/2 inches thick and reinforced with 6 x 6 - 10/10 welded wire mesh. Integral steel trowel finish.

(3) Concrete for Second Floor and Bridge Floor slab shall be Class AA , Table I of these specifications.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 3 CONCRETE

SECTION 3B

PRECAST CONCRETE UNITS

3-B.1 REQUIREMENTS

(a) The work covered by this Section consists of furnishing all materials, labor, plant, tools, equipment, appliances and services necessary to provide and install precast concrete units in accordance with the requirements in the drawings and specifications.

(b) Lifting rings and joint spline bar shall be furnished under Section 5B of the specifications, but, installed under this section of these specifications.

3-B.2 FABRICATION

(a) General Precast concrete units shall be fabricated using Type AA concrete. See Section 3A Page 3A-4 for Concrete Mix Design.

(b) Forming Forms shall be constructed to withstand high frequency vibration and compaction. All external horizontal edges shall have 3/4 inch champer.

On the centerline of top and bottom surface install longitudinally standard 24 guage galvanized anchor slot, true to a line and held in place during placing of Concrete. Lifting ring inserts and rings shall be placed in accordance with the spacings indicated on the drawings.

Install reinforcing as indicated on the drawings and as detailed therein. Reinforcement shall be properly supported in the forms by suspension and side space wires, cross bars and chairs, necessary to maintiàn proper postion of the reinforcement while placing and compacting the concrete.

(c) Placing Concrete Concrete shall be placed as rapidly as practicable without interruption until form is completely filled compacted and finished. Completed units shall not be disturbed, moved or exposed to the elements for 3 days after casting. After forms are removed units shall again be recovered and the curing process continued for a period of 7 days.

Information Handling Services, 1999
August 12, 1999 05:44:57

3-B.3 INSTALLATION

(a) Precast concrete units shall be transported and set in place using equipment with ample capacity to lift and properly postion the concrete units.

(b) Continuous steel spline shall be set in top riglet after unit is in postion and lifting rings have been removed. Steel spline shall be set in place loose without mortar or filler.

(c) Each unit shall be grouted at each end, before succeeding unit is placed. Grout shall consit of a mixture as follows.

1.	Portland Cement	1 Part
2.	Sand	1 Part
3.	Pea Gravel	1-1/4 Parts
4.	Lime (by Volume)	1/4 Part

(d) Acceptable irregularities shall be pointed with Class B Mortar, see Section 4 Page 4B-3.

3-B.4 TOLERANCE

(a) Voids between units when set in place shall be limited to a maximum 1/4 inches.

(b) Pointing shall be done by a mortar of creamy consistancy forced into the joint voids a minimum of 1 inch in depth. Units shall be well wetted before pointing.

3-B.5 FINISHING THE WORK

(a) When all units are in place pointed and cleaned down the Contractor shall install all steel retaining angles, plates or other fastening or anchorage items.

(b) When the installation of all precast concrete panels is completed the Contractor shall clean up the work area affected by his work inside as well as outside of the building.

3-B.6 SHOP DRAWINGS

(a) The Contractor shall submit to the Resident Engineer shop drawings in accordance with the requirements in Section 1-A.5 Special Conditions.

(b) Shop drawings shall indicate all dimensions, reinforcing, lifting devices, inserts and details including the design mix of the concrete to be provided in the fabrication of the precast concrete units.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 4 MASONRY

SECTION 4 A

BRICKWORK AND CONCRETE MASONRY WORK

4-A.1 REQUIREMENTS The work covered by this Section consists of furnishing all labor, materials, tools, equipment, appliances and services necessary to properly install all brickwork and concrete masonry work required on the drawings and specified herein.

Structural Facing Tile is covered in Section 4C.

For the materials, proportions and mixing of the motor required herein, see Section 4B.

4-A.2 MATERIALS Materials shall comply with applicable Specifications which are referred to herein by symbol.

a. Face Brick Except as otherwise shown or specified, the brickwork required by the drawings is based on the use of brick averaging 2-1/4 by 3-3/4 by 8 inches in size and the difference between dimensions of any two bricks furnished shall not exceed 1/8 inch for depth and width and 3/16 inch for length. For face brick the difference between any two bricks shall not exceed 1/16 inch for depth and width and 1/8 inch for length. Brick shall be solid or cored, conforming to ASTM C216-62. Every cored brick shall be at least 75 percent solid, holes at right angles to the bed, no holes larger than 1 square inch in cross section, no part of any hole less than 3/4 inch from any edge of the brick, not less than 1/2 inch thickness of material between holes. Modular size brick may be used in this work for proper bonding and coursing, to match existing work.

b. Common Brick ASTM C62-49; solid or cored; Grade H for parapets and for work in contact with earth or backfill; Grade M or better for all other common brickwork. Common brick shall be of dimensions that will lay to the bond of face brick or other units required and selected for this work.

Information Handling Services, 1999
August 12, 1999 05:44:57

c. Sand-Lime or Concrete Brick Sand-Lime brick, SS-B-681, or concrete brick, C55 as modified herein, may be substituted at the option of the Contractor for clay common brick, except in contact with earth or backfill and for facing exposed to the weather. Brick shall be solid, Grade M or better and of the dimension requirements for clay brick. Brick may be recessed on one bed not to exceed 10 percent of the total volume of the brick unit; no part of the recess to be within 1 inch of any edge. Concrete brick shall be high pressure steam cured under a pressure and for a period of time sufficient to produce a stabilized finished product, such that a linear shrinkage thereof from a saturated condition to that after drying to constant weight at 212 degrees F. shall not exceed .05 percent.

d. Face Brick Face brick shall be sound, firm and compact in structure and shall give a clear ringing sound when struck together. Faces and ends that will be exposed shall be uniformly straight and true: free from chips, spalls or loss of proper texture.

1. Color Color and texture is to match existing brick on the control wing. Colors shall be natural colors obtained by burning.Kiln marks shall not show on faces that will be exposed unless such markings are a face characteristic of the approved samples. Ends of the brick shall have the same texture, and color tone as the stretcher face. Slight variations and irregularities that are characteristics of the type of brick required are permissible.

2. Requirements Face brick shall meet the requirements specified for clay common brick, solid or cored, Grade H for absorption and Grade M or better for strength. Any drying agents added to over-wet clays shall be suitable and compatible material; adulterants, such as lime and cement, shall not be used.

3. Tests Face brick shall withstand the following week test for efflorescence or staining; clean the sample bricks and place on end in distilled water 1 inch deep and allow to stand at room temperature for seven days, then dry for 24 hours in a ventilated oven or on a heated radiator. The appearance of efflorescence or of staining which is clearly visible from a distance of ten feet, either during or at the end of the test, shall be sufficient cause for rejection of the brick

Information Handling Services, 1999
August 12, 1999 05:44:57

from which the test samples were selected.

4. Size Face brick not otherwise shown or noted shall be of the size specified. Face brick not of specified size will be considered only when of a size adapted to the requirements of the bonding, jointing and dimensions of the work to be done.

e. Concrete Masonry Units Concrete masonry units shall conform to the applicable ASTM Specifications as specified herein, except that the moisture content of the units at time of delivery to the building site shall not exceed 30 per cent of the maximum absorption value of the units, when tested as specified in ASTM Designation C90-Grade A. Units shall be thoroughly cured before shipment, free of any deleterious matter that will stain plaster or corrode metal. When tested in accordance with ASTM C426 and a maximum linear shrinkage of .030 from saturated to oven dry conditions when tested as in accordance with this specification. Concrete masonry units shall be standard 7-5/8 inches high by 15-5/8 inches long, thickness (width) as indicated in the drawings, and such special sizes, shapes and units as may be required. Maximum moisture contents at time of delivery shall be 30%. Units that are to receive plaster or other finish applied with mortar shall have a rough texture. Units that are exposed or painted in the finished work shall have a smooth texture.

1. Load Bearing Units Units shall conform to ASTM Designation C90-59.

2. Non-Load Bearing Units Units shall conform to ASTM Designation C129-59. Units shall be made with concrete weighing not more than 120 pounds per cubic foot.

3. Solid Load Bearing Units Units shall conform to ASTM Designation C145.

4. Concrete Building Brick and Split Block Units shall conform to ASTM Designation C55.

5. Tests Specimen units for testing will be taken from regular deliveries, by the Resid. Engineer, when unit tests are necessary, in his opinion.

f. Horizontal Joint Reinforcement Horizontal joint reinforcement shall be of a prefabricated factory formed type and made

Information Handling Services, 1999
August 12, 1999 05:44:57

of cold-drawn steel wire meeting the requirements of Standard Specifications for Cold-Drawn Steel Wire for Concrete Reinforecment; ASTM Designation: A82, zinc coated before fabrication. The reinforcement shall consist of two parallel longitudinal members, not less than No. 9 nor more than No. 6 gauge in size, connected together with welded cross wires not smaller than No. 12 gauge. Longitudinal wires shall be deformed to increase stiffness and bonding qualities. Cross wires shall be durably welded to longitudinal wires to form a truss pattern unit. Reinforcement sections shall be of proper width for wall construction in which it is used. Reinforcement shall be furnished in flat sections not less than 10 feet in length. Reinforcement corner units shall be factory fabricated with not less than 5 foot length in each side of the 90 degree corner unit. Reinforcement furnished in rolls will not be permitted for use in the work. Block reinforcement shall be Carter-Waters Extra Heavy Weight "Block-Mesh" or "Dur-O-Wall" by Durowall National Incorporated, or equal.

4-A.3 CRACK CONTROL Crack control measures are not necessary for concrete masonry used for backup in exterior walls that are furred and plastered. However, control joints shall be used where and as shown on the drawings, regardless of finally finished wall surface.

Horizontal reinforcement shall be placed in mortar joints at 16 inches vertically. Splices shall be made by lapping reinforcement not less than one space length of trussed cross-wire. Joint reinforcement shall be centered in the wall width to assure full embedment of the side members thereof.

4-A.4 MATERIALS PROTECTION Masonry materials, including all types of brick, concrete masonry units, reinforcement, shall be so handled as to prevent damage, stored off the ground, and kept protected against the elements until placed in the wall. Material shall be stacked on pallets and covered with weather-proof tarpaulins properly tied in place to prevent displacement during high wind weather cycles.

4-A.5 MORTAR Mortar for common brick, and concrete masonry units shall be Class B, except common brick below the first floor level shall be laid in Class A mortar. Mortar for select common brick exterior facing shall be Class B. Mortar for face brick shall be Class B. Where Class D Mortar is used for exterior facing, the same mortar may be used for the back-up work.

Where white or colored mortar for masonry joints is required, the mortar shall give an acceptable, uniform color throughout

Information Handling Services, 1999
August 12, 1999 05:44:57

and Class D Mortar or color pigment shall be used as necessary with the approval of the Resid. Engineer.

4-A.6 MEMBRANE FLASHING Membrane flashing where required in the drawings shall be: "Cop-R-Flash" 3 ounce copper faced or "Nervastral HD," or equal. When turning of corners and angles the fabric shall be folded and not cut to form miter. Where conditions require the fabric to be applied in mastic, only materials and methods recommended by the manufacturer of the membrane shall be used.

4-A.7 WATERSTOP Where indicated in the drawings provide a continuous waterstop. The waterstop shall be Carter-Waters "Block-joint" or Durowall National, Inc., "Rapid Control" or equal.

4-A.8 MATERIALS AND SUPPLIES LIST

a. The Contractor shall submit to the Resident Engineer for approval a list of all masonry materials, supplies and accessories he proposes to furnish and install in the work. Any masonry materials, supplies or accessories discovered within the Contractor's job-site material storage area; used or installed in the work, but is not included in the list of approved masonry items will be rejected by the Resident Engineer. The Contractor shall at his own cost, take down and remove from the site all rejected materials. The Contractor shall replace all rejected materials with new materials in accordance with the requirements in the drawings and the specifications. The Contractor shall have no recourse for reimbursement for new materials installed to replace rejected materials.

b. The list of materials, by item for the supplies and accessories referred to above, shall clearly state the manufacturer's name and address, the product trade name or trade mark and complete technical data for each item. Three copies of the list of items shall be submitted for approval.

4-A.9 SCAFFOLDING All face brick and masonry trim connected therewith shall be laid from the side to the wall on which the facing occurs and scaffolding shall be erected and maintained as necessary to properly meet this requirement.

Information Handling Services, 1999
August 12, 1999 05:44:57

4-A.10 PROTECTING INSTALLED WORK Masonry shall not be laid in freezing weather unless suitable means are used to heat the materials and protect the work from cold and frost and insure that the mortar shall properly set and harden without freezing. Anti-freezing ingredient is not permitted for use in this work. The Contractor shall protect facing materials of every kind and description against staining, and the tops of all walls shall be covered with non-staining waterproof coverings when the work thereon is not in progress, including the end of the days work. Covering shall be secured in a manner not to become displaced in the event of inclement and windy weather.

When starting or resuming work at a new level, the top surface of the work in place shall be cleaned of all loose mortar and foreign materials and, in drying weather, thoroughly wetted with clean water without any additives or detergents.

4-A.11 INSTALLATION (Brickwork) Generally under drying conditions (but not when subject to frost) brick with more than 8 percent absorption shall be drenched with clean, clear water, allowed to drain and shall be damp when laid. Brick shall not be laid in the wall while frost or excess water remains on their surfaces. Each brick shall be laid in a full, level bed of mortar, shoved into place and all joints filled, leaving no voids. Unfilled and furrowed joints are prohibited.

All vertical joints in brickwork and the joints next to other materials required in connection therewith shall be filled solid with mortar as each course of brick is laid. To insure full joints next to exterior masonry, the back of the facing shall be parged with mortar the full depth and thickness of the joints before the backup course is laid.

Recessed brick shall be laid with the frog side down. Brickwork shall be plumb, true to line, courses level and properly bonded and anchored to abutting masonry, concrete or basic construction. All metal work required shall be built in as the work progresses. Reglets, chases, slots and similar items shall be carefully installed in the work properly positioned and placed to receive the intended work to follow.

a. Face Brick For the bond and type of face joints required, refer to the drawings and details noted thereon and as specified herein. Courses shall be accurately spaced and the bond kept plumb throughout. Variations in the width of

Information Handling Services, 1999
August 12, 1999 05:44:57

vertical joints shall be inconspicuous and made only as necessary to maintain the bond.

The bond of face brick shall be laid out and adjusted to each wall space so that no course shall finish at an external corner or at a jamb with a piece less than 3-5/8 inches long. The bond of each course at the jambs of each opening shall be symmetrical. Where closers are required to maintain the bond above, below or between openings, they shall be placed symmetrically to the center lines of openings and piers. Closers shall be avoided and be used as an only recourse.

All face joints in exterior brick facing shall be finished with a metal jointing tool to the profile indicated, as soon as possible after the mortar has attained its initial set so as to compact the mortar in the joint, forcing it tightly against the brick edge closing all hair cracks and crevices. The use of "cut-off" joints shall not be permitted in exterior brick facing. The final finishing of the horizontal mortar joints shall be done with a sled joint tool.

b. Concrete Masonry Units Concrete block shall be set plumb and true to line in common bond with joints tooled and finished. Joints shall be concaved face with horizontal and vertical jointing in matching plane without eyebrows, overlaps and irregularity in width or depth of finish. All units shall be properly joined to other connecting work. Open ends are not permitted in either face of walls or partitions or at returns.

Set units in a bed of mortar the full width of face shell thickness, horizontal and vertical joints similar, unless specified or noted otherwise. Joints in final wall face finish and pointed shall be tooled and finished with a dense surface. Concrete masonry work adjoining or adjacent to existing similar work shall have joint finishing to match the existing work. Joints next to other materials required in connection with the work herein, shall be filled solid with a mortar as each course is laid.

The use of broken, chipped or cracked concrete masonry units in the work is not permitted. Concrete masonry walls to be finally finished with plaster shall be laid with same class workmanship as the work of finally exposed and pointed

Information Handling Services, 1999
August 12, 1999 05:44:57

concrete masonry, except, joints shall be struck flush with a face of adjacent units. Joint reinforcement, as specified above, is required in alternate courses of concrete masonry in all classes and types of work, 16 inches on centers vertically, with first line of reinforcement placed in the mortar joint between first and second course above floor slab and continuing the full height of the wall.

Closure block units, jamb blocks, lintel and bond blocks, and other standard manufactured shapes shall be furnished by same manufacturer as producer of other concrete masonry units used in the work.

Cutting and fitting of brick and concrete masonry units shall be done with a power driven masonry saw. Hammer and chisel cutting is prohibited. Cutting around built-in work of other trades shall be neat fitting cut units with minimum mortar pointing required.

c. Partitions, Furring, Etc. Partitions, furring, and similar construction parts shall be bonded each course at external corners, (8 inches on centers vertically), tied or bonded at intersections of alternate courses to regular wall reinforcement.

Brick and concrete masonry units shall be returned at door and window jambs to form full faced reveals. Provision shall be made for proper caulked joints by raking out mortar as indicated and required. In each mortar joint where a jamb anchor occurs the mortar joint shall be reinforced by installing a strip of 1/8 x 1/8 inch hardware cloth 16 inches long by a width 1 inch less than wall thickness. Reinforcing strip shall be laid after mortar bed is spread; pressed into the mortar bed for full embedment.

Column covering, isolated piers and pipe furring or other free standing items requiring covering, the masonry shall be reinforced at 8 inches on centers, vertically. Reinforcement shall be truss type as specified under this section. Reinforcement unit shall be modified to form a semi-continuous line by cutting the inside longitudinal wire and forming a 90 degree corner by bending outside wire at each corner. At last corner bend outside wire at each corner. At last corner bend outside wire with at least 6 inches each side of 90 degree corner bend to overlap sides, if in columns and piers and into wall if pilastered.

Information Handling Services, 1999
August 12, 1999 05:44:57

4-A.12 RECESSES Provide proper recesses in masonry work to receive the work of other trades as required on the drawings. Recessed openings shall be provided with suitable lintels. Jambs and reveals shall be finished same as adjacent wall face.

4-A.13 ANCHORING Brick and concrete masonry facing shall be anchored to the backing of poured concrete with suitable ties and anchors as indicated on the drawings and specified. Brick shall be anchored to the backing with ties at 2 feet on centers horizontally at every fourth course vertically. Brick facing on concrete masonry shall be tied continuously at 16 inches on centers vertically as specified above under this Section of the specification.

Anchors between unfurred walls, piers or columns and abutting partitions shall be iron or steel not lighter than 1/8 x 1-1/4 inches with ends turned up 2 inches and, where practicable, shall extend into concrete 4 inches and masonry 8 inches. Anchors shall be coated with asphaltum, red lead paint or zinc coated, installed as required on the drawings.

Slots and Anchors, where required on the drawings to provide masonry anchorage, shall be dovetail slots formed of sheet metal not less than .024 thick with companion anchors of No. 9 gauge zinc coated wire or 12 gauge x 1 inch zinc coated flat anchors. Slots shall be built into concrete walls not more than 2 feet on centers horizontally, one per face of columns and piers where masonry covering is required. Anchors shall be installed every fourth course of brickwork unless directed otherwise. Anchors shall be of crimped wire or close fitting stamped flat metal stock. Anchor slots are furnished herein and installed under Section 3A.

Metal shields, anchor bolts and similar devices required to secure the work of other trades shall be installed herein. Care shall be taken that proper alignment, projection and spacing is in accord with the requirements of their intended purpose.

4-A.14 CLEANING On completion of the work, all exterior and interior brick facing shall be cleaned down, removing dirt and foreign materials, excess mortar, mortar stains, etc. If acid is used, it shall be muriatic (hydrocloric) acid, and not stronger than one volume of the commercial acid to nine volumes of clear water. Cleaning shall start from top or uppermost exposed brickwork surfaces continuing downward. Brick facing shall be well wetted with clear water before any acid solution is applied. Protect

Information Handling Services, 1999
August 12, 1999 05:44:57

any finish surface adjacent that may be damaged by dripping or splatter of the acid solution. Acid solution shall be applied with stiff fiber brushes and the surface brushed vigorously to remove mortar and surface stains. Solution shall not be permitted to remain on the surface longer than the time required for the cleaning work. When the scraping necessary, and brushing of the acid solution is completed, the entire surface shall be rinsed with clear water from a hose--flooding wall, starting from its topmost edge allowing water to drench downward. During the cleaning operation all the work shall be examined for defects including damaged brick surfaces, loose or cracked mortar joints and joints improperly tooled and finished.

CAUTION: Acid solution shall be tested on the mortar joints in a 2 x 2 foot section of the wall. If the solution removes the mortar slick of the joints, exposing sand aggregate of the mortar, the solution shall not be used as proportioned and reproportioning is required.

Cleaning of exposed concrete masonry units shall be done in the "dry" by rubbing with corborundum rubbing blocks. Mortar spatters, overhang and eyebrow joints shall be dressed smooth to the same plane as adjacent block face. All mortar joints shall be examined and any loose, chipped or cracked joints shall be cut out and repointed, tooled and finished to match the adjacent joint work.

4-A.15 GENERAL

a. Where existing construction shall be altered, modified or additions made thereto by the work indicated in the drawings and specified, so far as practicable, the new work shall be of same kind, quality, color, sizes, texture and physical properties as the existing work.

b. No change in the requirements in "a" above shall be made without the approval of the Resid. Engineer, in writing.

c. No brick or masonry unit shall be shifted or realigned after it has been laid. Any shifting or realignment which may be necessary, shall be made by removing the defective work and relaying with fresh mortar.

d. Brick bed joints shall be level across and any work found sloping "out-to-in" shall be replaced.

Information Handling Services, 1999
August 12, 1999 05:44:57

e. Backparging of exterior face brick shall be a uniform layer of mortar 3/8 inches thick. A clear space shall be maintained between back parge surface and backup. Slushing of joints in brickwork or in the void between brick and backup, or spandrel, will not be accepted.

f. Repointing and tuckpointing shall be installed where defective mortar joints are cut out for replacement. Mortar for tuckpointing shall be made up of:

3 parts portland cement

1 part masonry cement

3 parts sharp masonry sand

Color adjust to match adjacent mortar joints. Sample joint shall be prepared before mixture is used in the finally finished work.

g. Protection of the materials and the installed work shall be provided by using weather proof covering material. Accumulation of snow, frost or ice on the work or the materials shall be prevented by the use of proper heating and covering equipment. Heating of the materials to a maximum 140 degrees F. shall be provided if frost or ice is in evidence.

No masonry work shall be done when the temperature of the surrounding atmosphere is below 40 degrees F. unless adequate protection is provided for heating mortar materials. All finished work shall be protected from freezing for a period of 72 hours after installation, by adequate enclosures and heating equipment.

4-A.16 SAMPLE PANEL

a. Prior to starting any masonry work, lay up a section of exposed block and brick masonry, typical of the exterior wall, at least 72 inches wide by 56 inches high for the Resid. Engineer's approval. Sample wall shall show texture, variation in color, coursing, reinforcing of mortar joints, pointing, and joint tooling.

b. Approved sample panel shall be protected and used for determining cleaning materials and methods and shall be removed from the site by the Contractor when no longer needed.

Information Handling Services, 1999
August 12, 1999 05:44:57

4-A.17 TOOTHING Toothing-in for joining brickwork or masonry units will not be accepted only stepped-back joining will be permitted.

4-A.18 BRACING Masonry walls in locations where they may be exposed to wind during erection shall not be built higher than ten times their thickness unless adequately braced or until provision is made for the prompt installation of permanent bracing or construction tie at level immediately above.

4-A.19 SITE CLEAN UP When the work covered by this Section of the Specifications is completed, all equipment, tools, excess materials, waste or salvage, debris, etc., shall be removed from the site at the Contractor's own expense.

4-A.20 MASONRY WALL REINFORCEMENT

(a) All masonry walls in this contract shall be reinforced as noted on the drawings and specified in these Specifications.

(b) Vertical reinforcement shall consist of installing one (1) #3 reinforcing bar in one vertical row of voids at 24 inches on centers full length of wall and center void at corner. Void shall be grouted solid with mortar.

Vertical bars shall be of longest practicable length with lapped splices minimum 16 inches long.

Horizontal mortar joint welded cold-drawn factory formed reinforcement units are specified in 4-A.2, Paragraph f. Installation specified in 4-A.11, Paragraph b.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 4 MASONRY

SECTION 4 B

MORTAR

4-B.1 REQUIREMENTS The work covered in this section consists of furnishing all materials, labor, equipment, appliances and services necessary to provide the mortars required in this work.

4-B.2 MATERIALS Materials shall comply with the applicable Specifications, except as otherwise noted on the drawings or otherwise specified in these Specifications.

a. Portland Cement ASTM C-150, Type I, and Type III, except that the 28 day test may be waived. White Portland Cement shall be non-staining. Portland cements shall not be considered as Masonry cements under this specification.

b. Masonry Cement ASTM C-91, bagged in standard size bags with manufacturers' trade mark or trade name for the contents, type and specifications, and manufacturer's name.

c. Non-Staining Cement Non-staining cement shall not contain more than .030 per cent by weight of soluble alkali calculated as Na 2 0 when tested in accordance with Federal Specifications SS-C-181c.

d. Lime Lime shall be either hydrated or finely pulverized quicklime, at the option of the Contractor. None of the lime delivered shall be used in the work until samples have been tested and approved by the Resid. Engineer.

e. Hydrated Lime ASTM C-207, , except that it shall have a plasticity figure of not less than 200 and the total free (unhydrated) calcium oxide ($C_a o$) and magnesium ($M_g O$) in the product as delivered on the site shall not exceed 8 per cent by weight.

f. Pulverized Quicklime ASTM C-5, SS-Q-351, shall pass a No. 20 sieve and not less than 90 per cent shall pass a

Information Handling Services, 1999
August 12, 1999 05:44:57

No. 5 sieve and, after slaking to a putty, shall have a plasticity figure of not less than 200 and shall show at the end of 72 hours that the total free (unhydrated) calcium oxide (C_aO), and magnesium (M_gO) in the hydrated product does not exceed 8 per cent by weight, calculated on the basis of lime solids in the putty.

g. Lime Putty Lime putty shall be a stiff mixture of lime and water and shall be kept moist until used. Putty from quicklime shall be slaked and allowed to soak at least 72 hours before it is used. During the slaking of the lime, care shall be taken to avoid burning or drowning of the quicklime.

h. Sand Sand shall be clean, well defined and graded, free from soluble salts (alkali) and organic matter. When dry, all the sand grains shall pass a No. 4 sieve and shall meet the following screen analysis:

Retained on a No. 8 screen	- 0 - 5 per cent
Retained on a No. 16 screen	- 5 - 30 per cent
Retained on a No. 30 screen	- 30 - 60 per cent
Retained on a No. 50 screen	- 65 - 85 per cent
Retained on a No. 100 screen	- 95 - 99 per cent

A maximum of 5 per cent passing a No. 100 screen will be allowed. Where 1/4 inch (nominal) mortar joints are required, all sand grains shall pass the No. 8 screen and not more than 10 per cent be retained on a No. 16 screen.

i. Water Water used for producing mortar shall be clean, clear and free from alkali and potable.

j. Pigments Pigments for coloring mortar shall be limeproof mineral oxides of the best obtainable quality and highest quality work. Pigments shall be accurately measured and thoroughly mixed with each batch to produce a uniform color throughout the work. Only the amount necessary to produce the desired color shall be added to each consecutive batch of mortar that when dry will be a color matching prepared and dried samples.

4-B.3 DELIVERY AND STORAGE Cement and lime to be used in producing job mixed mortar shall be delivered to the site in the manufacturer's original unopened, undamaged containers. Material shall be stored on the site and kept dry until used.

Information Handling Services, 1999
August 12, 1999 05:44:57

4-B.4 STANDARD UNITS Proportions specified are in units or unit parts as follows:

a. Portland cement; one sack, 94 pounds net.

b. Slag cement; one sack, 79 pounds net.

c. Masonry cement; one sack, 1 cubic foot capacity.

d. Hydrated lime; one sack, 50 pounds net.

e. Lime Putty; 50 pounds or 1-1/4 cubic foot.

f. Damp sand; 90/120 pounds = 1 cubic foot

g. Dry sand; 80/150 pounds = 1 cubic foot

4-B.5 MORTAR MIXES Mortar mixture shall be as given below and are referred to by their respective class designation in other sections of this specification. Where more than one mixture is given under a designation, the one to be used is at the option of the Contractor before the mortar mix is used in the work. The mortar mix selected shall not be changed during the installation of the work, unless directed by the Resident Engineer to alter or adjust mix to meet certain conditions that may occur that require such change. Schedule of Mix Classifications:

MORTAR	Portland Cement Sacks	Slag Cement Sacks	Masonry Cement Sacks	Lime Hydrate (Cu. Ft.)	or Putty (Cu. Ft.)	Sand Dry (Pound)
Class A	1	--	--	1/5	1/4	240
Class B	1	--	--	1	1-1/4	480
Class D	The same as Class A, except cement shall be non-staining					

Mortar mix classification shall be adjusted by proportioning to produce mortar with a minimum strength as determined by the field compressive test specimen of not less than 2500 p.s.i. at 28 days.

Information Handling Services, 1999
August 12, 1999 05:44:57

4-B.6 MORTAR MIXING Materials for mortar specified for masonry construction under other sections of the specification shall be accurately measured using an automatic mechanical measuring device that will consistently maintain the specified proportions within a plus or minus tolerance of not more than 5 per cent by weight or volume, and shall be thoroughly mixed until evenly distributed throughout the batch. Mortar shall not be retempered for use.

Mixer equipment shall be of the single batch mix type: continuous batch mixing equipment will not be accepted in this work.

After each batch is unloaded the mixing drum, internal paddles and blades shall be thoroughly cleaned before a new batch is loaded for mixing.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 4 MASONRY

SECTION 4 C

STRUCTURAL FACING TILE

4-C.1 REQUIREMENTS The work covered by this Section consists of furnishing all materials, labor, equipment, plant, tools, appliances, accessories and services necessary in connection with the installation of Structural Facing Tile, complete in accordance with the requirements of this Section and the applicable drawings.

4-C.2 LOCATION OF MATERIALS For location and extent of work, the size, caps, trim, base, finish and color of the tiles and typical details, examine the various drawings as they apply.

4-C.3 MATERIALS Tile units to be used in the work shall include all field stretcher units, base units (coved or straight), caps, sills, lintels, ends, jambs and corners, together with the necessary stops, starters, miters and returns, as required for a complete and acceptable installation. Surfaces that will be exposed in the finally finished walls shall have the required uniform color, finish and texture.

a. Cores Tile units shall be solid, multi-cored or hollow, at the option of the Contractor, except that the shortest dimensions of hollow tile units shall be 3-3/4 inches. The walls of cored or hollow tiles shall not be less than 3/4 inch thick. When scored, combed or roughened to a depth of not more than 3/16 inch, the wall thickness shall be the overall thickness. Field units shall be the bond thickness shown or specified except that none shall be less than 1-3/4 inches thick.

b. Burn Tiles shall be burned as straight and true as careful manufacture can produce within the tolerances specified. The body of glazed tiles shall be of clear burning, plastic, de-aired fire clay.

c. Glaze, (Ceramic) Ceramic glaze (clear and opaque) shall

Information Handling Services, 1999
August 12, 1999 05:44:57

be compounded of metallic oxides, chemicals and clays thoroughly ground together, sprayed on the smooth body form and made permanent by burning.

1. Clear Glaze Clear ceramic glaze shall be translucent to show the color of the body form materials and shall produce a glassy finish and smooth texture. The use of a tinting agent as an integral part of the glaze is permissible, but will not be accepted as a substitute for opaque glaze.

2. Opaque Glaze Opaque ceramic glaze shall be colored to conceal the body material color and shall produce a satin matte finish and smooth texture as required.

d. Glaze, (Salt) Salt glaze shall be produced by salt and chemicals applied to the smooth formed body as a vapor during the process of burning and shall give a glossy finish and smooth texture.

1. Color The colors furnished shall not be outside the range represented by the approved samples and shall be well distributed throughout the completed work.

e. Distortion Distortion of face and wall edges shall mean the depth of material that would have to be removed from the face of the unit to produce a true plane and straight lines; the depth to be measured at right angles to the face of the unit.

f. Tolerances Maximum variation in each face dimension between the largest and smallest tiles furnished in any one size;

Dimension:	2-3/8"	3-3/4"	5-1/16"	7-3/4"	11-3/4"
Variation:	3/32"	3/32"	1/8"	3/16"	1/4"

g. Distortion Maximum distoration of the face from a true plane and of free edge from a straight line:

Unit Size	Distortion
2-3/8 x 7-3/4 inches	1/16 inch
5-1/16 x 7-3/4 inches	1/16 inch

Information Handling Services, 1999
August 12, 1999 05:44:57

Unit Size (Con'td.)	Distortion (Con'td.)
3-3/4 x 11-3/4 inches 5-1/16 x 11-3/4 inches	3/32 inch
7-3/4 x 11-3/4 inches	5/32 inch

h. Appearance The patching or hiding of defects in the tile units will not be permitted.

1. Finish Glaze finish shall be free from chips, crazing, crawling, blister, checks, cracks, or other imperfections, detracting from the appearance of the tiles in place when viewed at a distance of 5 feet when surface is in flood of daylight.

2. Chippage The number of chipped tiles that may be used is not definite, but shall be limited to a reasonable percentage not to exceed 10 percent of tiles placed in the work.

   Chippage shall not exceed 1/16 inch in from any face edge and 1/8 inch in from any face corner of the finished face or faces that will be exposed when in place, except that not in excess of 5 per cent of the total tiles installed may have chippage up to 1/8 inch in from an edge and 1/4 inch in from a corner of the exposed face.

3. Finish Glaze Ceramic glaze shall not fail when subjected to the test for Resistance to Crazing as specified in A.S.T.M. Designation C126

i. Special Tiles Special Tiles including special sizes, shapes and decorative units, other than standard units of stock specials, shall be laid out and fitted at the factory and shall be numbered or code marked to correspond with numbers or code markings given on setting drawings.

j. Handling and Storing Materials Tiles shall be delivered, stored and handled at all times to protect them from stain or damage. All tiles shall be packed in suitable containers, thoroughly protecting edges of both sides and ends against chipping or other damage in transit or on the job site. The numbers or marks of special units other than standard stock specials shall be marked on the outside of each package, and special setting drawings shall be provided.

Information Handling Services, 1999
August 12, 1999 05:44:57

k. Mortars For mortar materials, proportions and mixing, refer to Mortar Section 4B. Setting mortar for tiles shall be Class B or Class D, at the option of the Contractor. However, if Class B mortar is used for setting pointing mortar shall be Class D.

4-C.4 ANCHORAGE Tile shall be bonded or anchored to the backing. Selection of bonding or anchoring is at the option of the Contractor, except where bonding or anchoring is shown on the drawings and specified herein.

a. Bonding In bonded work, the bond course shall be spaced not more than 16-1/2 inches apart. Double faced construction shall be bonded and two or more units shall comprise the thickness, except that 4 inch walls and partitions shall be two-faced, through bearing units. Two faced units shall be gauged for thickness in setting to produce practically flush surface on both sides of the wall or partition.

b. Anchors Metal anchors shall be spaced not more than 16-1/2 inches apart vertically and not more than 24 inches apart horizontally.

1. To Masonry Anchors to masonry shall be of wire or sheet metal so looped, perforated or corrugated as to form a secure bond in the mortar joints. Anchors shall be zinc-coated and of proper length. Wire shall be at least 0.12 inch in diameter and "U" loop formed, corrugated sheet metal ties shall be at least 7/8 inch wide and 0.036 inch thick, perforated ties shall be at least 1-1/4 inches wide and 0.036 inch thick. Anchor ties shall extend into the masonry backing nominal 4 inches and to within 1/2 inch of the face of the tiles.

2. To Concrete The anchorage to concrete back-up shall consist of anchors and anchor slots or inserts in the concrete. Sheet metal slots fabricated of not less than .024 inch thick shall be built vertically into the concrete at the proper locations, plumb and at 24 inches on centers vertically. Slots shall be designed, constructed and built into the concrete to develop the full strength of the anchors without breaking or pulling loose from either the anchor or the concrete. Slots shall be provided with a suitable filler to prevent the slot filling with concrete during the placing of the concrete in the wall. The anchors shall fit snugly

Information Handling Services, 1999
August 12, 1999 05:44:57

into the slot with flared end of same angle as sides of slot with a "twist in place" fit. Flat anchors shall be not less than 1 inch wide and 0.06 inch thick. Wire anchors shall be fabricated from No. 9 gauge wire with looped end to fit into slot and open ends of sufficient length to provide a 90 degree hook at each to within 1/2 inch of the face of tiles. All slots shall be galvanized; anchors and wire shall be zinc-coated steel.

4-C.5 SETTING Tile units shall be cleaned, then sponged or sprayed with clean clear water just before setting, to reduce suction. Each piece shall be set level and true to line in a full bed of mortar and tapped home to a full, even bearing. Any permissible variation as specified under "Tolerances" shall, so far as practicable, be adjusted and equalized in the process of setting. All spaces at backs and cross joints from front to back and top to bottom shall be filled with setting mortar leaving no voids. Faces of tile shall be kept free from mortar.

4-C.6 WORKMANSHIP The tiles shall be laid out in regular bond, unless shown on the drawings and specified to be otherwise. Vertical internal corners shall be square-bonded; vertical external corners shall be bullnose. Wall finish shall extend into the reveals of openings, unless otherwise indicated. Face joints shall be nominal 1/4 inch wide, as nearly uniform as practicable within 3/16 to 5/16 inch limits, finished with a glass or non-staining metal jointing tool. All cutting and fitting on the job shall be done with a motor driven carborundum saw to assure clean cuts and joints. The completed work shall be straight, plumb and level; extremity to extremity of the wall.

4-C.7 POINTING If Class B mortar is used in setting the tiles, face joints shall be raked out 1/2 inch deep at the time of setting, leaving clean surfaces for pointing with Class D mortar. Pointing shall be done as soon as the setting mortar is hard enough to permit it. Before pointing is started the raked out joints shall be brushed clean: free from loose setting mortar, dust and dirt. When thoroughly cleaned the joints shall be wetted thoroughly with clear clean water and pointed solidly with Class D mortar.

If Class D mortar is used in setting, the joints shall be filled and finish jointed as the setting work progresses.

The mortar in the face joints shall be compacted and finished

Information Handling Services, 1999
August 12, 1999 05:44:57

uniformly straight and true to lines and face surfaces. Joints, when finish jointed, shall have a glass-like finish surface without visible aggregates: shall be uniform in color and joint tool pattern. Use only stainless steel or glass joint finishing tools.

4-C.8 CLEANING Upon completion of the work, all exposed surfaces of tiles shall be cleaned down using soap powder boiled in clean water and applied with fiber brushes and then rinsed with clean water. Hard lumps of mortar shall be removed by using sharpened wood paddles. Metal cleaning tools or brushes or any form of acid solution shall not be used in the cleaning.

After tile cleaning is completed, all scaffolding, tools, equipment, surplus materials, waste and debris shall be removed from the site and all areas adjacent to and affected by the work herein left broom clean.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 5 METALS

SECTION 5A

STRUCTURAL STEEL

5-A.1 REQUIREMENTS The work covered by this Section consists of furnishing all materials, labor, equipment, plant, tools, appliances, accessories and services necessary in connection with the requirements of this Section of the Specifications and the applicable drawings.

5-A.2 LOCATION For locations of the variou sections and members, sizes of units and character of the work necessary, see the various applicable drawings as they apply and the requirements specified thereon.

5-A.3 CONFORMITY AND QUALITY The Contractor shall furnish, in triplicate, certified copies of mill tests and laboratory analysis showing that the material to be used is in conformity with or exceeds the contract requirements.

The Contractor shall furnish a certificate stating name and location of mill where shapes are rolled as well as shop where fabrication will be made.

The Contractor shall furnish shop drawings showing setting diagrams and details of all structural members. All structural members, connections, bolts, accessories, sizes and dimensions shall be clearly indicated. See Section 1-A.5.

Fabrication of structural steel framing or miscellaneous members shall not be started before submittal drawings have been approved. Upon receipt of approved shop or submittal drawings the Contractor shall proceed with the work affected thereby.

5-A.4 MATERIALS All structural steel, shapes, plates and bars, shall conform to the requirements of ASTM A36. All sections and members shall be clean and free from mill scale, flake rust and rust pitting.

All structural steel tubing shall conform to ASTM A500. (Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing.)

Information Handling Services, 1999
August 12, 1999 05:44:57

All structural bolts shall conform to ASTM A325. Anchor bolts shall conform to ASTM A307. All structural washers shall conform to ASTM A325.

5-A.5 BOLTS, NUTS AND WASHERS Bolts for general steel construction and connections of structural parts and members shall be furnished in the proper lengths required, with smooth or ribbed surface practically the full length of grip.

All bolts and nuts, other than those with self-locking screw threads, shall be American National Coarse threads series, Class 2 fit. Self locking screw threads are to be the manufacturer's standard. Nuts with self-locking screw threads may be cold-rolled bar stock. Washers adjacent to nuts and bolts heads shall be hardened. Open holes shall be provided for loose anchors and for bolted connections of other work under the general contract, to the structural metal.

Bolt diameter shall be as indicated on the drawings. Connections are bearing type. Threads may be included in the shear plane.

5-A.6 BOLTED CONSTRUCTION Holes for bolts shall be 1/16 inch larger than the nominal diameter of the bolt unless otherwise noted on the drawings. If the thickness of the material is not greater than the nominal diameter of the bolt plus 1/8 inch, the holes may be either drilled from the solid, or sub-punched and reamed. The die for all sub-punched holes, and the drill for all sub-drilled holes, shall be at least 1/16 inch smaller than the nominal diameter of the bolt.

Drifting done during assembling shall not distort the metal or enlarge the holes. Holes that must be enlarged to admit the bolts shall be reamed. Poor matching of holes shall be cause for rejection of the steel sections affected thereby.

5-A.7 BEARING PLATES Bearing plates shall be provided under the ends of beams, girders, trusses and columns, resting on masonry and concrete to conform to the details and requirements on the Drawings. Bearing plates shall conform to the standards and recommendations of the American Institute of Steel Construction and latest published Manual.

Information Handling Services, 1999
August 12, 1999 05:44:57

5-A.8 STEEL LINTELS Steel lintels shall be provided for all square head openings in masonry where other lintels are not specified, or shown. Built-up lintels shall be bolted or riveted together, with separators where noted. The lengths of end bearings shall be not less than 1 inch per foot of span, but in no case less than 4-1/2 inches. The unit pressure of gross bearing surface shall not exceed 70 p.s.i. on hollow masonry units and 200 p.s.i. on solid masonry units, and suitable steel bearing plates shall be used as necessary to meet this requirement. Lintels of square head openings in partitions of concrete masonry units shall be set with a clearance of 3/8 inch above the head members of bucks and frames unless otherwise shown on the drawings.

5-A.9 OTHER INCLUDED WORK Items of structural steel indicated on the drawings, shown in detailed sections and inferred to be required even if not shown clearly, called out or specified, shall be provided herein.

Generally steel members necessary for bracing, supporting, or reinforcing the various parts of the work that require steel sections measuring more than 3 inches are included in this Section even if not specified, shown or detailed, yet are required in the erection of high quality construction.

Structural steel framing around certain openings, special hangers for supporting work of all trades, suspended floors and ceilings etc. shall be furnished and installed and includes all necessary bolts, rods, welding, clips and accessories for complete assembly and installation in accordance with the requirements of the applicable drawings.

5-A.10 ERECTION

(a) The erector shall check the structural steel pieces for correct shop fabrication of the members on their arrival at the job site. Errors which cannot be immediately corrected at the site shall be brought to the attention of the Resident Engineer. Structural members damaged during shipment or during loading or unloading and hauling shall also be brought to the attention of the Resident Engineer, when the defect cannot be corrected by the erector. The end preparation of beams and columns at their connections shall be checked. Bevels must conform to the preparation as shown on the drawings. If required, re-beveling in the field, prior to erection, shall be done by grinding. Beam ends prepared for splicing shall be checked for accuracy of fabrication. The fit shall be checked for having the noses of the

Information Handling Services, 1999
August 12, 1999 05:44:57

flanges and web of each beam in a single plane. Variations shall take into consideration the welding clearances required for proper structural alignments after the welds have cooled. Check match markings, in addition to the erection marks to insure conformity with the shop and erection drawings. The sequence of field welding operations shall be such as to control shrinkage and prevent high internal or "locked-in" stresses on cooling of the weld and base material.

(b) Structural Steel Framing Structural steel framing must be squared and plumbed before permanent field bolts are tightened and before permanent field welds are made. The building frame shall be plumbed or leveled to an error not greater than 1 to 600.

(c) Temporary Bracing Temporary bracing shall be introduced wherever necessary to take care of all loads which the structure may be subjected to during erection, inlcuding erection equipment and its operation. Such bracing shall be left in place as long as may be required for safety.

(d) Temporary Gravity Loads Wherever piles of material, erection equipment, or other loads are carried during erection, proper provision shall be made to take care of stresses resulting from such loads.

(e) Permanently Bolting and Welding As erection progresses, the work shall be securely bolted, or welded, to take care of all dead load, wind and erection stresses. No permanent bolting or welding shall be done until as much of the structure as will be stiffened thereby has been properly aligned.

(f) Allied Operations to Erection Welding, burning and drilling of holes in the structural steel framing shall not be permitted. When necessary to weld any part of the structural steel after erection, the member being welded shall be temporarily supported in order to relieve the member of the imposed loads.

5-A.11 GROUTED BASES

(a) Grouted Steel Provisions for grouting under the column base plates shall be made during erection in order to maintain the top of the roof framing beams at the same height, as indicated on the drawings, within the tolerance specified herein. The method used shall be approved by the Resident Engineer.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) Grout Material The grouting material shall be NONSHRINK ready-to-use product requiring only mixing with water at the job site. It shall be EMBECO PRE-MIXED GROUT as manufactured by the Master Builders Company of Cleveland, Ohio, or equal.

(c) Grout Operation The underside of the base plate shall be cleaned of all grease and oil like films; the pertinent concrete surfaces shall be cleaned af all similar contamination and debris. The top of the concrete shall be chipped and roughened and all laitance or poor concrete removed. The concrete shall be water-saturated for a period equivalent to two hours, the excess water removed and the nonabsorbent edge-forms erected. Minimum depth of grout shall be one inch and it shall be placed under the base place in a manner which will avoid air voids. The grout shall be packed and tamped from one or two sides only and shall be sufficiently compacted in order to transfer adequately the column loads to the concrete foundation. If shims are used, they shall be placed in such a manner that they can be removed after the grout has cured and is capable of supporting the column. Care shall be used in keeping the grout damp during the curing mixing, placing, curing and for protecting the exposed surfaces.

5-A.12 APPLICABLE DOCUMENTS

(a) Design Specifications Structural design is based on current AISC and AWS codes and specifications. Basic type of construction and design assumptions, where applicable, are based on Type 1 (rigid frame) construction in accordance with AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings."

(b) Material Specifications All materials shown on the structural steel drawings or specified in this Section are in accordance with the specifications and standards of the American Society for Testing and Materials (ASTM) unless noted to be otherwise.

5-A.13 WELDER AND WELDING OPERATOR QUALIFICATIONS

(a) Qualifications Welds shall be made only by welders and welding operators who have been previously qualified by tests as prescribed in the Standard Code for Arc and Gas Welding in Building Construction of the American Welding Society, to perform the type of work

Information Handling Services, 1999
August 12, 1999 05:44:57

required by this standard and as indicated in the drawings. This provision also applies to tack welds which will later be incorporated into the finished welds of the structure.

(b) Welding All welding (both in the shop and in the field) shall be complete penetration. Welds shall be made by the submerged-arc welding process or by manual sheilded metal-arc process.

5-A.14 WORKMANSHIP Shearing and punching shall be without ragged or torn edges. Material at edges shall not be "pulled thru" to form flared edge. The punch shall not exceed the size of the bolt or rivet to be used, neither shall the diameter of the die be greater than the punch, by more than 1/16 inch. The thickness of the material in punch work shall not exceed the nominal diateter of the bolt or rivets plus 1/8 inch. Holes shall be accurately spaced so that when parts are assembled bolts or rivets will enter without distortion. Holes shall be enlarged by reaming. Drift pins will not be permitted to enlarge, align or distort holes to receive bolts or rivets. Burning of holes is prohibited. All members shall be assembled without twist, kinks, buckles or open joints.

Parts assembled with bolts or rivets shall be in close contact, except where separators are required. All members shall be so accurately made that when assembled the parts shall come together without distortion and without shimming. Bearing stiffeners for girders shall have their bearing ends closely fitted to the flanges. Separators shall be closely fitted.

Bearing ends of columns and tops of column base plates over 4 inches thick shall be machined bearings. Column base plates under 4 inches thick shall be straightened by pressing so as to provide a satisfactory contact bearing between the plate and the column above same.

5-A.15 BOLTED CONNECTIONS All structural metal work shall be accurately set and properly secured in place. Except as otherwise specified or noted on the structural drawings, field connections shall be riveted or bolted with turned, ribbed or high-strength bolts. Where the structural drawings allow bolted connections to be made with square-head unfinished bolts, washers shall be used under the nuts. However, unfinished bolts shall not be substituted for rivets or other types of bolts specified. All nuts shall be drawn up tight. Structural metalwork shall be temporarily braced and stayed in position until permanently secured.

Information Handling Services, 1999
August 12, 1999 05:44:57

(a) Bolts for structural steel work assembly exposed to the weather, temporarily or permanently, shall be dipped in red lead paint just before they are put in place.

(b) Anchor bolts and anchors shall be properly located and built into the connecting work, being preset where practicable. Column anchor bolts shall be located, set and maintained in position with suitable templates or base plates. Column bases shall be set on metal shims and grouted solid.

(c) Bolts and nuts, used herein, are specified under 5-A.4 (c) Ribbed Bolts (d) High Strength Bolts.

The bolts shall be used in holes generally 1/16 inch larger in diameter than the bolt size for high strength bolts. For ribbed bolts the diameter of holes shall be for a driving fit. Bolts shall be tightened to the tension specified in Table III.

Bolts of the same nominal diameter may be substituted in joints in lieu of rivets, provided bolts and nuts required in (c) above are used.

(d) Bolt length shall be determined by the grip (total thickness of connected material) calculated the same as for rivets, and the values given in Table II, below, shall be added thereto. These compensate for thickness of nut, two flat washers and bolt joint. The total length shall be adjusted to the next 1/4 inch increment up to and including 5 inch length and to the next 1/2 inch increment for bolts over 5 inches long.

TABLE II

Bolt Size (Inches)	Add to Grip (Inches)
1/2	1
5/8	1-1/8
3/4	1-1/4
7/8	1-1/2
1	1-5/8
1-1/8	1-3/4
1-1/4	1-7/8
1-3/8	2

(e) If other than the specified thickness of flat washer is used, the required bolt length shall be adjusted accordingly. Where bevel washers as specified are used, an additional 1/8 inch shall be added for each such washer.

Information Handling Services, 1999
August 12, 1999 05:44:57

(f) Surfaces of Bolted Parts

(1) Surfaces in contact with the bolt head and nut shall be parallel, except as provided herein under 5A.5 (f), (1), (2) and (3). Bolted parts shall fit solidly together when assembled and without interposing gaskets or other flexible material.

(2) Contact surfaces, including those adjacent to washers, shall be clean and free from loose scale, pits, burrs or other blemishes that would prevent the solid seating of the parts. Contact surfaces of the joints may carry a shop coat of protective lacquer or standard shop coat of paint.

(3) Flat washers may be used if the abutting surfaces adjacent to the bolt head and nut do not have a slope more than 1 in 20 with respect to a plane normal to the bolt axis; provided that in all cases of non-parallel abutting surfaces, the nut shall be torqued against a non-sloping surface.

(g) Tightening of the nuts of high-strength bolts shall be done with calibrated torque wrenches that show by dial or by automatic release, the measure in foot-pounds of torque induced by the wrench. The minimum torque for sizes of bolts shall conform to the values listed in TABLE III. The wrenches shall be properly calibrated and the nuts shall be in motion when the torque is measured.

Note: Torque wrenches shall be tested and adjusted for accurate calibration; with proper certification tag attached thereto before used in erection of the work.

Information Handling Services, 1999
August 12, 1999 05:44:57

TABLE III - BOLT TENSION AND TORQUE VALUES

Bolt Size (in.)	Recommended Bolt Tension for Calibrating Wrenches (lb.)	Required Minimum Bolt Tension (lb.)	Approximate Equiv. Torque for Required Minimum Bolt Tension (lb. ft.)
1/2	12,500	10,850	90
5/8	20,000	17,250	180
3/4	29,000	25,600	320
7/8	37,000	32,400	470
1	49,000	42,500	710
1-1/8	58,000	50,800	960
1-1/4	74,000	64,500	1,350

(h) Power wrenches if used shall be done in strict accordance with the manufacturers recommendations and instructions for its use, operation and care. Periodic tests shall be made to assure the proper working condition and accurate calibration maintained.

5-A.16 PAINTING All structural metal shall be painted, except that which is to be encased in concrete and direct contact fireproofed. All surfaces shall be clean and dry when the paint is applied. The paint shall be kept well stirred during application and unless otherwise specified, shall be thoroughly brushed on and worked into joints and open spaces. No paint shall be used after pigment has become caked or hardened.

Shop painting is required on only structural metal that is to have a finally finished painted surface. Surfaces shall be cleaned, by effective means, of all rust, loose mill scale and foreign matter and shall be given one coat of primer in accordance with System Number St-1 of FAA-STD-003 (Federal Aviation Agency Standard, Paint System for Structures). Machine finished surfaces and surfaces that are to be field welded shall be protected against corrosion.

Information Handling Services, 1999
August 12, 1999 05:44:57

Field painting of all connections, abraded and damaged shop coat surfaces is included herein. Touch-up painting and the painting specified above shall be done as soon as practicable after the work is executed. Paint used shall be same kind, color and type used for the original shop coat.

For second coat paint either blue lead paint, graphite paint or aluminum paint as specified may be substituted, at the option of the Contractor.

Aluminum paint shall be mixed in the proportions of 2 pounds of aluminum pigment per gallon of mixing varnish. The paint shall be freshly mixed and only enough for one day's use shall be mixed at one time.

5-A.17 PROTECTING EXISTING STRUCTURES

(a) The Contractor shall examine all existing construction and structures and determine the type of equipment that will be required for the work indicated in the drawings and specified.

(b) The Contractor shall furnish and use construction equipment of adequate capacity and mobility to properly handle the new work without endangering existing utilities, structures, towers, and other existing items that would interfere or interrupt the normal activity of the existing facility.

(c) The Contractor shall submit to the Resident Engineer a schedule of the equipment and operations he proposes to employ in critical work areas prior to commencing work therein. The Resident Engineer will give the Contractor an order to proceed with the work as scheduled or modified as may be necessary in the operation of the facility.

5-A.18 STRUCTURAL SLIDE BEARING

(a) Friction reducing slide bearing is required at steel angle supporting first floor slab adjacent to existing concrete wall and is included in this Section of these specifications.

(b) The location of required slide bearings and details shall be in accordance with the requirements on the drawings and as specified in these specifications.

Information Handling Services, 1999
August 12, 1999 05:44:57

(c) The slide bearing units shall be a factory fabricated element consisting of a face sheet of tetrofluorethylene 3/32 inches thick bonded to a 10 gauge steel plate. A complete slide bearing shall consist of two units placed face to face in width indicated on the drawings and in longest practical unit length.

(d) Slide bearing unit shall be installed at top of horizontal leg of steel support angle by tack welding 12 inches on centers. The opposing upper half of the slide bearing element shall be tack welded to the continuous steel bar insert for concrete floor slab.

(e) Steel bar insert for concrete slab shall be properly positioned and secured to prevent displacement during the construction of the formwork and placing of concrete.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 5 METALS

SECTION 5B

MISCELLANEOUS METAL

5-B.1 REQUIREMENTS

(a) The work covered by this Section consists of furnishing all materials, labor, equipment, plant, tools, appliances and services necessary in connection with the installation of Miscellaneous Metal, complete, in accordance with the requirements in this Section of the specifications and the applicable drawings.

(b) Included under this Section are steel stairs, loose lintels, steel shapes, bent plate items, anchors and anchor bolts, steel parts, struts and items necessary for proper fastening and securing the various items. Metal expansion joint assemblies required for floor wall and ceiling installation shall be furnished herein. All exposed parts of expansion joint assemblies or devices shall be satin finish all other parts mill finish aluminum extrusions. Items and parts indicated in the drawings, and specified, shall not be construed as a complete list of items to be furnished herein; but only as a partial list of major items. All items necessary in connection with the use of the listed items and the work indicated in the drawings for complete assembly, fabrication and installation of all miscellaneous metal items shall be furnished and performed in accordance with the accepted practice. Items not named or specifically called out, in the drawings, but normally necessary in top quality work are required to be furnished hereunder.

5-B.2 MATERIALS

(a) Materials of the various items furnished under this Section shall be commercial quality regardless of kind, trade name or manufacture.

5-B.3 STEEL STAIRS

(a) Steel framed pan type for concrete filled treads shall be furnished, fabricated and installed as indicated in

Information Handling Services, 1999
August 12, 1999 05:44:57

the drawings, details and specified. Include all stringers, headers, supporting steel and anchors, support framing for steel pan at landings, risers and treads, pipe railing and hand rail brackets.

(b) Stringers, supports, connections, bolting and welding shall be designed and adequate to sustain a live load of 125 pounds per square foot.

(c) Stringers at wall shall be 12 inch 10.6 pounds channels with 1-1/2 inch flanges; flanges to face wall. Stringers at open sides of stairs shall be 12 inch 10.6 pound channels 1-1/2 inch flanges with a 3/16 inch thick by 12 inches wide steel cover plate continuous welded across face of flanged side of channel. Weld shall be ground smooth and finished to match edges of channel.

(d) Stringers shall be anchored to floor with 4 inches by 4 inches by 3 inches long clip angles welded to stringer on tread side and punched for 1/2 inch diameter expansion bolt and shield.

On tread side of stringer apply a continuous 1/4 inch thick by 1 inch wide bent to size of tread and riser; attach to stringer with minimum two welds 1-1/4 inches long at each tread and riser length.

On top of and centered on the stringers locate and weld in place 1-1/4 inch diameter by 8 inches long dowel to support stair railing at each rail post. Dowel shall be shop fitted to rail post before welded into position. Rail post shall be attached to dowel with two plug welds in the field; ground and finished to match adjacent surface.

(e) Tread and riser pan shall be formed from No. 12 gauge steel sheets in "tread-riser" units as indicated and fastened in place by welding to supporting bar at each end and minimum three intermediate welds between stringers.

(f) Railing shall be shop fabricated from 1-1/4 inches diameter standard steel pipe. Railing shall be fabricated in largest practicable sections with minimum field welding and finishing. Railing shall be fabricated in accordance with the details indicated in the drawings.

Wall hand rail shall be fabricated and shaped as indicated on the drawings using same size pipe as center railing. Provide standard stock pattern wall hand rail brackets as detailed in the drawings. Ends of wall hand rail shall be turned back and flush capped 1/2 inch from finished wall.

Information Handling Services, 1999
August 12, 1999 05:44:57

(g) Abrasive safety nosing shall be installed and properly anchored into the tread construction. Nosing shall be Wooster Products Inc. No. 131 three inches wide or Andco Building Speciality, Incorporated Style 131-EX or equal. Steel pan nosing shall be notched to allow nosing to finish flush with face of tread. Provide suitable anchors at 16 inches on centers maximum spacing.

NOTE: Same abrasive safety nosing provided for steel pan stairs shall be furnished and installed in poured-in-place concrete stairs. Provide suitable anchors for concrete tread.

(h) All steel stair parts shall be shop coat painted with one coat of rust inhibitive paint.

(i) The Contractor shall submit shop drawings in accordance with the requirements in Section 1-A.5 Special Conditions.

5-B.4 STAIR RAILING (CONCRETE STAIR)

(a) Included herein is the furnishing, fabricating and insta stallating steel stair railing and steel wall hand rail including wall brackets and expansion bolts and shields for mounting all rail items.

(b) Rail members and wall rail shall be standard 1-1/2 inches square steel tubing minimum wall thickness shall be 3/16 inches. Post shall be standard 2 inches square steel tubing same wall thickness as rails. Terminal ends of rails and post shall be closed with end caps welded in place and ground to same radius as corners of tubing.

Provide internal pipe spacers inside of post where attachment bolt holes are drilled to prevent collapse of wall.

(c) Shop fabricate railing in largest practicable sections with minimum field welding and finishing to be necessary.

(d) Shop paint all parts with one coat rust inhibitive paint.

(e) NOTE: See note in 5-B.3 (g) above for abrasive safety nosing for interior concrete stairs.

(f) The Contractor shall submit shop drawings in accordance with the requirements in Section 1A.5 Special Conditions.

Information Handling Services, 1999
August 12, 1999 05:44:57

5-B.5 ROOF CURBS

(a) Under this Section of the specifications, steel plate roof curbs shall be provided and installed as indicated in the drawings.

(b) Roof curbs shall be of ¼ inch thickness steel plate bent, formed and welded as specified. Required dimensions are shown in the drawings and details. Curb walls shall be continuous welded at all corners. Outside corner of roof flange shall be filled in with a square of steel plate same thickness and width as flange; continuously welded in place. Stud bolts ½ inch in diameter by 1- 5/8 inches long shall be welded on exterior face of curb on a line 1-3/4 inches below top of curb and at 24 inches on center, but, not less than two on any one side. Stud bolts shall be fitted with standard washer and nut to fasten nominal 2 inches thick lumber nailer as indicated.

(c) Structural supporting frame of structural steel angles between steel joist are included herein. Size of steel members, dimensions of frame and method of fastening to steel joist shall be in accordance with the details indicated in the drawings.

(d) Roof curbs shall be shop coat painted after fabrication with one coat of rust inhibitive paint.

(e) The Contractor shall submit shop drawings in accordance with the requirments in Section 1-A.5 Special Conditions.

Information Handling Services, 1999
August 12, 1999 05:44:57

5-B.6 EXTERIOR STAIR RAILING

(a) Standard steel pipe stair and area railing required on the drawings are included herein.

(b) All railing sections shall be fabricated from standard 1-½ inches inside diameter black steel pipe. All joints shall be coped, welded and ground smooth ready for , and shop painted. Railing shall be shop fabricated in largest practicable sections keeping field welding to a minimum. Railing shall be fabricated for setting in sleeves with grout.

(c) Setting sleeves shall be cut from standard galvanized steel pipe seven inches long. Bottom end of sleeve closed with steel plate 4 inches square by ¼ inches thick welded in place. Inside diameter of sleeve shall be not less than 3/4 inches greater than outside dimension of railing post to allow for grout setting.

(d) Area railing shall be fabricated to provide a removable section as indicated in the drawings.

(e) Welding both shop and field shall be smooth, watertight, without pitted surfaces. Metal filler shall not be used in lieu of smooth welding.

(f) Wall railing shall have a terminal post 4 inches out from building wall line. Wall railing shall be located on the centerline of wall.

(g) Stair railing shall be a continuation of wall railing by field welding of connecting parts.

(h) Railing posts shall be fabricated to set into sleeves six inches in depth and grouted in with Embeco or similar grout materials.

(i) The Contractor shall submit shop drawings in accordance with the requirements in Section 1-A.5 Special Conditions.

Information Handling Services, 1999
August 12, 1999 05:44:57

5-B.7 BRIDGE SUB FRAMING (See Structural Drawings for Main Framing)

(a) Sub-Framing and glazing frame for observation Bridge shall be furnished, fabricated and installed herein in accordance with the requirements on the drawings and as specified.

(b) Sub-framing generally consists of wall and glazed panel framing installed on a structurally suspended floor system. Sub-frame wall panel members between suspension tubes shall be 3-5/8 inches wide metal channel type standard screw studs at 16 inches on centers. Standard floor channel shall be used as a header below window openings. Double studs back to back under each window sill frame cross channel. Spot weld double studs at 6 inches on centers both sides.

(c) Glazed openings shall be framed with standard 3 inch channels and 1-1/2 inch by 1-1/2 inch by 3/16 inch steel angle glass stops. Angle stops shall be mitered and welded in all corners. Unit frame attached to channel frame with field welds or by drill, tap and cap screw spaced not more than 16 inches on centers.

(d) Glazing bead shall be a channel formed from 10 gauge sheet steel or a drawn tube 3/4 inches wide by 1-3/8 inches deep. Glazing bead shall be attached to glass stop frame with 1/4 inch diameter by 1-5/8 inches long counter-sunk head machine screws at 16 inches on centers.

(e) Structural channel frame shall be fitted and fabricated in largest practicable sections in the shop to require minimum field welding. Clip angles shall be provided for supporting sub-framing by suspension from structural side framing member above as indicated in the drawings.

(f) The Contractor shall submit shop drawings in accordance with the requirements in Section 1-A.5 Special Conditions.

Information Handling Services, 1999
August 12, 1999 05:44:57

5-B. 8 ATTIC SPACE WALKWAY

(a) Furnish and install steel grating walkways in the attic space in accordance with the requirements in the drawings and as specified herein.

(b) Grating shall be fabricated from 1-½ inches deep by 1/8 inches in thickness steel bar stock for bearing bars spaced at 1-3/16 inches on centers; cross bars shall be ½ inches deep by 1/8 inches in thickness spaced at 4 inches on centers. Grating shall be fabricated by electropressure welded process.

Fabricate grating in longest practicable lengths and in widths indicated in the drawings. At ends of each section of grating provide a bar header of bar stock 1-½ inches deep by ¼ inches in thickness continuous welded to ends of each bearing bar, full width of grating section.

(c) Sections of grating shall be placed over structural framing members (beams and channels) and tack weld outside bearing bar at each point of bearing. Note: Prevent damage of large area of galvanized (zinc coated) surface in process of welding in the field.

(d) After fabrication grating sections shall be finished in the shop by hot dip process galvanizing.

(e) The Contractor shall submit shop drawings to the Resident Engineer for his approval before fabrication of the work is started, in accordance with the requirements of Section 1-A Special Conditions.

(f) The Contractor shall submit a sample section of grating to the Resident Engineer for his examination and approval. Sample shall be a 12 inches by 12 inches square cut from a corner showing end header fabrication and all the nominal features and characteristics of the grating proposed to be furnished. Included with sample shall be manufacturer's catalogue sheets and performance data.

(g) Grating shall be similar in appearance to steel grating manufactured by one of the following manufacturers:

1. Reliance Steel Products Company
2. Kerrigan Iron Works Company
3. Irving Subway Grating Co., Inc., or equal.

Information Handling Services, 1999
August 12, 1999 05:44:57

5-B .9 RAMP GRATING PLANK

(a) Provide ramp grating plank as required in the drawings, detailed and specified herein.

(b) Plank sections shall be fabricated from 2-1/2 inches deep by 3/16 inches in thickness aluminum bar stock with cross bars of 3/4 inches deep by 3/16 inches in thickness aluminum bar stock. Bearing bars shall be 1 inch on centers and cross bars 2 inches on centers.

(c) Grating shall be fabricated by, double-lock, pressure locked joints. Plank shall be 12 inches in width and length as indicated in the drawings. Lower end of plank shall be beveled and welded to a 10 inches wide by 12 inches long by 1/8 inches in thickness aluminum base plate. Upper end of plank shall be beveled to a plumb cut with a bearing stirrup formed from aluminum sheet stock 12 inches wide by ¼ inches in thickness and 10 inches long base. Stirrup plate shall form plank header and shall be continuous welded to each bearing bar.

(d) Surface finish shall be treated with aluminum oxide abrasive filled in "V" edge formed by surface parting of the grate members. Abrasive particles shall be embedded in a epoxy binder that is totally reistant to acids, oil, gasoline, alkali re-agents and corrosive effects of salt water.

(e) Grating plank shall be fabricated from grating manufactured by one of the following manufacturers:

1. Reliance Steel Products Company
2. Kerrigan Iron Works Company
3. Irving Subway Grating Co., Inc., or equal.

(f) The Contractor shall submit to the Resident Engineer shop drawings in accordance with the requirements of Section 1A Special Conditions.

(g) The Contractor shall submit a sample section of grating to the Resident Engineer for his examination and approval. Sample shall be a section not less than 12 inches square and shall show the required construction details. Included with the grating shall be manufacturer's catalogue sheets and performance data.

Information Handling Services, 1999
August 12, 1999 05:44:57

5-B.10 SHOP FABRICATED STAIR UNIT

(a) A completely shop fabricated stair unit shall be provided at door between rooms 115 and 110 as indicated on the drawings.

(b) Stringers, anchors, rails, treads and fastening devices are included in this Section.

(c) Treads shall be fabricated from grating sections with 1-½ inches deep by 1/8 inches in thickness bearing bars and ½ inches deep by 1/8 inches in thickness cross bars. Bearing bars shall be at 1-3/16 inches on centers and cross bars at 4 inches on centers. Wearing surface of all bars shall be treated with aluminum oxide abrasive filled into "V" grooves and embedded in a epoxy binder. Weld each bearing bar to supporting bar on stringer at each end of tread sections.

(d) Railing shall be fabricated from 1 - ½ inches by 1- ½ inches square steel tube with minimum 10 gauge wall thickness. Fabricate railing in accordance with the detailed drawings.

(e) Completed unit shall be shop finished with one coat of rust inhibitive paint.

(f) The Contractor shall submit shop drawings to the Resident Engineer for his approval in accordance with the requirements under Section 1A Special Conditions.

5-B.11 LIFT RINGS AND SEAL BAR

Furnished under this Section are lift rings required for handling and setting precast concrete wall sections. Rings shall be fabricated from 1 inch diameter mild steel rod stack with welded closed eye one end and standard pitched thread at opposete end.

Insert receiver shall be fabricated in accordance with the detailed drawings.

Seal bar is cut from 3/4 inches thick by 2 inches wide steel bar stock.

Included herein are all types of retaining angles, clips, bolts, shields and accessories necessary for securing precast sections in place as indicated in the drawings. Structural steel framing for opening through precast concrete sections, to prevent seismic slipping, shall be provided in accordance with the drawing requirements and is included in this Section of these Specifications.

Information Handling Services, 1999
August 12, 1999 05:44:57

5-B.12 FLOOR TRENCH COVER

(a) Furnish and install a floor frame to fabricated from 2 inch by 2 inch by 1/4 inch steel angles with strap anchors at 18 inches on centers.

(b) Frame shall be fabricated with mitered and fully welded corners. All exposed face welds shall be ground smooth. Provide 1/4 inch thickness steel checkered plate cover fabricated in sections each approximately 5 feet in length. Each section shall be provided with one #1226 zinc plated chest handle for removing and replacing of cover sections.

(c) Floor frame shall be shop fabricated in longest practicable lengths and minimum field welding. After shop fabrication floor frame and cover plate shall be finished with a hot dip galvanizing process conforming to ASTM Specification A123, with a 1.25 ounce per square foot coating deposit. Fabricator shall not use coated welding rods or any other fabrication method which would prevent proper galvanizing or coat bond. All bolts connecting galvanized members shall be galvanized by same process as adjacent members.

5-B.13 ACCESS DOORS AND PANELS

(a) Where indicated on the drawings access door shall be provided and installed under this Section of these specifications.

(b) Locations of doors and installation details shown and indicated on the drawings and Door Schedules. Access doors and frames shall be rated and labeled in accordance with Underwriters' Laboratories Inc., "B" Label classification. Access panels shall be standard non-labeled construction with cam type lock. Labeled doors shall have manufacturer's standard items of hardware with label similar to door to which hardware is applied.

(c) Access doors and panels shall be fabricated with frame surrounds that can be securely anchored to the type of wall construction into which installation is required. Panel door shall be fabricated from sheet steel not less than 8 gauge in thickness with continuous piano type hinge.

Information Handling Services, 1999
August 12, 1999 05:44:57

5-B.14 STEEL LADDER

(a) Furnish and install steel ladder where indicated on the drawings and in Mechanical Room Area.

(b) Ladder shall be fabricated from 2 inches wide by 3/8 inches thick steel bar stock side rails. Rungs 12 inches on centers: 18 inches long cut from 7/8 inches square steel bar stock. Rungs shall be plug welded on a center line between side rails with corners vertical.

(c) Side rails shall be provided with a 90 degree x 2-1/2 inch angle bend at top with a punched hole for 1/2 inch diameter bolt and expansion shield. Bottom end of side rail shall be 12 inches above floor and extend 30 inches above top landing with a 10 inch radius 180 degree return to provide a safety guard. Side rail shall be attached to wall with three angle brackets of 2 inch by 3/8" x 9 inches welded to outside face of rails one each opposite lower and upper rung and one at mid span. Anchor brackets to wall with 1/2" bolt and expansion shield at 2-1/2 inch leg of 9 inch angle bracket.

Information Handling Services, 1999
August 12, 1999 05:44:57

5-B.15 EXPANSION JOINT COVER

Aluminum expansion joint covers shall be furnished and installed as indicated on the drawings. Joint cover assembly shall consist of aluminum extrusions with stainless steel anchors. Expansion filler strip of pure vinyl shall be retained in place by key lock and adhesive. All exposed surfaces shall be of mill finish aluminum.

5-B.16 HANGER RODS AND BOLTS

(a) Hanger rods 3/8 inch in diameter and greater shall be furnished under this Section of these Specifications.

(b) Hanger rods, bolts, braces and accessories necessary to provide the required support for folding partitions indicated on the drawings shall be provided herein.

(c) Bolts 5/8 inch in diameter and greater that are necessary for field assembly of work indicated on the drawings, or reasonably inferable therefrom, shall be provided herein. (Structural bolts and high strength bolts are not included herein.)

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 5 METALS

SECTION 5C

STEEL DECKING

5-C.1 REQUIREMENTS. The work covered in this Section consists of furnishing all materials, labor, equipment, tools, accessories, and services necessary to complete the installation of Steel Decking in accordance with the requirements on the drawings and specifications.

Location and extent of decking, spacing of supporting members, and elevations are shown on the drawings.

5-C.2 MATERIALS. Steel decking shall be prefabricated units, formed from zinc-coated steel sheet stock. Decking units shall be cut to lengths that will locate end joints over supporting members.

Steel decking as specified herein shall be as manufactured by Inland Steel Products Co., the R. C. Mahon Co., the H. H. Robertson Co., or equal. Decking shall be formed from steel conforming to requirements to ASTM A245, ASTM A446 or ASTM A366.

Except as hereinafter amended, decking shall be designed in accordance with American Iron and Steel Institute's Specifications for the Design of Light Gage Cold Formed Steel Structural Members and the requirements of the Steel Deck Institute.

Maximum fiber stress shall not exceed 20,000 p.s.i. under total dead and live load. The maximum allowable deflection under live load shall not exceed 1/240 of the span length. Dead loads and live loads shall be taken from drawings.

Where possible fabricate units in length to extend over three or more spans. Stagger end joints. Fabricate sheets so as to permit telescoping end laps not less than two inches. Side laps shall be interlocking and continuous for the length of section. Deck units shall be cut to lengths that will locate end joints over supporting members.

The steel sheets shall have a protective coating of zinc base applied to the steel before forming. Coating shall conform to Federal Specifications QQ-S-775, Type I, Class E.

Steel decking furnished and installed under this Section of the specifications shall conform to the following schedule

Information Handling Services, 1999
August 12, 1999 05:44:57

of properties and distribution:

(a) Steel Decking

1. Steel decking for roof shall be single sheet type, nominal thickness of 3 inches out to out.

2. Steel sheet stock used in fabrication shall be 18 gauge, section modulus .73 in. 3, moment of inertia 1.23 in. 4.

3. Steel decking shall be welded to support beams in accordance with the Steel Deck Institute specification requirements to provide a continuous diaphragm action.

(b) Second Floor Decking

1. Steel decking for second floor shall be double sheet type with a nominal thickness of 3 inches out to out.

2. Steel sheet stock used in fabrication shall be 16 gauge, section nodulus 1.260 in. 3, moment of inertia 2.888 in. 4, 14 square inches per void for electrical raceway 8 inches on centers required.

3. Steel decking shall be welded to support beams in accordance with the Steel Deck Institute specification requirements to provide a continuous diaphragm action.

(c) Bridge Decking

1. Steel decking for bridge floor construction shall be double sheet type with a nominal thickness of 3 inches out to out.

2. Steel sheet stock used in the fabrication shall be 14/16 gauge, section modulus 2.18 in. 3, moment of inertia 3.91 in. 4, 14 square inches per void for electrical raceway 12 inches on centers required.

3. Steel decking shall be welded to support beams in accordance with the Steel Deck Institute specification requirements to provide a continuous diaphragm action.

Cut holes in units for mechanical and electrical work as shown. Closure plates or caps shall be provided where holes are cut in cells.

Information Handling Services, 1999
August 12, 1999 05:44:57

Welding washers or similar accessories shall be provided for a complete installation. Cants, curb intersections and otherwise necessary formed sections in connection with steel decking shall be provided under this Section of these specifications.

5-C.3 INSTALLATION. Installation of steel decking shall be done by only well qualified and experienced welders. Every steel decking unit shall be welded to the supporting members at each rib using welding washers adaptable to the rib width. Provide two welds of the interlocking edge of adjacent sheets between supporting members. Where decking units lap over supporting members the weld shall penetrate both sheets as a single unit.

If ribs of decking are more than 6 inches apart, one weld shall be made at the center point between ribs at each end joint where sheets lap over supports for splicing. Weld shall provide the necessary tie to prevent collapse between the ribs.

Welds shall be cleaned as the work progresses and shall not be permitted to oxidize. As each weld is completed the weld splatter and surface oxides shall be immediately brushed away and the weld reheated to approximately 600 degrees F. and the surfaces shall be re-galvanized with zinc. The zinc alloy shall conform to Federal Specification O-G-93 "Galvanizing Repair Compound".

5-C.4 SHOP DRAWINGS. Shop drawings shall show complete details of the typical and special units. All necessary fastening devices and appliances locations and descriptions of welding; closure units, welding washers, cants, and curbs. A plan shall indicate the pattern of joint lapping of the units.

Submit with shop drawings 6 x 24 inch prepared deck samples of the sheet stock used in fabrication of the steel decking units. Samples shall not be finished shop coat painted same as steel decking to be furnished.

Fabrication shall not be commenced until shop drawings have been approved and returned. See Section 1-A.5 Special Conditions.

The Contractor shall furnish and submit to the Resident Engineer an affidavit from the manufacturer, certifying that the materials or products delivered to the Contractor. meets the requirements specified in these specifications.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 5 METALS

SECTION 5 E

PROTECTED METAL SIDING

5-E.1 REQUIREMENTS The work covered by this Section consists in furnishing all plant, labor, equipment, and materials, and in performing all operations in connection with the installation of protected metal siding, complete, in strict accordance with this Section and the applicable drawings.

5-E.2 LOCATION The protected metal siding to be furnished shall match, as nearly as possible, the existing siding at the facility. The following is the original specification which shall be applicable for this project. The color and material are subject to the approval of the Resid. Engineer.

5-E.3 SHOP DRAWINGS Shop drawings are required. They shall show complete details of the typical and special sheets and the details to fastening same. Erection plans shall show the location of every sheet, with all closures, end and side laps. Sheets and accessories shall be marked before delivery to correspond with the shop drawings.

5-E.4 MATERIAL Siding shall be of that pattern known in the trade as "V"Beam" or "Deep Rib." Siding shall be prepared from rolled steel sheet, not lighter than 22 gauge before forming. It shall be capable of withstanding a wind load of 30 pounds per square foot on spans governed by the girt spacing shown on the drawings, without deflection of more than 1/240 of the clear span and without developing stresses in excess of 18,000 psi under normal wind loading. Color of siding shall be yellow buff to match existing siding of the control wing.

5-E.5 PROCESS The material shall be processed approximately as follows. Factory processing is preferred.

a. The steel core shall be thoroughly cleaned with acid before molten zinc is applied. The molten zinc shall completely cover both sides and edges of the steel sheet. It shall be fused to the steel sheet while in a molten state. Asbestos

Information Handling Services, 1999
August 12, 1999 05:44:57

felt, before application to the molten zinc, shall be heated to a degree which will burn all impurities from the material. In this state, the felt shall be pressed into the molten zinc by a rolling operation of such a nature that the semi-liquid metal will be forced into the interstices of the felt, so that on cooling the metal adhesive forms a permanent metallic bond between the steel core and the felt.

b. The asbestos felt shall then be impregnated with asphalt. The impregnating compound shall uniformly and completely saturate the felt and be of a moisture and fume resisting character.

c. The exterior surface shall be a fast inorganic colored coating, factory applied. Preferally hot, this coating shall be water repellent, fume and chemical resistant, and shall not crack away from the core under field erection conditions at temperatures as low as -10 degrees F., nor shall it flow at temperatures under 150 degrees F.

d. The finished sheet, when bent over a 1" diameter form after one hour exposure to zero degrees F. shall show no cracking or separation of laminations. Outside weathering shall be resistant to a 3% salt bath solution.

e. The material shall be suitable for punching and forming, and shall not chip, crack or craze under these operations. It shall have a uniform appearance after erection.

f. Mineral coated asphalt-protected sheets, factory fabricated, consisting of a specially prepared, annealed sheet-steel core of the gauge specified, cleaned thoroughly and covered on all surfaces with a rust inhibitive coating, may be used instead of asbestos-protected metal. The sheet shall be heated and coated with a modified asphalt adhesive. After the coated sheet has been cured, it shall be given two separate coats of weather resistant, fume, corrosion and chemical resistant reinforced bituminous compound.. Immediately after the second bituminous coat, a layer of mineral mica shall be embedded in the coated sheet, under heat and pressure. An integral color coating of alweather-resistant, fume, corrosion and chemical resistant synthetic resin shall be applied to the sheet in the desired color. The type of siding selected shall match the existing siding at the facility.

5-E.6 EXTENT OF WORK Siding shall include all closures, corners, flashings, special sheets and any miscellaneous items required for a complete water-tight installation. All exposed accessories

Information Handling Services, 1999
August 12, 1999 05:44:57

shall be asbestos protected metal of the same color and quality as the siding sheets. Fasteners shall be furnished with the sheets and shall be of suitable size, weight, shape and number for the site conditions. Fasteners shall include the necessary nails, bolts, clips, washers, straps, and shall be of the siding markers' standard pattern and design. Fastenings if steel or iron, shall be plated or coated to prevent corrosion or staining. Fasteners that pass through the sheets shall have washers of an elastic material that will effectively and permanently seal the work against wind and water. All caulking in connection with this phase of the work shall be done by the siding erector, and of a color matching the siding.

5-E.7 INSTALLATION Protected metal shall be installed in accordance with the approved shop and erection drawings, and in accordance with the maker's instructions. All flashings, fittings, and corners shall be installed complete. Where it is necessary to cut finished sheets in the field, the exposed edges shall immediately be protected with a sealing compound supplied by the maker of the sheets.

5-E.8 TESTS AND TESTING Materials specified herein, other than protected-metal sheets, will be tested for conformance, as required. All protected-metal sheets specified above shall meet the following test requirements:

a. Acceptance Tests Prior to delivery of the proposed siding sheets to the site, the Contractor shall furnish the Resident Engineer certified laboratory test reports showing that the type of sheets being furnished have been tested within the past 12 months and have passed the following tests:

1. Salt-spray test A 10- by 12-inch sample of the protected steel sheets, with a minimum of two raw cut edges, shall withstand a salt-spray test for a minimum of 720 hours in accordance with the ASTM Standard B 117, exclusive of the scratch requirement in the test. Immediately upon removal of the panel from the test, the covering shall show no signs of cracking, peeling, or blistering. Loss of adhesion between the protective coating and base metal or between the coating and the asbestos-felt on the exposure side shall not exceed 50 per cent of the surface. Corrosion shall be limited to surface rust with no visible pitting of the base metal.

Information Handling Services, 1999
August 12, 1999 05:44:57

2. Impact and fracture test The protected steel sheets shall withstand an impact and fracture test wherein a 760-gram steel ball is dropped through a distance of 7 feet, controlled to strike the crest of a corrugation near the center of a 12-inch square sample of standardseorrugated material placed on a flat concrete testing surface. The impact shall not break the coating seal or dislodge or loosen the coating over an area greater than 8 square inches on the exposure side when tested at 0 degrees F. Coating, that can be readily removed with a penknife blade, will be considered dislodged or loosened.

3. Bending test A 4-by 8-inch sample of a 24-gauge protected steel sheet shall be bent 90 degrees around a 1-inch diameter mandrel at 32 degrees F. without adversely affecting the sheet. The bend shall be accomplished in 2 seconds. Cracks in the surface coating in excess of 1/32-inch wide shall be cause for rejection of the sheets.

4. Accelerated weathering test The protected steel corrugated sheets shall withstand a weathering test a minimum of 1,000 hours in accordance with the ASTM Standard E 42, using Type A weathering machine without cracking, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Particular attention shall be given to the loss of adhesion in the valleys of the corrugations.

b. Field Tests At the discretion of the Resident Engineer, sample sheets may be taken at random from each delivery or from stock piles on the site at any time during the construction period for tests to check the conformance of the materials with the above acceptance tests and with other requirements specified herein. Failure of the sample sheets to pass any of the required tests shall be cause for rejection of all sheets represented by the samples.

5-E.9 CERTIFICATES At the time a list of sub-contractors is furnished in accordance with GENERAL CONDITIONS, the Contractor shall also furnish a statement from the manufacturer of the protected metal certifying that the product when installed in accordance with the manufacturer's recommendations will meet the contract requirements. After installation of the protected metal, and before final acceptance by the Resident Engineer, the Contractor shall deliver to the Resident

Information Handling Services, 1999
August 12, 1999 05:44:57

Engineer a certificate by the manufacturer stating that the material has been installed properly and will be free from defects for a period of one year from date of acceptance.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 6 CARPENTRY AND MILLWORK

SECTION 6A

ROUGH CARPENTRY

6-A.1 REQUIREMENTS The work covered in this section of the specifications consists of furnishing all materials, labor, equipment, tools, plant accessories, appliances and services necessary to complete all Woodwork required in the drawings and specified herein.

6-A.2 LOCATION AND EXTENT OF WORK

a. The work indicated in the drawings and specified in this Section of the specifications is a general listing of the work to be performed herein.

b. All types and classifications of Rough Carpentry including installation of work other than woodwork but normally performed under rough carpentry are included herein.

c. The intent of this Section is a guide to the work herein and not to assign work to any one or other trade.

6-A.3 GENERAL The classification, basic grades and sizes of structural material, boards and strips, including rough, surfaced or worked lumber, shall be in accordance with Federal Specification MM-L-751c.

6-A.4 HANDLING AND STORAGE Material shall be so delivered, piled and handled as to protect it against damage.

6-A.5 DEFECTS Defects or blemishes prohibited by MM-L-751-c shall not appear in the material used. Sizes specified are nominal (board measure) dimensions, unless otherwise noted.

Information Handling Services, 1999
August 12, 1999 05:44:57

Lumber and timber shall be sound, thoroughly seasoned and well manufactured. Materials generally shall be free from warp that cannot be corrected in process of bridging or nailing. Woodwork exposed to view in finished interior spaces shall be dressed.

6-A.6 GRADES

a. General The grades of materials shall be as defined by the rules of the recognized association of lumber manufacturers producing the materials specified, but the maximum defects and blemishes permissible in any specified grade shall not exceed the limitations of American Lumber Standards. Grades better than specified will be accepted.

b. Grade

(1) Less Than 2 Inches Materials from stock less than 2 inches thick shall be any of the following:

No. 1 Common Grade: Southern Pine, Douglas Fir (coast Region), Western Red Cedar, Englemann Spruce, Sitka Spruce or Hemlock.

No. 1 (Merchantable) Eastern Spruce.

No. 1 Heart Common Redwood.

No. 2 Common Grade: Douglas Fir (inland Region), white fir, Cypress.

No. 3 Common Grade: Northern white pine, sugar pine, Idaho white pine, Ponderosa pine or Western larch.

(2) 2 Inches and Larger Structural material of every description 2 by 4 inches (nominal) and larger in cross-section shall be structural grades of joists and plank or beams and stringers or posts and timbers as the use may require as follows:

No. 1 dimension medium grain (1450#) short leaf Southern pine.

No. 1 dimension (1700#) long leaf Southern pine.

Information Handling Services, 1999
August 12, 1999 05:44:57

No. 1 structural (1600#) Southern pine.

Select all-heart (1300#) redwood.

Common structural (1450#) Inland Empire or No. 1 dimension (1450#) West Coast with slope of grain not more than 1 in 10 Douglas fir.

Select structural (1300#) Eastern hemlock.

Structural Eastern spruce (1300#).

Common Structural (1450#) Western larch.

Structural heart (1450#) cypress.

Common dimension (1450#) oak.

No. 1 common dimension (1100#) Western Red Cedar.

6-A.7 LABEL Each piece of lumber (or bundle in bundled stock) shall bear the official grade and trade mark of the association under whose rules it is graded, or the lumber shall be accompanied by a certificate of inspection issued by that association.

6-A.8 FRAMING

a. General Woodwork shall be properly framed, closely fitted, accurately set to the required lines and levels and rigidly secured in place. Shims shall not be used for leveling on wood or metal bearings. Slate or tile shims with full bearings may be used as necessary for leveling on masonry or concrete.

b. Bridging Horizontal blocking shall be provided at midspan but not over 8 feet apart in framed walls or partitions covered with wallboard or similar materials.

c. Blocking Blocking shall be provided between framing wherever necessary to receive the ends of diagonal covering, and for fastening of light outlets, plumbing fixtures, radiator brackets, etc.

6-A.9 SLEEPERS AND NAILERS Sleepers, nailers, blocking, and cants,

Information Handling Services, 1999
August 12, 1999 05:44:57

for metal roof shall be pressure treated as specified herein and shall be 2 or 3 inch stock, either square-edged or beveled 1/2 inch on both edges, or as indicated in the drawings.

6-A.10 FURRING (WHERE REQUIRED)

a. General Wood furring shall be provided where and as necessary to obtain the required lines, contours, or levels in the finished surfaces, except where metal or tile furring is specified.

b. Size Furring shall have a face width of at least 1-5/8 inches and be of the required depth and spaced not more than 16 inches on center.

c. Fastening Wall furring less than 2 inches deep shall be fastened at 3 foot intervals, and furring 2 inches or more in depth shall be fastened at 5 foot intervals.

6-A.11 WOOD GROUNDS

a. General Grounds shall be set for plaster at points where other finish will connect therewith. Grounds shall be continuous and set back 1/2 inch from the exposed edges of overlapping finish. They shall be straight and plumb or level and in true alignment. Spot grounds set in plaster of Paris not more than 12 inches on centers may be used where continuous grounds are not practicable.

b. Size Grounds shall be 13/16 inch thick for lath and 5/8 inch thick on masonry and 1-1/2 inches wide.

c. Temporary Where the removal of grounds is required, temporary grounds shall be set to provide 1/2 inch clearance between the plaster edge and the other finish.

6-A.12 TEMPORARY CLOSURES

a. General Temporary doors and cloth covered frames for windows shall be provided for all exterior openings during plastering and until the building has dried out.

b. Option Windows may be glazed instead of being fitted with temporary closures, but the windows and glass shall be

Information Handling Services, 1999
August 12, 1999 05:44:57

carefully protected and any glass that is broken, scratched or otherwise damaged shall be replaced with new.

6-A.13 ANCHORS, BOLTS, ETC.

a. General All bolt heads and nuts bearing on wood shall have standard washers. Where sizes of anchors and bolts are not indicated on the drawings, the following requirements shall govern.

Fastenings for wood grounds and furring to masonry or concrete shall be of metal and of type and spacing best suited to conditions. Hardened steel nails, expansion screws, toggle bolts, self-clinching nails, metal plugs, inserts or similar fastenings shall be used. Wood plugs or nailing blocks are not acceptable.

Powder actuated or powered devices and equipment shall not be used in this work, and shall not be delivered to the site.

(a) Anchor Bolts Anchor bolts generally shall be 1/2 inch diameter with nut and washer and wall end bent 2 inches. Anchor bolts shall extend at least 4 inches into masonry or concrete.

(b) Expansion Bolt Expansio · bolts shall be 1/2 inch diameter with expansion sleeves.

(c) For Nailers Bolts for nailers and bearing strips on steel shall be 1/2 inch for nailers and 3/4 inch for bearing strips.

6-A.14 PRESSURE TREATMENT

a. General Pressure treatment for woodwork shall conform with the Standard Specifications of the American Wood Preservers' Association latest issued publication for treating structural timbers. Treatment shall be applied to all wood except temporary structures or finally interior finish materials.

b. Treatment The preservatives shall be zinc-chloride, zinc-meta-arsenite or wolman salts with arsenic content, at the

Information Handling Services, 1999
August 12, 1999 05:44:57

option of the Contractor. The zinc chloride treatment shall be not less than one pound of zinc chloride (dry salt) or 3/4 pound of chromated zinc chloride (dry salt) per cubic foot, and the wolman salts and zinc-meta-arsenite treatments shall be not less than .30 pound (dry salt) retained per cubic foot. The Contractor shall furnish the Resid. Engineer a certificate in duplicate stating that the material delivered for use has been pressure treated as specified and giving the name of preservative and quantity retained per cubic foot of material. The certificate shall state the name of the building, the name of the General Contractor and the name and address of the treating plant and shall be signed and dated by the General Contractor and his Sub-contractor. The Resid. Engineer will keep one copy of the certificate and forward the other copy to the Regional Office.

6-A.15 ROUGH HARDWARE Furnishing and installing of all rough hardware of approved types and sizes required to draw and hold members together is included herein. Rough hardware shall meet the following Federal Specifications:

(1)	Lag Screws	FF-B-561a
(2)	Nuts and Bolts	FF-B-571a
(3)	Nails	FF-N-101
(4)	Screws	FF-111a

6-A.16 TEMPORARY PROTECTION Temporary protection of every type shall be provided by the contractor and removed by him at his own expense when no longer needed. Temporary protection shall generally include but is limited to the following items.

a. General Protection shall include wood doors, wood railings, protection upon stairs at floor openings; provide and maintain temporary stairs, ladders, ramps, scaffolds, chutes, and runways as required for the execution of the work of all trades. However, certain trades that require special type scaffolds, and ladders, in the performance of their work shall be furnished under the applicable Sections of the specifications.

b. Openings in Slabs and Decks Protect openings with adequate wood railings substantially framed, braced and nailed or bolted together. Cover openings not required to be kept open with planking of adequate thickness.

Information Handling Services, 1999
August 12, 1999 05:44:57

c. Finished Surfaces Provide box protection for finished surfaces exposed to possible damage.

d. Stair Protection Provide temporary wood protection for stair, cover treads, risers and stringers.

6-A.17 Exterior Openings Provide temporary enclosures for exterior openings where required, properly secured and maintained until finished work is in place. Provide temporary doors to give access to building, provide hardware, locks and keys. Use of the permanent building finish hardware for temporary enclosures is not permitted.

6-A.18 DUST PARTITION Provide dust proof temporary partitions to enclose work area where dust is created in heavy demolition or similar work. Dust proof partitions shall be constructed to screen out work areas from the occupied areas where walls are being removed, holes or openings cut through existing walls, ceilings, floor or related conditions.

Dust partitions shall be constructed using nominal 2 inch by 4 inch studs at 24 inches on centers with a conventional single sole plate and double top plate. Cover wall with 3/8 inch thick plywood with all joints nailed and taped. Caulk perimeter of partition for total sealing and dust proofing.

Dust partitions shall remain in place until the dust hazard no longer exists, or when directed by the Resid. Engineer that removal is acceptable.

6-A.19 BARRICADES Outside barricades, guard railings, temporary fencing and similar structures are included herein.

a. Extent of the Work The extent of the work included herein shall be determined at the site; approved by the Resid. Engineer, adequate to provide a reasonable degree of protection for workmen at the building site, personnel in adjacent areas, the public authorized to frequent the site, finished existing or new work and equipment.

b. Reference The provisions and methods under this Section shall be in accordance with the requirements and recommendations in the "Manual of Accident Prevention in Construction" issued by the Associated General Contractors of America, Inc.

Information Handling Services, 1999
August 12, 1999 05:44:57

6-A.20 CUTTING AND REPAIRING Included herein is all cutting, fitting, framing and repairing of the work included and the work herein connected with all other trades which come in contact or conjunction with any part of the work herein. All work shall be left complete and satisfactory and shall comply with the requirements indicated in the drawings.

6-A.21 MISCELLANEOUS CARPENTRY All carpentry work necessary to complete the work generally classified as, and performed under, rough carpentry shall be complete. Any work shown in the drawings and not specifically detailed and which is not particularly mentioned in the specifications, and vice versa, shall be performed in accordance with the standard and accepted practice for highest quality work of its respective kind or character.

6-A.22 BRIDGE PROTECTION

(a) Included under this heading is furnishing all materials and labor required to install a "pole and beam" overhead protection enclosure for the construction of the Bridge in the existing space as indicated in the drawings and specified.

(b) Construction of this protection enclosure will be above and in proximity to equipment that will be in operation during theconstruction period and must be protected to prevent any interruption in operation.

(c) The Contractor shall examine this work area in the presence of the Resident Engineer, who will designate the allowable location for the gallery supports on the Operation Room floor. Should certain hours be more favorable to, or necessary in the construction of this protection enclosure, the Contractor shall do so on premium time.

(d) Location of poles in framing shall be spaced to provide ample workman space on outside walls of Bridge and in positions not to interfere with the equipment adjacent to the work area. Poles shall be wood timbers resting on floor pads and top anchored to ceiling above. Floor pads shall be 18 inches square of two piles of nominal 2 inch thickness lumber laminated with grain perpendicular one ply to the other.

(e) Beams shall be framed into pole framing to carry a solid floor decking of 3/4 inches thickness plywood covering

Information Handling Services, 1999
August 12, 1999 05:44:57

entire work area. Between poles from floor decking to the ceiling, a frame of nominal 2 inches by 4 inches at 24 inches on centers shall be installed and covered on the outside face with 3/8 inches thickness plywood.

(f) All joints in plywood shall be taped with two plies of reinforced tape; first ply 2 inches wide, second ply 4 inches wide. Perimeter shall be provided for a 1/4 inch wide caulked joint.

(g) The finished protection shall be a complete enclosure separating the new construction from the occupied operating space below.

(h) Protection enclosure shall remain in place until all new work within is completed and removal is directed by the Resident Engineer. The Contractor shall remove all materials and do all patching, finishing and cleaning of the existing adjacent surfaces affected in this work, at his own cost.

(i) Cleaning shall include washing windows on both sides and all exposed finished surfaces, ready for final inspection.

6-A.23 BRIDGE WALL SHEATHING

(a) Bridge interior wall sheathing shall be 3/4 inches thick particle board. Install particle board in longest practicable lengths.

(b) Vertical joints between sheets shall occur at mid-span of wall stud framing. Joint between sheets shall be backed up with a strip of particle board 12 inches wide and full height of joint. Back up board shall be attached with a full coat of adhesive and No. 10 by 1-1/2 inch long wood screws at 6 inches on centers; 3 inches from end of sheets.

Information Handling Services, 1999
August 12, 1999 05:44:57

6-A.24 BLOCKING FOLDING PARTITIONS

(a) Blocking for supporting folding partitions overhead track shall be provided and installed as indicated on the drawings under this Section of these Specifications.

(b) Blocking shall be No. 1 Douglas Fir S4S kiln dried lumber cut to size called for on the drawings. Blocking shall be cut to size and shape required to properly attach and align track assembly.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 6 CARPENTRY AND MILLWORK

SECTION 6B

FINISH CARPENTRY

6-B.1 REQUIREMENTS The work covered in this section consists of furnishing all materials, labor, equipment, plant, tools, accessories and services necessary to complete all work generally included as Finish Carpentry. Work shall be in accordance with the requirements indicated in the drawings and specified.

6-B.2 WORK INCLUDED

a. The work herein includes furnishing miscellaneous light fasteners, nails, screws, glue, braces, and brackets, normally used in finish carpentry work.

b. The listing of items is only general and shall in no way be construed as a restricted or complete schedule of work included. Only a part of the major work items are listed, herein, for convenience only. All items of work which in general practice are in finish carpentry and incidental thereto are to be furnished hereunder even if not clearly indicated in the drawings, called for or specified, but required in the completed work.

c. Major Work Included

1. Install all hollow metal door frames regardless of type of wall construction.

2. Hang all hollow metal doors and apply all items of finish hardware scheduled for each door.

3. Fit and hang all wood doors and apply all items of finish hardware scheduled for each door.

4. Install and adjust all items included under Finish Hardware, Section 10A of these specifications other than door requirements #2 and #3 above.

Information Handling Services, 1999
August 12, 1999 05:44:57

5. Fit, install, secure and anchor in place all items of millwork furnished under Section 6C of the specifications.

6-B.3 MATERIALS

a. Wood used for blocking, shimming and wedging, shall be kiln dried wood of species best suited for the purpose it will be used.

b. Nails, screws, glue, clips, anchors and straps, shall be the size and type best suited to the work applied to provide solid and durable installation accepted as minimum requirements in highest quality work of the various kinds and conditions.

c. Notes, dimensions, details and other information in the drawings shall be examined to determine all conditions and materials that affect this work. Details included in the work are generally indicated in the drawings, noted or specified, however, it is the Contractor's responsibility to complete the work in accordance with the intent of the applicable drawings, notes, dimensions, and details, even though all specific details have not been shown.

6-B.4 INSTALLATION OF WORK

a. Installation of hollow metal door frames shall be coordinated with the work of other trades as their work is affected therein.

b. Frames shall be solidly anchored to floor with suitable drilled in expansion shield and bolt-after frame location has been properly located. Frame shall be set with jambs perfectly plumb, both ways and head level. Frame shall be temporarily braced until adjacent permanent construction will adequately provide support.

c. Hollow metal doors shall be installed with all items of scheduled finish hardware applied and adjusted for free swing without rub, spring or hinge binding.

d. Finish door hardware shall be applied by workmen skilled and experienced and qualified to do top quality work. Finish surfaces or parts of hardware that show gouges,

Information Handling Services, 1999
August 12, 1999 05:44:57

scores, or other surface damage caused by tool marks will be rejected. Damaged screw heads shall be cause for replacement with new and undamaged screws of kind and type as original screws.

*e. Fitting and hanging of wood doors shall be done by experienced mechanics known generally to the trade as "Door Hangers." Doors shall be fitted with proper bevel at hinge and lock sides to allow free and easy swing without binding at hinge side. Top and bottom shall be cut square (90 degrees to face of door), planed and sanded to a finish surface equal to face panel of door, back and hinge sides to be finished similarly.

Hinge and butt mortise shall be neatly fitted to hardware with only a hair line clearance of hinge leaf to wood will be acceptable. Any other items that require a mortise shall be of similar and equal workmanship. All door edges shall be eased to a 1/16 inch radius with 00 sandpaper. Location of finish hardware on wood doors shall be same as the locations specified for hollow metal doors.

6-B.5 PROTECTING FINISH HARDWARE

a. After door is fitted, hung and finished with all items of finish hardware in place, adjusted and in proper working order, the Contractor shall remove all finish hardware items, with the exception of hinges, each unit with its companion screws and bolts shall be wrapped in paper and stored in the manufacturers' original delivery carton marked and identified. Finish hardware shall be replaced after doors and frames are painted and finished.

b. Loss or damage of finish hardware while in storage or after installation is the responsibility of the Contractor until final approval and acceptance of the completed work.

c. Plastic laminate shop fabricated Bridge trim shall be installed under this Section. Plastic laminate work is furnished under Section 6C of the specifications.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 6 CARPENTRY AND MILLWORK

SECTION 6C

MILLWORK

6-C.1 REQUIREMENTS The work covered in this section of the specifications consists of furnishing, fabricating and delivering all items of Millwork as required in the drawings and specified. Included is all materials, labor, plant, tools, equipment, accessories and services necessary to complete the work herein.

6-C.2 WORK INCLUDED

a. The work herein includes wood facing, miscellaneous finish items of wood and all plastic laminate work indicated in the drawings and specified.

b. Fabricated work shall be top quality in material and workmanship regardless of kind, type or article.

6-C.3 PLASTIC LAMINATE

a. The work herein consists of shop fabrication of plastic laminate interior trim and finish work. The major work applies to the Bridge area as indicated in the drawings.

b. Standards Materials and methods in this specification are those of Formica Corporation to establish a standard of quality. The following material will be considered:

Micarta - Westinghouse Electric Co.

Texalite - General Electric Co.

c. Shop Drawings and Samples The Contractor shall submit shop drawings in accordance with the requirements in Section 1-A.5 Special Conditions. The Contractor shall submit actual sample in duplicate of color as directed by the Resid. Engineer.

Information Handling Services, 1999
August 12, 1999 05:44:57

6-C.4 MATERIALS

a. Core: The core material shall be particle board not less than 3/4 inches in thickness. Core shall be similar and at least equal to "supercore."

Option: Optional acceptable core shall be 3/4 inches thick, 5 cross ply plywood graded equal to B-D or better. The face veneers shall be clear birch.

b. Adhesive: The adhesive for veneering the laminated plastic to the core shall be a modified urea formaldehyde type, similar and equal to "Urac" glue, or equal, or as recommended by the manufacturer of the laminate used in the work.

c. Sealer: All exposed wood core surfaces shall be sealed with a clear synthetic resin sealer, approved by the manufacturer of the laminate used in the work.

d. Plastic Laminate: The plastic laminate used in this work shall be a type satisfactory for use in both horizontal and vertical applications. The type, class and grade used in this specification is based on National Electric Manufacturers Association Publication No. LD1-1964, classifying thermo setting laminated sheet materials. The following classification and general specification shall apply:

1. Type - General - purpose.

2. Class - No. 1 or No. 2

3. Grade - Standard Decorative except 840 - Class No. 1
Standard 840 - Class No. 2

4. Finish - Furniture finish in accordance with test LD-1-2.13 NEMA 8-19-1964.

5. Thickness - 1/16 inches in accordance with LD 1-3.02 NEMA 8-26-1964.

6. Wear Resistance - Maximum 0.08 grams per 100 cycles in accordance with test LD 1-3-03 NEMA.

7. Boiling Water Resistance - No failures when tested in accordance with LD 1-2-02 NEMA.

8. High Temperature Resistance - No disturbance when tested in accordance with LD 1-2.03.

Information Handling Services, 1999
August 12, 1999 05:44:57

9. Burning Cigarette Surface Test - No failure in less than 110 seconds when tested in accordance with LD 1-2.05 NEMA.

10. Stain Resistance -

    (a) Unaffected by reagents 1 through 20.

    (b) Unaffected by reagents 21 through 29 except for superficial stains which are easily removed with a mild abrasive hand soap.

11. Color Fastness - No color change or crazing when tested in accordance with LD 1-2.06.

12. Impact Resistance - No fracture shall occur when tested in accordance with LD 1-2.15, when the steel ball is dropped from a height of 36 inches.

13. Finishes - All finishes shall meet the requirements of LD 1-1.05 when tested in accordance with LD 1-2.13.

6-C.5 FABRICATION

a. Fabrication of all plastic laminate surfaced work shall be done in a well equipped shop using skilled shop mechanics experienced in producing top quality plastic laminate faced work.

b. Fabricated units shall be self-edge type using either hot or cold veneering process; manufacturer to determine process to be used to produce the highest quality and durability in the product. Units shall be fabricated in one piece for all units of short lengths. Longest practicable lengths shall be used where continuous units are required. Joints in units longer than standard sheet length shall be joined at the most inconspicuous points. Joints shall be of hair width using joint fasteners manufactured by:

    1. Tite-joint Fastener. E. L. Cedarquist Company,

    2. Quick-joint Fastener. Vulcan Manufacturing Company, or equal.

c. Edges shall be carefully banded and trimmed with bevel edge trim cut using a high speed router or shaper.

Information Handling Services, 1999
August 12, 1999 05:44:57

d. All work of plastic laminate shall be applied to core, cemented and finished, prefitted and crated for delivery to job site. Installation is under Section 6B Finish Carpentry.

6-C.6 SHOP DRAWINGS The Contractor shall submit shop drawings in accordance with the requirements in Section 1-A.5 Special Conditions.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 7 MOISTURE PROTECTION

SECTION 7A

DAMPPROOFING (FOUNDATION)

7-A.1 REQUIREMENTS The work covered in this Section consists of furnishing all materials, labor, equipment, plant, tools, accessories and services necessary to provide and completely install the dampproofing and waterproofing in accordance with the requirements indicated on the drawings and specified herein.

7-A.2 MATERIALS Materials shall comply with the following Federal specifications, which are referred to by symbol.

(a) Asphalt Primer For roofing and waterproofing SS-A-701.

(b) Cement, Bituminous, Plastic SS-C-153, Type I.

(c) Membrane Inorganic, glass-fibers, open mesh, smooth and evenly woven, HH-C466b.

7-A.3 PREPARATION OF SURFACES Surfaces to be dampproofed shall be smooth, clean, dry and free from frost. All holes, joints, cracks and honeycombs, etc., shall be pointed up flush with mortar and all high spots shall be ground smooth. Surfaces shall be carefully swept of excess mortar, or dusted to remove all foreign matter. Before each coat of dampproofing is applied, surfaces to be covered shall be inspected and approved by the Resident Engineer. The top surface of any projecting ledge of masonry or concrete below grade, except footings, shall be finished with cement mortar to a steep bevel before application of dampproofing.

7-A.4 INSTALLATION Dampproofing shall not be applied when temperature is below 40 degrees F.

(a) Prime Coat The prime coat shall be a heavy-bodied asphalt emulsion of brush or power spray consistency for protecting masonry. It shall be applied to damp, or "green" surfaces to form a continuous membrane coating on the exterior surface, from top of the footing to a line 4 inches below finish grade. This prime coat shall be permanently non-staining, non-inflamable, and will not cake, harden, or coalesce in the container.

Information Handling Services, 1999
August 12, 1999 05:44:57

Prior to application of prime coat, dampen the surface with water. Dilute the material to be used for this first coat by addition of ten percent by volume of water, then apply, by brush or power spray, in a continuous unbroken film, free from pinholes or other surface breaks. Cover the top and edge of footings, forming a cove at the junction of the wall and footing, also around joints, grooves, and slots. Follow all breaks in the surface. Allow to dry 12 to 14 hours before applying an additional coat, this coat shall not be confused with the "second coat". This additional coat shall be applied without thinning. For proper thickness, coverage should not exceed 50 sq. ft. per gallon in a two coat application. Under normal weather conditions, the application will dry in 24 hours.

Each layer or coat shall be laid complete before the next coat is started.

(b) Second Coat (Application) This application shall be smooth evenly woven, open mesh of inorganic glass fibers, which will permit full penetration and impregnation of the asphalt emulsion primer. This shall be applied in horizontal strips, lapping a minimum 3 inches and free from air pockets, wrinkles, and buckles.

(c) Third Coat (Application) A black bituminous plastic cement compound of trowel consistency, heavily reinforced with asbestos fiber, shall be applied to the exterior surface of the walls; from approximately 4 inches below finish grade, down to the footings. A wetting agent will assist in penetration and bond to rough, damp or "green" surfaces and shall be added only if required to obtain proper consistency. The compound shall be formulated to comply with Federal Specification SS-C-153, Type I. Apply mastic over top and edges of footings, forming a cove at junction of wall and footing; also around all joints, grooves and slots, and following all breaks in the surface. For proper thickness in application covering should not exceed 25 sq. ft. per gallon of mastic. Under normal weather conditions the application will dry in 24 hours.

7-A.5 PROTECTION The installed dampproofing materials shall be protected by application to fiber board sheets and allowed to set in place for 48 hours prior to placing of backfill.

Information Handling Services, 1999
August 12, 1999 05:44:57

7-A.6 COUNTER FLASHING The upper edge of the dampproofed surfaces shall be counter-flashed with 16 oz. copper as provided in Sheet Metal Work, Section 7F.

7-A.7 ACCEPTANCE Any leaks that may develop in the dampproofed surfaces shall be corrected and made watertight and all work disturbed thereby shall be properly restored before final acceptance.

7-A.8 ADDITIONAL PLIES OF MEMBRANE The specification for dampproofing as written herein, is the minimum acceptable dampproofing for exterior walls, below grade dampproofing. Should any ground water be encountered, the number of plies of membrane shall be increased according to the dampproofing manufacturer's recommendations and the approval of the Resident Engineer.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 7 MOISTURE PROTECTION

SECTION 7B

CAULKING

7-B.1 REQUIREMENTS The work covered in this Section consists of furnishing all materials, labor, equipment, tools, appliances, accessories and services necessary to complete all items of caulking in accordance with the requirements indicated on the drawings and specified herein.

Included herein is the sealing of all expansion, control joints, and joints between metal frames and masonry and concrete and other joints where caulking is required, interior and exterior, to seal the construction against weather, water and air leakage. The extent of the work herein includes all caulking work indicated on the drawings or specified in these specifications.

7-B.2 PREPARATION All joints for plastic caulking compound shall be cleaned out, full width, to the minimum depths specified below and all dust and loose material removed completely by compressed air blast or other suitable means before caulking. All joints shall be clean and dry at the time of caulking.

7-B.3 VOIDS Any voids or recesses that are encountered beyond the minimum depth required for caulking shall be packed with oakum or rope yarn before caulking.

7-B.4 VARIATIONS It is not intended that minor variations in the width of mortar joints in exterior masonry facing shall be corrected by cutting or grinding to a uniform width for caulking.

7-B.5 CUTTING Any joints or parts at the outside perimeter of frames in exterior walls that are found to be less in width or depth than the minimum required shall be enlarged to the required width and depth by skilled operators using suitable cutting or grinding equipment. Any damage to adjacent or connecting work resulting from such cutting or grinding shall be repaired by the Contractor to the satisfaction of the Resid. Engineer.

Information Handling Services, 1999
August 12, 1999 05:44:57

7-B.6 NON-ACCEPTABLE SUBSTITUTE Certain provisions in other Sections require that caulking joints shall be raked out and kept free from mortar during construction. This shall not be construed as an acceptable substitute for preparatory work under this Section.

7-B.7 MATERIALS

(a) Plastic Caulking Compound Federal Specification TT-S-00230 component polysulfide polymor compound. It shall be factory prepared, delivered in sealed containers and used according to the manufacturer's printed directions without the addition of any material whatever. Color of compound shall match as closely as possible the surfaces adjacent to the caulked joint.

(b) Rope Yarn Ravelled strands of rope fiber, free from oil or other staining substance.

(c) Oakum Untarred, picked (loose), fine hemp fibers.

(d) Primer, where required, shall be material recommended by the manufacturer of the compound to be used.

(e) Joint fillers shall be sponge rubber, rigid foam, cork or impregnated fiberboard.

(f) Bond breaker polysulfide tape as recommended by the manufacturer of the caulking compound to be used.

7-B.8 LOCATION The following locations shall be included:

(a) Frames The outside joints adjacent to masonry construction around the perimeter of the frames of all doors, and louvers in exterior walls shall be filled with plastic caulking compound, except sills of door frames. Joints shall be 3/16 to 1/4 inch wide and not less than 3/4 inches deep. Caulking of frames shall also include the joints at jambs of spandrels imposts, cornices and similar features of door and window treatment.

(b) Brickwork Continuous caulking 3/4 inch deep in the exposed edges of joints at shelf angles and of pressure relieving joints in brick facing.

7-B.9 APPLICATION The plastic caulking compound shall be forced into the joints with enough pressure to expel all air and

Information Handling Services, 1999
August 12, 1999 05:44:57

provide a solid filling. Any evidence of flowing or sagging shall be corrected before approval at time of final inspection. Joints in wash surfaces shall be filled slightly convex. Joints adjacent to painted work shall be caulked before the final coat of paint is applied. The use of kerosene or fuel oil in the finishing of the joints is prohibited.

Generally all joints shall be finished with a glass or stainless steel finishing tool that will not discolor the finished joint.

Masking of adjacent surfaces shall be done with non-staining masking tape that will not leave a dirt collecting surface on the material after tape is removed.

7-B.10 CLEANING The surface of all materials adjacent to caulked joints shall be cleaned free from any smears of compound or other soiling due to caulking operations.

7-B.11 SOLVENT The Contractor shall notify the Resident Engineer of the type of solvent and cleaner to be used in this work.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 7 MOISTURE PROTECTION

SECTION 7C

THERMAL INSULATION (ROOF)

7-C.1 REQUIREMENTS The work covered in this Section consists of furnishing all material, labor, equipment, tools, appliances, accessories and services necessary to provide and install complete all Thermal Insulation Work (Roof) required on the drawings and specified herein.

The work herein includes all roof area insulation cut section; stock sections as required to complete roof coverage.

7-C.2 WORK NOT INCLUDED Insulation required for general thermal insulation Section 7-C.1 and sound transmission is included in Section 10E of these Specifications.

7-C.3 PROTECTION The insulation shall be dry when delivered and shall be kept dry until covered by permanent roofing. During application and until covered by permanent roofing, the insulation shall be protected against damage due to the storage, moving or placing of materials or other construction operations. While roofing is being laid, any exposed insulation shall be covered with a tarpaulin when the work is suspended for any reason.

7-C.4 GENERAL Requirements specified herein are based on winter season conditions. When more than one type of insulation is specified for a given location, one type of the quality specified shall be used; at the option of the Contractor.

All roof surfaces shall be insulated. For the location of the insulation with reference to the roof construction, see drawings.

7-C.5 INSULATION Roof insulation may be corkboard, mineral wool boards, or insulating fiberboard. The insulating material shall be not less than 2 inches thick and shall have a conductance (c) factor of not more than .10 for its total thickness.

7-C.6 MATERIALS Materials shall comply with the following applicable Federal Specifications, which are referred to by symbol,

Information Handling Services, 1999
August 12, 1999 05:44:57

and the requirements specified:

(a) Asphalt primer SS-A-701

(b) Asphalt, Type I (except where Type IIA is specified) SS-A-666-IA

(c) Coal-tar pitch, Type I R-P-381

(d) Waterproof sheathing paper, any Type (except Types VI and VII) Class A, 35 pounds strength) UU-P-147b

(e) Compressed Corkboard HH-C-561b

(f) Mineral wool boards HH-I-526a - HH-I-562

(g) Fiberboard

(1) Class C above roof construction. Multiple-ply fiberboard that is to be mopped into place without mechanical fastening shall be cemented together. All mechanical fastenings required shall extend entirely through the insulation.

Insulating fiberboard delivered for use above roof construction shall contain not less than 0.50 percent by weight of pentachlorophenol (sodium pentachlorophenate reacted with aluminum sulphate), or not less than 0.25 percent by weight of copper pentachlorophenate, or not less than 0.30 percent by weight of arsenic oxide, or other equivalent protective chemical treatment as may be approved in writing by the Resident Engineer.

The protective chemical shall be uniformly distributed throughout the board by absorption and filtration during the process of manufacturing the board. Each board or bundle delivered shall be marked by the manufacturer, giving the kind of chemical and guaranteed minimum quantity retained in the board. Check tests as to kind and retained quantity of chemical shall be made by methods adopted by the National Bureau of Standards.

(h) Definitions Under this section of the specification, the term "dense concrete" shall mean concrete weighing more than 120 pounds per cubic foot and having stone, slag or gravel aggregates, including any required precast dense concrete channel slabs; and the term "nail-

Information Handling Services, 1999
August 12, 1999 05:44:57

able decking" shall include wood sheathing, poured gypsum, nailable lightweight concrete and nailable precast roof slabs or planks.

(i) Metal Fastenings Metal fastenings for blocks and boards shall be zinc coated. The type and size of fastenings shall be as recommended by the manufacturer of the insulation.

(j) Nails Nails shall be long enough to give a minimum penetration of 3/4 inch into wood or 1 inch into nailable concrete.

(k) Preset Fastenings that are preset in the forms for dense concrete shall be flanged or headed to give adequate support for the insulation, furring or nailers and shall provide a permanent bond into the concrete.

(l) Vapor Seal Vapor seal is not required on steel decking.

7-C.7 INSTALLATION For roof insulation above the roof construction, the units shall be laid with close joints, in regular courses in ashler pattern, with cross joints staggered, and adhesive bonded. The joints shall be sealed. When applied in two or more layers, surfaces in contact shall be adhesive bonded with all joints staggered between layers, ashler pattern continued in each layer.

7-C.8 STEEL DECK Insulation on top of steel decking shall be bedded in hot asphalt (Type II, Grade 2) applied uniformly at the rate of not less than 25 pounds per 100 square feet of surface to the back of the insulation as laid. The insulation shall be stuck in place while the asphalt is still hot.

7-C.9 INSULATION REQUIREMENTS FOR NEOPRENE-HYPALON COATING SYSTEM

(a) Insulation board shall be applied over roof deck by methods and adhesives recommended by the manufacturer of Neoprene-Hypalon coating material to be used in this work.

(b) Over concrete surfaces as substrate material surface the insulation shall be applied with a non-bituminous base, non-staining adhesive acceptable for use with neoprene-hypalon coating system.

(c) Over metal deck surfaces as substrate the insulation shall be applied using clips, screws or suitable metal

Information Handling Services, 1999
August 12, 1999 05:44:57

fasteners or by using adhesives acceptable for use with neoprene - hypalon coating system.

(d) The insulation board used shall be of same performance characteristics as specified in 7-C.5. However, no bituminous binders shall be used in the manufacture of the insulation board.

(e) The work under this Section shall be closely coordinated with the work under Roofing Section 7E.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 7 MOISTURE PROTECTION

SECTION 7D

DAMPPROOFING FLOOR SLABS ON GRADE

7-D.1 REQUIREMENTS The work covered in this Section of the specifications consists of furnishing all materials, labor, equipment, tools, plant, appliances, accessories and services necessary to complete the work in connection with Dampproofing Floor Slabs On Grade in accordance with the requirements in the drawings and specified herein.

7-D.2 LOCATION AND EXTENT OF WORK

(a) Location The work herein affects the Basement floor slab (on grade) and entrance stair slab (where so indicated in the drawing for stair slab).

(b) Extent The extent of the work herein consists of providing a continuously sealed moisture barrier membrane below finished concrete floor and stair structural slabs.

7-D.3 MATERIAL

(a) Primer Heavy bodied asphalt emulsion - SS-A-701.

(b) Membrane Five ply 48 inches by 96 inches size sheet asphalt core board and compressed felt, tested for vapor transmission in accordance with ASTM-E96-53T shall be not more than 0.0066 grains per square foot per hour.

(c) Horizontal joints and seams shall be sealed with catalytic bonding asphalt; low oxidation, non-setting bitumen type recommended by the membrane manufacturer.

(d) Vertical joints and turned up surface of membrane shall be sealed and cemented to wall with PM 5X adhesive prepared especially for use with the membrane used.

7-D.4 INSTALLATION

(a) General All surfaces to be covered shall be thoroughly cleaned with stiff fiber brooms to a dust free surface. Any

Information Handling Services, 1999
August 12, 1999 05:44:57

concrete protrusions shall be removed to prevent puncturing of the membrane, Entire area to be covered shall be cleaned and prepared before any work is commenced in connection herewith.

(b) Priming Concrete supporting surface shall be primed with a spray, brush or rolled on coat of emulsified asphalt primer cut back by addition of water equal to 10 percent (10%) of volume of asphalt. Primed surface shall be free from pinholes or other surface imperfections. The primed surface shall be a continuous unbroken film of uniform thickness. For proper film thickness cut back asphalt shall be applied at a rate of one gallon per 100 square feet of surface covered.

*(c) Membrane Sheets of membrane shall be laid with long length parallel with longest room wall. Starting sheet shall have one end and side bent to form a 4 inch high pan side. Apply vertical joint type adhesive to wall in a continuous layer 4-1/2 inches high and a similar layer on floor along side end where sheet will be installed. (Apply adhesive with a trowel or broad blade spreader.) Place the formed sheet in place and press firmly into the adhesive. Continue placing formed sheets the full length of space end lapping previously laid sheet 4 inches. Lapping of sheets shall be sealed with same adhesive as applied to wall.

The second row to be laid shall be started with a half length sheet to provide staggered jointing of horizontal surface. Side joints shall overlap edge of previously laid sheets 4 inches and sealed same as end laps and joints.

Membrane shall be placed on stair similar to method used for floor slab, where so indicated in the drawings.

After all membrane is laid and all joints sealed the top edge of membrane turned up at wall shall be sealed by a trowel applied bead, of vertical joint type adhesive, continuously the full length of the membrane edge.

(d) Protection When all membrane work is completed in accordance with the manufacturers instructions, and as specified herein, these areas shall be closed to traffic and general use until the placing of concrete is completed.

7-D.5 CLEANING UP All waste materials, surplus materials, dirt and debris shall be removed from the site immediately after work is completed. The finished area shall be left broom clean. Cleaning up is included herein.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 7 MOISTURE PROTECTION

SECTION 7E

NEOPRENE-HYPALON COATING SYSTEM FOR ROOFING

7-E.1 REQUIREMENTS The work covered in this Section of the specifications consists of all materials, labor, equipment, tools, plant, accessories and services necessary to complete the Neoprene-Hypalon Coating System for Roofing, as required in the drawings and specified herein.

7-E.2 GENERAL Application shall be in strict accordance with the requirements of Specification number ASA-20 Revised February 1967 for Application Over Insulating Board.

7-E.3 MATERIALS All materials used for the work in this Section shall be furnished by the same manufacturer. Material shall be delivered to the job site in manufacturer's standard, unopened containers. Each container shall be labeled stating the type and kind of material and trade name of the contents.

The label shall also show the name of the manufacturer and complete directions for the installation of the materials.

7-E.4 INSTALLATION

(a) The Contractor shall submit to the Resid. Engineer samples of each material for approval. Samples shall consist of materials from bulk containers and cartons in separate containers; also made up as sections of actual construction use. Included with submittal of samples shall be three copies of material characteristics, laboratory test reports and manufacturers warranty, and copies of installation recommendations and directions.

(b) The surface of the insulation shall be dry and free from dust or loose particles that would interfere in obtaining proper and adequate bond for applied coating.

(c) The surface of the insulation shall be primed with a primer agent furnished by the manufacturer of coating. Primer coat shall be applied at a rate 2 gallons per 100 square feet of

Information Handling Services, 1999
August 12, 1999 05:44:57

area. To determine the correct coverage, areas measuring 100 square feet shall be marked off and primed until the correct coverage is attained which shall then be followed for the remainder of the area. Application shall be made by means of spray equipment, hand roller, pressure feed roller or brush.

(d) Joint in the insulation board must be sealed after priming and before surface coating is applied. Joint sealing shall be done with self-sticking 4 inches wide Reinforcing Tape centered over the joint below, using a walking applicator. Saturate the tape with Black Neoprene Coating overlapping 1 inch on each side onto insulation.

(e) Over cant strip apply Neoprene Contact Adhesive lapping 2 inches cut f om top and bottom edge of cant. Allow adhesive to dry for 24 hours. Apply neoprene adhesive to a strip of Neoprene sheeting of sufficient width to extend not less than 3 inches out and above cant strip edges. Care shall be used in proper covering and adhesion of sheeting and allow 24 hours for drying before coating is applied.

7-E.5 APPLICATION OF COATING

(a) First coat; apply Black Neoprene Coating over entire surface at the rate of 2 gallons per 100 square feet of area. Wet film thickness shall be spot checked with a wet film thickness gauge once per 100 square feet covered and results and locations of tests recorded. Test shall show a thickness of 34 mils.

Dry coating thickness shall be checked after coating has cured for 3 days by cutting random samples out of the surface and checking thickness with calipers. Dry film thickness shall be 8 mils minimum.

(b) Second Coat; second shall proceed only after first coat has dried tack free, average 24 hours.

The second coat shall be Black Neoprene Coating applied by same method as first coat, at a rate of 1-1/2 gallons per 100 square feet of area. Dry film thickness shall be measured after second coat has dried at least 24 hours. Total dry mil thickness of the primer, first and second coat shall be 14 dry mils minimum.

Information Handling Services, 1999
August 12, 1999 05:44:57

(c) Third and Fourth Coats; shall proceed after second coat has thoroughly dried and checked for proper film thickness.

The third and fourth coats shall be Hypalon Coating, of the color selected for this work, and shall be applied at the rate of 3/4 of one gallon per 100 square feet of area for each coat. Third and fourth coat shall be applied by the same method used for second coat. Total dry film thickness after third coat shall be minimum 16 mils and after fourth coat minimum 18 mils.

(d) All coating described above shall be continuous and extend over cants and vertical surfaces to prevent moisture edge entrance.

(e) Final coat shall be applied just prior to final acceptance of the building and after all normal construction traffic, over areas included herein, no longer exists. Final coat shall be Hypalon Coating applied at the rate of 1 gallon per 100 square feet of area.

7-E.6 CLEANING UP

(a) Before final coating is applied all surfaces to be coated shall be cleaned free from all dirt, dust and other matter injurious to good bonding of final coating.

(b) During the clean up, in (a) above, all surfaces shall be examined and any surfaces damaged shall be properly repaired before final coating is commenced.

(c) Final coating shall be done in a continuous application for the entire area without interruption.

7-E.7 SAFETY RULES

(a) Flammable The solvents used in these coatings are flammable. Proper precaution shall be taken to prevent exposure to open flame. Close all containers at end of work period. These coatings are not flammable after curing period.

(b) Toxic These coatings may be harmful if swallowed. Avoid prolonged contact with skin and breathing of vapor or spray mist. If swallowed by accident do not induce vomiting.

(c) Sunlight The effect of sunlight reflected from the light colored Hypalon Coatings necessitates the use of dark glasses to protect eyes against glare during application.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 7 MOISTURE PROTECTION

SECTION 7F

SHEET METAL WORK

7-F.1 REQUIREMENTS The work covered in this Section consists of furnishing all materials, labor, equipment, tools, plant, accessories, and services necessary to provide and completely install all items of Sheet Metal Work in accordance with the requirements indicated on the drawings and specified herein.

Included herein is generally all sheet metal items; flashings, counter flashings, sheet metal in connection with roofing, louvers and louver frames including screens which are air intakes or exhausts in exterior openings. Although every necessary item classified under Sheet Metal Work is not specifically denoted in the specifications, nor, clearly indicated on the drawings all such items are included herein, and required to be furnished and installed.

7-F.2 WORK NOT INCLUDED Sheet metal work in connection with mechanically operated systems of heating, ventilating and air conditioning is included under other Section 15C of these Specification. Lead flashing for plumbing pipes are included under "Plumbing", Section 15B.

7-F.3 EXTERIOR USE OF SHEET METAL Exterior sheet metal shall be as follows:

(a) Copper For all sheet metal that will be concealed in the finished work, such as: reglets, sill and head flashing, spandrel flashing, flashing at the top edge of membrane dampproofing, through flashing with or without exposed edge turned down as counter-flashing and for all sheet metal on the roof side of water stops at eaves of flat roofs; splash pans; and ventilation on "flat" roofs.

(b) Lead-coated Copper For exposed sheet metal that is so located that plain copper would stain the facing materials or paint; except where other metals are specified for said locations.

Information Handling Services, 1999
August 12, 1999 05:44:57

(c) Galvanized Steel Sheet Metal For exterior louvers and their frames, set in zinc coated steel bucks; for the covering on the sills of exterior windows and similar work where indicated in the drawings.

7-F.4 INTERIOR USE OF SHEET METAL All interior ferrous sheet metal work shall be zinc coated.

7-F.5 MATERIALS Materials shall comply with applicable Federal Specifications, which are referred to by symbol, and the requirements herein.

(a) Copper QQ-C-576a; sheet hard copper (light cold-rolled) and weighing 16 ounces per square foot.

(b) Options Nickel-copper alloy QQ-N-281, hot-rolled, pickled and annealed; or Corrosion-resisting steel QQ-A-766a, Class 2 finish 2 (dull) may be substituted at the option of the Contractor for copper and lead coated copper and shall weigh 10 ounces or more per square foot, except where such substitutions are prohibited by the specifications. The requirements specified for copper and lead coated copper shall also apply to the optional metals, except as follows: The minimum thickness, in inches, of Nickel-Copper alloy or Corrosion-Resisting Steel, substituted for 16 ounce copper shall be .018.

(c) Option Zinc-copper alloy Having the following physical and chemical properties, may be substituted for the previously mentioned metals in masonry walls where the metal is entirely concealed from view; such as sill and head flashing, cavity wall flashings, water table flashings and for bituminous type of spandrel flashing as specified for shallow beams not over 16 inches high. The ends of metal for shallow beams shall be bedded in bituminous plastic cement and lapped not less than 3 inches. The metal shall be semi-cold rolled sheet material conforming to the following chemical analysis:

	Minimum Percent	Maximum Percent
Copper	0.200	1.000
Lead	0.006	0.200
Iron	---	---
Cadmium	---	0.70
Chromium	0.003	0.020
Manganese	0.002	0.010
Zinc, QQ-A-351a, Grade A	Remainder	

Information Handling Services, 1999
August 12, 1999 05:44:57

The minimum thickness of zinc-copper lloy, when substituted for 16 ounce copper shall be .020 inches, and .012 inches for spandrel flashing. All shapes shall be factory formed cold forming at the site is not permitted except for spandrel flashings.

(d) Zinc-coated Metal QQ-S-775a, Type I. The weight of zinc-coating as determined by the single spot test shall be not less than 1 ounce per square foot of sheet. Unless otherwise specified, the metal shall be at least .025 inches thick.

(e) Aluminum Sheets No. 3003, with commercial bright finish; the temper shall be the hardest consistent with forming operation and service required.

(f) Extruded Aluminum Mill finish, thoroughly cleaned and of reasonably uniform color, No. 6063 -T42.

(g) Solder AA-S-571b, Composition 50% lead, 50% tin.

(h) Paper Lining UU-P-271b, Class C-1, non-bleeding (para. 3.7) weighing not less than 3.7 pounds per 100 square feet.

(i) Bituminous Plastic Cement SS-C-153.

(j) Plastic Caulking Compound TT-S-00230, either Grade 1 or 2 as best suited for the purpose. It shall be mixed to proper consistency at the factory delivered in sealed containers and used according to the manufacturer's printed directions without the addition of any other material. For field tests, see Paragraph 1-9, TT-C598. A copy of the manufacturer's directions shall be furnished to the Resident Engineer prior to commencement of work covered by this section.

7-F.6 FASTENINGS Fastenings, reglets and receivers are to be of like material to the part or parts joined except as specified below.

(a) For Zinc-copper Alloy Like metal or aluminum.

(b) For Copper and Lead-coated Copper Shall be of bronze or copper, or copper-clad. The copper or copper-clad fastenings shall be 10 percent of the diameter.

(c) For Aluminum Nails screws and bolts, QQ-A-266 or QQ-A-268, or QQ-A-351c; heat treated after forming and threaded after heat treating.

Information Handling Services, 1999
August 12, 1999 05:44:57

(1) Rivets Not less than 3/16 inch in diameter with washers and burrs for peened heads.

(2) Slating Nails Shall be long enough to give a minimum penetration of 3/4 inch into wood, or 1 inch into nailable concrete.

(3) Stainless Steel Screws (18-8 alloy) may be substituted for aluminum screws.

(4) Tap Screws Steel thread-forming screws, plated with zinc or cadmium, may be used into metal.

(5) Steel Screws Not smaller than No. 8 by 1 inch.

(6) Into Concrete Fastenings into concrete shall have metal shields set 1 inch into the concrete, minimum.

(7) Other Fastenings for other sheet metal work shall be tinned or zinc-coated, type used in normal and accepted practice.

7-F.7 SHOP DRAWINGS Shop drawings of expansion joints, ventilators and equipment for louvered openings, showing the materials, gauges of metal and all details of construction shall be submitted for approval, see requirements in Section 1A, Special Conditions.

7-F.8 WORKMANSHIP Sheet metal work exposed to the weather shall be permanently weathertight, with suitable provision made for free-expansion and contraction without causing leaks. Soldering flux shall be non-acid. Seams shall overlap in the direction of the flow. Flat seams; at least 1/2 inch wide; single locked and sweated with solder, or double-locked and malleted flat. Loose-lock seams, single-locked and without solder, the bottom hook to be 1-1/4 inches and the top hook 1 inch wide, unless specified otherwise.

(a) Fasten to Woodwork Sheet metal shall be fastened to woodwork with cleats of the same metal, spaced not over 24 inches apart.

(b) Ornamental Work In ornamental work the seams shall be neatly finished and without solder showing on the face. Lines, moldings, etc., shall be true, sharp and of the required profile. Plain surfaces shall be free from waves or buckle and, where practicable, shall be firmly crimped. Joints and seams in plain surfaces shall be avoided so far as possible.

Information Handling Services, 1999
August 12, 1999 05:44:57

(c) Unlike Metals

(1) Copper Copper shall not come in contact with other metals, except tin or lead. When copper overlaps or is joined to such other metal, the copper shall be bedded in bituminous plastic cement, or applied over paper lining, or the metals shall be separated in the joint by 1-pound sheet lead. Where practicable, the edges of copper shall be tinned before assembling in soldered seams.

(2) Aluminum Aluminum shall not come in contact with other metal, except zinc or zinc-coating. Surfaces of aluminum that will come in contact with masonry, concrete or cement finish shall be painted with asphaltum or similar bituminous paint before installation. Note: lead plugs, wedges, washers or strips are not to be used in contact with aluminum.

(d) Paper Lining Copper flashing, copper and lead-coated copper, covering masonry concrete and on the water stops at eaves of flat roofs; shall be laid over a continuous paper lining, lapped 2 inches at joints. Paper on wood shall be nailed every 16 inches along the laps. Paper on concrete or cement surfaces shall be "spot" pasted in place, using canvas cement, linoleum paste or similar adhesive which is free from coal-tar, asphalt or bituminous solvents.

(e) Reglets Metal reglets for use in vertical concrete surfaces shall be formed from copper to receive copper or lead-coated copper, or formed from zinc-coated metal to receive other metals or felt; include miters for angles and returns; bottoms to slope upward from the face for drainage; and be fitted with continuous, removable inserts to prevent crushing or filling during the placing of concrete.

(1) For Felt Reglets for felt flashing shall provide continuous grooves 5/8 inch wide at the opening, 1/2 inch wide at the top, and having a horizontal depth of at least 1-1/2 inches. Include metal strap brackets for the support and fastening of the reglets to the forms at points not over 24 inches apart and near each end, each angle or return.

(2) For Sheet Metal Reglets for sheet metal shall provide a continuous groove, not less than 3/16 inch or more than 5/16 inch wide at the opening, with a horizontal depth of at least 1-1/8 inches and having the top surface

Information Handling Services, 1999
August 12, 1999 05:44:57

toothed or dovetailed in section, to anchor the upturned edge of sheet metal when inserted. The reglets shall be fastened to the forms every 12 inches by double-head nails, in both edges, or other equivalent means. Sheet metal turned into reglets shall be wedged every 12 inches with clips of the same metal or with lead wire or lead wedges and the reglets filled solid with plastic caulking compound. Surfaces shall be clean and dry when compound is used.

7-F.9 METAL RECEIVERS FOR SHEET METAL Receiver shall be open type in masonry and friction-type in concrete; factory formed from copper to receive copper and lead-coated copper, from zinc-coated metal to receive other metals. Slip joints or splice plates at running joints and corner fittings at angles shall be included.

(a) Open-type Friction Open-type receivers shall extend 2-1/4 inches into the mortar joint, with secure anchorage in the mortar, and form a continuous open groove to turn down 1/2 inch as a guide flange and the top edge to project 1/2 inch beyond the face of the wall. After the sheet metal has been inserted, the projecting edge shall be turned down and malleted flat to retain the sheet metal.

(b) Open-type Locking Open-type receivers with locking edges shall extend 2-1/4 inches into the mortar joint, with the back edge turned up and back 1/4 inch and with a locking edge on the front that will receive and permanently hold the top edge of a separate strip of metal, that is shaped to interlock with the receiver.

(c) Friction-type Friction type receivers shall form a vertical, closed slot at least 5/8 inch deep and flush with the face of the concrete; edges of receiver to turn back into the concrete for anchorage. Fasten to forms by double-headed nails spaced not over 12 inches apart. Insert the sheet metal the full depth of the slot and secure in place by indenting the face of the reglet with a dull-pointed center-punch every 12 inches.

7-F.10 FLASHINGS Roofing and sheet metal covering exposed to the weather, shall be flashed and made watertight at all edges abutting or connecting to other work.

Information Handling Services, 1999
August 12, 1999 05:44:57

(a) Base Flashing Not Counter Flashed Base flashing at the curbs of roof openings, that are not counter flashed, shall be turned over the top of the curb and fastened on the inside by locking to continuous cleats of the same metal, which shall be fastened to the curbs every 4 inches.

(b) Base Flashing Counter Flashed Metal roofing, metal coverings, and metal base flashing not otherwise specified, shall turn up at least 5 inches against abutting vertical surfaces, except that metal roofing on level surfaces and slopes of less than 3 inches per foot of run, shall turn up 8 inches.

(c) Fastenings Where counter flashed, the top edge of all metal flashings shall be secured every 12 inches by hook-head nails, tinned flashing hooks, or other suitable fastenings that permit free longitudinal movement.

(d) Reglets Base flashing connections to reglets shall be made by means of narrow strips of the same kind and weight of metal. Where the connection is made on a vertical surface, the flashing shall be loose-locked to the strips. The other edge of each strip shall be secured in the reglet as specified under "Reglets" of this Section.

(e) Thimbles Braces, posts and the like, extending through roofing shall be flashed with thimbles, which completely surround the protrusion. Thimbles are to make a watertight connection to the roofing.

(f) Sill and Head Flashing For location and extent of flashing for sills and heads of masonry openings, see drawings. Concealed flashing shall be as specified, factory formed to bond in the mortar bed and to prevent lateral movement in both directions; the turned up portion may be plain or formed. Cross joints, if any, shall be lapped or locked and sweated with solder.

(g) Head Flashing Head flashing back of facing brick shall extend 8 inches beyond the lines of the jambs, with the front edge 3/4 inch back of the exterior face of the wall. Between the jambs the flashing shall be turned down to form a drip. The entire piece shall extend 4 to 8 inches back into the wall and turn up approximately 8 inches, with the top edge inserted into the mortar joint of the back-up material.

Information Handling Services, 1999
August 12, 1999 05:44:57

7-F.11 COUNTER FLASHING All flashing (both metal and felt) having the top edge exposed shall be counter flashed with metal in strips not over 10 feet in length, shaped to lie flat against the flashing and overlapping the same not less than 4 inches. Where cant strips occur, the counterflashing shall turn down to within 1 inch of the top edge of the cant strip. Exposed edges shall be doubled under 1/2 inch to straight lines. End joints shall lap 3 inches, and at corners the metal shall be bent around the angle or locked and soldered.

(a) Material Counterflashings for sheet metal shall be of the same material as the flashings, and for felt flashings they shall be of copper, unless otherwise specified. Counterflashings on the metal curb of roof scuttles shall be of aluminum, form a part of the scuttle equipment and be bedded in bituminous plastic cement.

(b) Width Where the run of flashings is level or the slope is less than 3 inches per foot of run, the exposed vertical height of the counterflashings shall not exceed 11 inches at any point. Where the exposed vertical height of counterflashing for sheet metal exceeds 11 inches, the bottom edge shall be loose-locked to auxilliary strips or clips soldered to the flashing.

(c) Membrane Dampproofing Provide continuous copper reglet and counterflashing at top edges of membrane dampproofing on the outside face of walls below grade; counterflashing to lap 1-1/2 inches at joints and overlap membrane not less than 4 inches.

7-F.12 LOUVERED OPENINGS

(a) Metal louvers are required for openings through exterior walls as indicated in the drawings. Fabrication, materials, delivery and installation is included herein.

(b) Louvers are detailed, dimensioned and located in the drawings and specified.

(c) Louver frame shall be a tubular surrounding frame of No. 16 gauge sheet metal. Frame shall be formed with integral flashing leg at head and at jambs. Head and sill shall be formed to provide a 1/2 inch sloped top for wash. Frame shall be formed with a face 2 inches wide and 4 inch depth, out to out. Sill shall be formed to provide a positive drip edge. Corners of surrounding frame shall be welded and all exposed to view welds; ground smooth.

Information Handling Services, 1999
August 12, 1999 05:44:57

(d) Blades shall be formed of No. 20 gauge sheet metal to a 45 degree out and down slope and a 1 inch vertical and 1/2 inch horizontal bend at upper and lower edge of each blade. Blades shall be attached to surrounding frame by continuous welds. Blades shall be placed in surrounding frame at 4 inches vertical center to center.

(e) Louvers more than five feet long shall have a 2 inch wide by 4 inches deep vertical section of same gauge as surrounding frame installed at mid-span continuous welded to head and sill.

(f) Bird screens shall be provided on the interior face of surrounding frame with a removable unit. Screen frame shall be fabricated from 1 inch by 1 inch by 1/8 inch thick steel angle with corners mitered and welded; then ground smooth. Fabricate frame with plane leg of angle directed inboard. Wire fabric shall be 1/2 inch square mesh of .062 inch diameter steel wire, stretched and welded to the outside face of inboard directed frame leg. Attach screen frame to louver frame with self tapping screws at 24 inches on center, but not less than two screws per side.

(g) Louver and screen unit shall be thoroughly cleaned with suitable solvents for shop painting as specified.

(h) Louvered opening directly through wall and finally exposed on the room or space side of wall shall be fitted with approved insect screen fabric in lieu of bird screen (in (f) above) screen frame shall be similar to that above. Insect fabric shall be standard 18 by 18, or 18 by 14 mesh size of galvanized wire.

(i) Louvers and screen frames shall be shop coat painted with a rust inhibitive paint and one coat of baked enamel after fabrication.

7-F.13 SCUPPER AND DOWNSPOUT

(a) Metal roof scuppers shall be shop fabricated and delivered to the job site complete; ready to be installed in the work. Scupper shall have outlet tube shop installed.

(b) Scupper shall be fabricated from No. 16 gauge sheet steel with all joints and seams welded and ground smooth. Outlet tube shall be flanged and continuous welded to bottom of scupper. Outlet tube projections shall be 4 inches with all sides tapered 1/4 inch for entry into downspout.

Information Handling Services, 1999
August 12, 1999 05:44:57

(c) Downspout shall be fabricated from No. 16 gauge sheet steel in longest length practicable. Splices shall be provided by internal sleeve continuous weld to upper tube section at splice.

(d) Scupper and downspout shall be galvanized after fabrication using hot dip galvanizing tank process.

7-F.14 METAL WALL COPING (METAL PANEL WALL)

(a) Wall coping similar and matching coping in place on existing building shall be provided and installed hereunder.

(b) Construction consists of a No. 14 gauge continuous cap supporting unit conforming with shape and outline of aluminum finish cap. Supporting unit shall be welded to structural frame members true to a line.

(c) Cap shall be formed from aluminum sheet stock 18 gauge in thickness shape and size to match existing cap.

(d) Provide one ply of asphalt membrane between steel supporting unit and aluminum cap to form a continuous separation between the unlike materials. Provide hold down clips at face edge between drip bend and steel supporting unit, no screw heads or other fasteners shall be visible on face of cap. Back side of cap shall be held in place with No. 10 by 1 inch long stainless steel binding head screws.

(e) After installation exposed surface of coping shall be cleaned free from markings, hand prints and soil.

7-F.15 METAL WALL FASCIA (MASONRY WALL)

(a) Metal wall fascia at roof edge above masonry wall shall be furnished and installed where indicated in the drawings.

(b) Fascia shall be formed from No. 18 gauge aluminum sheet stock in accordance with the requirements in the drawings and specified. Fascia shall be fabricated in maximum length units of 10 feet. At each joint provide a back up unit 12 inches long of profile to fit neat into back of fascia from inside drip hem to cant edge. Attach back up unit to wood nailers with aluminum nails. Use same type and kind of material for back up unit as facia.

Information Handling Services, 1999
August 12, 1999 05:44:57

(c) Aluminum clips, of same material as fascia, 2 inches wide shall be provided at 24 inches on centers. Clip shall be nailed to wood nailers with aluminum nails. Set clips true to a line vertically and horizontally.

(d) Apply a thin coat of approved sealant over entire area of back up unit before fascia is installed.

(e) Clean all exposed surfaces of the finished work after installation.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 7 MOISTURE PROTECTION

SECTION 7G

THERMAL INSULATION (OTHER THAN ROOF)

7-G.1 REQUIREMENTS The work covered in this Section of the specification consists of furnishing all materials, labor, equipment, tools, appliances, accessories and services necessary to provide and install all Thermal Insulation (Other than Roof) work in accordance with the requirements in the drawings and specified.

7-G.2 MATERIALS

(a) Materials provided in this work shall be the manufacturers top quality, produced under rigid quality control methods, for rigid and finally rigid insulating materials.

(b) Certain materials are named or identified in this specification by name or trademark title in order to establish a standard of quality, system, or performance requirement and shall not be considered as preventing use of the products of other manufacturers provided they are equal to the standard. However, the Contractor shall submit to the Resident Engineer complete laboratory test reports and performance data regardless of manufacturer's product he proposes to furnish.

(c) Materials by the following manufacturers will be considered as standards in this section:

1. Dow Chemical Company

2. Armstrong Cork Company

3. The Celotex Corporation

Insulation used in this work shall equal or exceed a thermal conductivty of .20 regardless of thickness. Thickness called for in the drawings other than the performance requirements above is necessary for dimension requirements.

(d) Thermal roof insulation is under Section 7C of the specifications.

Information Handling Services, 1999
August 12, 1999 05:44:57

7-G.3 WALL INSULATION (UNEXPOSED AREAS)

(a) Thermal wall insulation provided in unexposed areas and spaces, attics and crawl spaces shall be installed to provide a continuous thermal unit with performance characteristics equal to or exceeding the minimum requirements in 7.G-2 (c) above.

(b) Thermal insulation unit shall be installed without thermal conductive fasteners, clips or similar devices.

(c) Use of plastic applied material shall set and cure to stable unit mass without surface dusting or erosion. The use of plastic applied thermal insulation shall be approved, in writing, by the Resident Engineer. The Contractor shall submit sample, laboratory and performance data or other information requested by the Resident Engineer for his use in evaluating the material and its performance, before approval.

7-G.4 WALL INSULATION (PLASTER BASE)

(a) Thermal wall insulation in finally plaster finished areas and spaces shall be rigid foam insulation and plaster base combination unit.

(b) Material and method of installation in this specification is based on Dow Chemical Company's Styrofoam FR or equal as quality standard. The requirements in this specification are the instructions in the manufacturers "Release Bulletin", "Series 7 - Comfort Insulation 7:3" Dated February, 1968 or in a like bulletin of the manufacturer whose product has been approved as "equal". In the event manufacturereshall issue revised "Release Bulletins" describing improved methods of installation, quality of materials, the work herein shall be performed in accordance with the latest issued Manufacturer's publication.

(c) Installation shall consist of the operations, procedures, and methods.

(1) Surface Preparation Mortar joints in masonry shall be cut flush without fins or projecting out of line masonry.

On concrete surface installation form joints of concrete burrs shall be removed to provide a smooth even surface.

The entire surface to be covered with insulation shall be broomed clean and free from dust or flaking surface

Information Handling Services, 1999
August 12, 1999 05:44:57

material. Surface must be dry and absorbent to permit the water carrier to escape from the mastic.

On concrete walls the surface shall be examined carefully for traces of form release oil, paint or other surface coating that would prevent bonding of the adhesive. Wet or green cement or concrete walls shall not be covered. Concrete walls shall be covered only when dried out and cured.

(2) Application of Insulation Bond the rigid insulation sheets directly to the wall without metal attachment devices. Install the foam insulation boards horizontally starting at the floor line with all end butt joints pushed tightly together, but do not force or spring sheets in place. Stagger vertical joints between sheets at third point of sheet below and continue placing sheets on wall in ashler pattern.

(3) Application of Adhesive Use only the manufacturers recommended bonding agent to attach insulation of wall. Mechanical applicators shall be used in placing the adhesive on the back of insulation board. In the case of mastic, hand or pneumatic dispensing equipment may be used that will extrude a 5/16 inch diameter ribbon of mastic on the surface of the board. A continuous bead shall be extruded longitudinally and about 3 inches from each edge of board and one bead at center of board. After mastic is placed the board shall be positioned on the wall within 10 minutes, or within the time recommended by the manufacturer. Board shall be firmly pressed against wall to form a full bond with the adhesive agent.

If irregularities in the wall surface are in evidence, the amount of adhesive shall be increased or additional intermittent quantities placed on the board as may be required for a full bonding.

(4) Room Temperature Room temperature shall be maintained at above 55 degrees F. for a period of not less than 72 hours prior to application of the work, during and after installation is completed. All materials shall be stored in the area during the 72 hour period prior to beginning of the work.

(5) Control Joints Plaster crack control joints are required at approximately 20 feet on centers. Location of control joints are described under Plaster Section 9A and indicated in the drawings. Manufacturers recommendation for control joint spacing shall be submitted to the Resident Engineer for approval.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 8 DOORS, WINDOWS AND GLASS

SECTION 8A

HOLLOW METAL FRAMES

8-A.1 REQUIREMENTS The work covered in this Section consists of furnishing all materials, labor, equipment, plant, tools, accessories and services necessary to provide and install all Hollow Metal Frames in accordance with the requirements indicated on the drawings and specified herein.

8-A.2 MATERIALS Material shall be prime grade, cold rolled sheet steel, properly annealed and process leveled; having smooth, clean surfaces free from pitted or scaled areas.

(a) Thickness: Material thickness for sheet steel shall be of the decimal equivalents of manufactures' Standard Gauges for the items specified or indicated on the drawings. Minimum thickness of sheet steel used shall be as follows:

Item	
Interior Door Frames	16 Gauge (.060 inch)
Exterior Door Frames	14 Gauge (.075 inch)

8-A.3 FITTING OF HARDWARE Shall be done at the factory, either to templates or to the hardware, as may be required.

(a) Location of hardware, unless shown otherwise, shall be as follows:

(1) Door knobs, center 38 inches above floor.

(2) Door push or pull plates, center 45 inches above floor.

(3) Single horizontal pushbars center 48 inches above floor.

(4) Where two or more pushbars occur on same door, locate at 4-1/2 inches o.c.

(5) Butts Hinges, top of door to top of upper butt hinge 5 inches

Information Handling Services, 1999
August 12, 1999 05:44:57

Floor to bottom of lower butt hinge 10 inches.

Center butt hinge located equally spaced between top and bottom butt hinges.

(6) Locking Cylinder, center of cylinder 52 inches above floor.

(b) Reinforcement for hardware shall be provided and concealed, welded in place, drilled and tapped for hardware fastening. Box type units are required for all reinforcement work. Reinforcement shall not be less than .15 inch thick with offset plates used for lock strikes.

8-A.4 FRAMES

(a) General Unless specified or shown otherwise, all frames shall be combination integral type, channel sections, rebated for doors, and of the proper width to suit the details of the walls and to form a continuous trim of uniform width around the opening. Edges of flanges shall be turned to form plaster keys where plaster occurs and to form retainers for adjustable anchors where the frames are not attached to rough bucks. Frames shall be furnished with cutouts and concealed reinforcement for hardware, as specified. Reinforcement shall have box covers welded in place.

(b) Construction Corner joints of frames shall be accurately squared, and welded in full depth and width, or the following construction may be used at the option of the Contractor: The integral trim portions shall be mitered and full-welded; the jamb portions coped and tenoned to the head member and either fillet-welded on the back in full width or welded at the tenons and fillet-welded on the back of both vertical and horizontal planes at the stop. All contact edges shall fit tight.

(c) Stops The stops of interior door frames (except for fire doors and dust-proof doors) shall be cut off and the ends beveled and closed 4 inches above the floor level.

(d) Clip Angles The bottom of frames that rest on the floor shall be at the indicated finished floor level and secured to the structural slab with concealed clip angles. Where floor fill occurs the frame shall be supported by adjustable extension clip angle resting on and anchored to the structural slabs.

Information Handling Services, 1999
August 12, 1999 05:44:57

(e) Frames Without Rough Bucks Include adjustable steel anchors as specified near the top and bottom of all jambs and at points between, not over 25 inches apart. At bottoms of door jambs, provide for and furnish adjustable floor anchors and include removable steel spreaders of adequate strength and stiffness.

(f) Spreader At the bottoms of frames and rough bucks shall be channel or angle sections s· placed and secured that, where the construction will permit, they will be left in place and concealed in the finished work. Where they cannot be concealed in the finished work, they shall be left in place until the frames and bucks are properly set and securely anchored. Spreaders shall be cut or removed to permit the installation of floor hinges or pivots where same occur. The use of permanent spreaders shall not exclude the floor anchors specified.

(g) Frames with Rough Bucks Flanges shall be in close contact with the bucks and be secured thereto every 12 inches with not lighter than No. 8 by 32 shakeproof machine screws, or No. 8 thread-forming screws with lock washer heads, that will be concealed in the finished work.

(h) Caulking Exterior frames will provide a caulking groove, 1/4 by 3/4 inch in section, with closed back, that will retain the cauling compound.

8-A.5 ANCHORS

(a) Adjustable Adjustable anchors for frames and rough bucks in masonry shall be of steel, T shaped and of the same thickness as the metal of the frames or bucks. The head shall be either integral with the stem, or be so lapped and welded thereto as to give equivalent strength, and shall positively engage the retainers or both flanges of each jamb member when in place. The stem shall be corrugated or perforated for mortar bond and extend 12 inches into the masonry. The stem generally shall be 3 inches wide, but shall be reduced to 2 inches wide in masonry having a nominal thickness of 3 inches or less. Anchors shall be placed near the top and bottom of each jamb and at points not more than 25 inches apart and shall lie flat in the masonry joints. Anchors for aluminum work shall be zinc-coated. Floor anchors shall be 1/2 inch in diameter and be fitted with lock nut and traveling nut for vertical adjustment and extend not less than 2 inches into the concrete or masonry below. The lower ends of the anchors shall be grouted in place or fitted with expansion sleeves.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) Non-Adjustable Jamb anchors shall be 1/4 by 1/2 inch bar anchors, spot-welded or flush-riveted to the jambs near top and bottom at intermediate points not more than 25 inches apart.

(c) Standards: Hollow metal frames manufactured by the following fabricators using their top quality line is the standard of quality used in this specification, however, this shall not limit the use of the product of any other manufacturer provided it is equal to the standard thus established by comparison with any of the fabricators listed:

1. Pioneer Industries
2. Tex-Steel Manufacturing Co.
3. Ceco Steel Products Company

8-A.8 FINISH

(a) On Steel:

(1) General: For kind, color and character of finish, see drawings.

(2) Prime Finish: All metal surfaces shall be cleaned and given one dip or spray coat of rust-inhibitive, metallic oxide paint on all surfaces, and baked, including the inside of frames. All surfaces that will be exposed shall then be given a mineral filler in one or two coats, as necessary, to conceal all surface blemishes and insure a smooth even finish, followed by one coat of metallic oxide primer. Each filler and prime coat shall be separately baked and rubbed to a smooth surface.

(3) Brush Coat: When the finish coats consist of brush coats of paint or enamel, applied at the site, the metal shall have been cleaned and prime finished at the factory as in (2) above.

8-A.9 SHOP DRAWINGS Shop drawings showing thickness of all metal parts, details of construction, profiles, fastenings, anchors, reinforcement and location of all hardware shall be submitted for approval before fabrication is commenced.

Information Handling Services, 1999
August 12, 1999 05:44:57

8-A.10 SAMPLES

(a) The Contractor shall submit a sample of mitered corner of hollow metal frame.

(b) Samples shall be completely welded and finished including shop coat of paint. Not less than 12 inch length of jamb section each side of miter to be provided.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 8 DOORS, WINDOWS AND GLASS

SECTION 8B

HOLLOW METAL DOORS

8-B.1 REQUIREMENTS The work covered in this Section consists of furnishing all materials, labor, plant, tools, equipment, accessories and services necessary to provide and install all Hollow Metal Doors in accordance with the requirements indicated on the drawings and specified herein.

8-B.2 MATERIALS Materials shall be prime grade, cold rolled sheet steel, properly annealed and process leveled: having smooth, clean surfaces free from pitted or scaled areas.

(a) Thickness Thickness specified for sheet steel are decimal equivalents of manufacturer's Standard Gauges for the items specified or indicated on the drawings. Minimum thickness of sheet steel used shall be as follows:

Item	
Door Face Panels	18 Gauge (.048 inch)
Reinforcement	(.125 inch)
Locks and Latches	(.125 inch)
Lock Strikes	(.150 inch)
Butt Hinge	(.150 inch)
Closer	(.150 inch)
Surface Hardware	(.125 inch)

Length of reinforcement to be determined by requirements of hardware as they apply.

Location of reinforcement for hardware is specified in Section A, Hollow Metal Frames.

(b) Fillers Filler core for hollow metal doors shall be, full door thickness, compressed fiberboard LLL-I-535; corkboard HH-I-525; or a rigid asbestos (solid or cellular) at the option of the Contractor.

Information Handling Services, 1999
August 12, 1999 05:44:57

8-B.3 WORKMANSHIP All shapes shall be formed, rolled and formed or cold drawn, according to gauge and profile, with contours and arises as true and sharp as can be produced in the thickness of metal required. Shapes such as moldings, casing, stops and any applied trim shall be cold drawn.

(a) Joints in Steel Construction joints of steel work shall be welded in full depth and width. Exposed surfaces of welded joints shall be dressed to produce visible connections. Spot welding shall be used where practicable in preference to the use of rivets, screws or bolts.

8-B.4 DOORS

(a) General Shall be 1-3/4" thick, and free from warp and twist, reinforcement shall stiffen the sheet metal and shall prevent sagging, and with proper bevel on lock stiles or rails to operate without binding. Meeting stiles of doors in pairs; standard bevel for single-swing; rounded for double-acting; fire doors to have astragals.

(b) Clearance Door sizes shall include standard clearances as follows: 3/32 inch at jambs and heads; 3/16 inch at bottoms of doors with thresholds and 11/16 inch at bottoms of doors without thresholds. See standard detail. Note that the thickness of any resilient floor covering is included in the 11/16 inch clearance.

(c) Louvers and Grilles Grilles and louvers shall faithfully reproduce the details furnished and shall be secured by substantial fastenings. Grilles that are visible from both sides shall be double-faced. Castings shall be of fine, even texture with clean, sharp lines and full arises.

(d) Flush Type Doors Flush type doors shall consist of two face plates formed to the required door thickness and with the edges continuously welded to reinforcing plates or channels. The face plates shall be stiffened by channels or z members not less than .048 inch thick, spaced not more than 6 inches apart, extending the full height in the spaces between stiffeners. Tops and bottoms of doors shall have continuous formed channels not less than .060 inch thick, welded to the face plates.

Information Handling Services, 1999
August 12, 1999 05:44:57

(1) Stiffener Option A continuous truss-formed inner core of sheet metal not less than .015 inch thick may be substituted for the stiffeners specified above provided it is spot welded to the face plates every 2-3/4 inches horizontally and vertically over the entire surface of both sides. The core shall include a suitable type of insulation to give the effect of solidity.

(2) Cutouts Cutouts shall be made and properly framed in flush doors having louver panels. Such accessories shall be furnished and installed as part of each door.

(e) Fire Doors Fire doors shall conform to the standards of the Underwriters' Laboratories, Inc. as regards fire and casualty hazards. The label of the Underwriters' Laboratories will be accepted as conforming with this requirement.

(1) Construction Construction generally shall be as specified for steel doors of similar type, subject to restriction imposed on the required classes as to maximum sizes of doors, areas of glass panels (if any), heights of stops on frames and minimum throw of locks and latches. Doors in pairs shall have an astragal welded to the active leaf.

8-B.5 REINFORCEMENT FOR HARDWARE

(a) General Concealed metal reinforcement, of well finished stock or rolled shapes welded in place and tapped for hardware fastenings, shall be provided in doors, and frames, using steel for steel work.

(b) Locks and Latches For locks and latches and their trim: Box type unit, plate not less than .060 inch thick. For lock strikes: Offset plate not less than .150 inch thick.

(c) Butts and Jamb Pivots For door butts and jamb pivots: Offset plates not less than .150 inch thick. Plates in frames to be 10 inches long by the full inside width of the jamb. Plates in doors to be either (a) the full height of the door, or (b) the following combination; at the option of the Contractor: A continuous cold-rolled channel .060 inch thick the full height of the door and separate plates not less than 10 inches long and as wide as the space between the channel flanges at every butt and pivot location; the channel welded to the face plates of the door and to the reinforcing plates.

Information Handling Services, 1999
August 12, 1999 05:44:57

(d) Closers For door closers and for top and bottom pivots: In doors and frames: Plates not less than .150 inch thick, of proper length for suitable fastenings and as wide as the space between face plates of door or the flanges of reinforcnng channels. Where concealed, overhead closers are required, adequate space, reinforcement and provision for fastenings shall be made for the closers.

(e) Surface Hardware: For surface applied hardware, other than lock trim: Plates of suitable size not less than .125 inch thick.

(f) Welding Steel plates; either continuous fillets at both edges of the long dimension, 1/2 inch fillets not over 2 inches apart in all contact edges, or spot welds at points not over 2 inches apart in both directions on contact surfaces. Any variation due to job conditions shall be as approved by the Resid. Engineer.

(g) Fitting of Hardware Fitting of hardware shall be done at the factory, either to templates or the hardware, as may be required.

8-B.6 FINISH All surfaces of hollow metal doors shall be cleaned and given one dip or spray coat of rust-inhibitive, metallic oxide paint on all surfaces, and baked, including the inside of doors and backs of panel sheets. All surfaces that will be exposed shall then be given a mineral filler in one or two coats, as necessary, to conceal all surface blemishes and insure a smooth even finish, followed by one coat of metallic oxide primer. Each filler and prime coat shall be separately baked and rubbed to a smooth finish.

Brush coat finish consists of field applied enamel finally finished for all exposed to view surfaces, and is not included herein.

8-B.7 Sound Retardant Doors

(a) Sound retardant metal doors indicated on the drawings and required in the Door Schedules are furnished under this section of the specification and installed under Section 6B.

(b) Sound retardant metal doors shall be fabricated from same quality material with same class of workmanship as hollow metal doors specified in this Section. In addition to requirements of hollow metal doors, sound retardant doors, shall be fabricated with a solid core that will produce a Sound Transmission Class rating of minimum STC-42.

Information Handling Services, 1999
August 12, 1999 05:44:57

(c) Sound retardant metal doors shall be:

1. Munchausen, "Stealsound"
2. Rysden, "Sonicbar D52-45F
3. Overly, STC-45 Flush or equal

(d) Sound retardant door to jamb gaskets and automatic drop door to floor seal in accordance with the requirements on the drawings and indicated in the Door Schedules shall be furnished under this Section and installed under Section 6B, of these specifications.

8-B.8 SHOP DRAWINGS Shop drawings showing thickness of all metal parts, details of construction, profiles, fastenings, openings, reinforcement and location of hardware shall be submitted for approval before fabrication of doors is commenced.

8-B.9 SAMPLE The Contractor shall submit to the Resident Engineer for approval a 24 inches by 25 inches corner section of door panel. Sample shall show actual construction of interior and exterior surfaces, welding and finishing. Section shall be taken to show the detail of cutout section for glass or other similar requirements. Finish sample with specified shop coat paint.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 8 DOORS, WINDOWS AND GLASS

SECTION 8C

WOOD DOORS

8-C.1 REQUIREMENTS The work covered in this Section of the specifications consists of furnishing all material, labor, plant, tools, equipment, accessories and services necessary to provide the Wood Doors in accordance with the requirements in the drawings and as specified.

8-C.2 MATERIALS

(a) Doors shall be hollow core 1-3/8 inches thick clear birch flush panel type as indicated in the drawings.

(b) Door unit shall consist of a set of four doors bi-parting and bi-folding operation in a hollow metal frame.

(c) Doors shall be Weyerhauser Roddis lifetime guaranteed type or equal. Doors of similar and equal quality manufactured by the following manufacturers are acceptable:

1. U. S. Plywood Company

2. Morgan Company

Hollow metal frame is furnished under Section 8A and installed under Section 6B.

Wood doors are installed under Section 6B. Finished under Painting Section 9F.

8-C.3 SHOP DRAWINGS The Contractor shall submit shop drawings in accordance with requirements in Section 1A-5, Special Conditions.

Information Handling Services, 1999
August 12, 1999 05:44:57

SECTION 8D

GLASS AND GLAZING

8-D.1 REQUIREMENTS

(a) The work covered in this Section of the specifications consists of furnishing all materials, labor, plant, equipment, tools, accessories and services necessary to complete all Glass and Glazing work in accordance with the requirements in the drawings and specified.

(b) All glass shall be installed, cleaned and polished. Any glass with scratched or other surface damage, cracked or broken shall be replaced at the Contractor's expense.

8-D.2 MATERIALS Materials shall be furnished in accordance with the following Specifications and requirements unless noted or specified otherwise:

(1) Plate Glass - Interim Federal Specification DD-G-451b, Type I (Polished Plate Glass) Class 1, q^3 quality.

(2) Neoprene - Closed cell neoprene for cushions, tapes and ropes: 70 durometer for setting blocks, 40 durometer for tapes, ropes and cushions; sizes and shapes as required or detailed; similar to products manufactured by Pauling Rubber Company, Firestone Tire and Rubber Company, Rubatex Corporation, or approved equal.

(3) Tapes and Caulking - Tapes and caulking shall be the types, thickness, sizes and composition, and installed as required by the various conditions, all in accordance with the details, specifications, and recommendations of the manufacturers, and as approved by the Resid. Engineer.

A. Tapes shall be closed cell neoprene, of types, thickness and dimensions indicated or required for the specific application where they are to be used. Poly-Urethane tape shall be Sterling Alderfer Company, Akron, Ohio, products, or equal.

Information Handling Services, 1999
August 12, 1999 05:44:57

Caulking material shall be one part, non-staining 100 percent liquid polymer base material conforming to the performance requirements of Federal Specification TT-S-00230 and approved by the Resident Engineer for color and certification.

(4) Glass Thickness - Glass shall be of thickness and type indicated in the drawings, details, notes and schedules, but not less than 1/4 inches in thickness unless otherwise noted or indicated.

8-D.3 IDENTIFICATION Materials for this work shall be shipped to the job site with the manufacturer's seals and labels of recognized American manufacturers attached. Labels must show grade, thickness, type and quality. Each piece of glass must have a label which shall not be removed until it has been inspected.

8-D.4 INSTALLATION

(a) Unless otherwise indicated or specified, glazing shall conform to the applicable standards of the Flat Glass Jobbers Association "Glazing Manual" latest edition.

(b) Verify all glass size requirements by actual field measurements for proper clearance and installation details.

(c) Position glass sheet in center of glazing opening as indicated in the drawings providing proper setting blocks, cushions, shims and accessories. Set glazing tapes in continuous strips with corners neatly sealed or formed in a single piece. Glazing tapes shall be held back a distance sufficient to provide a 1/8 inch clearance between outer edge of tape and stop or sight line of framing, for caulking. All glass shall be set with glazing tape on both sides of glass or as indicated in the drawings, if other method is required. No glazing tape, glass or accessories shall be installed until glazing spaces, and rebates have been completely painted.

(d) After all glass is in place the perimeter of glass panels shall be caulked on both sides flush with glazing stop. Caulking bead shall have a slight slope outward on bottom edge to prevent water collecting or remaining when washing and polishing glass.

Information Handling Services, 1999
August 12, 1999 05:44:57

8-D.5 COMPATIBILITY OF MATERIALS Where a combination of sealing materials and glazing tapes are required for glazing in the same frame, the Contractor shall submit to the Resident Engineer manufacturer's certificates stating that all materials furnished are compatible with each other including setting blocks, shims, and metal framework. Glazing tapes shall be prepared with a non-adhesive face against glass but with a full width adhesive surface against metal stops and setting beads.

8-D.6 SHOP DRAWINGS AND SAMPLES

(a) The Contractor shall submit complete shop drawings in accordance with the requirements in Section 1A Special Conditions.

(b) The Contractor shall submit duplicate samples of each type of material used in this Section of the Specifications.

8-D.7 CLEANING

(a) The Contractor shall clean and polish both sides of all glass installed herein just prior to final inspection, (except labels shall not be removed until all glass has been approved by the Resident Engineer.)

(b) Any piece or pieces of glass, tapes, setting, and caulking that is not acceptable shall be removed from the site and replaced with materials that will meet the specification requirements. Any glass or glazing material replacement shall be completed before final inspection of the work. Inferior or improper installation shall be corrected to comply with the requirements of this specification.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 9 FINISHES

SECTION 9A

LATHING, PLASTERING, FURRING

9-A.1 REQUIREMENTS The work covered in this Section consists of furnishing all materials, labor, equipment, tools, plant, accessories and services necessary to complete all Lathing, Plastering and Furring in accordance with the requirements on the drawings and specified herein.

9-A.2 GENERAL Plaster work generally and except as otherwise specified, shall be 3-coat work on metal lath, foam plastic insulation, 2-coat work on concrete walls and masonry, and shall include all interior lathing and plastering, metal studs, metal furring, and metal accessories, such as grounds, base screeds, casing beads and corner beads. For location, extent and character of plaster work, see drawings. Plaster "ceilings" refer to all overhead surfaces that are to be plastered, including beams and girders and the soffits of arches, stairs and suspended construction, unless otherwise shown or specified. Plastered "walls" include walls, partitions, piers, pilasters, columns, reveals and recesses, except where other finish is required.

Areas to receive furring, lathing, plastering, foam plastic insulation plaster base are shown or indicated on the Finish Schedules, sections, details, elevations contained in the contract drawings.

9-A.3 APPLICABLE DOCUMENTS

(a) Standard Specifications - The following Standards and Publications shall govern the work herein, except as modified or specified otherwise.

1. American Standards Association

A. Standard Specification for Gypsum Plastering ASA - A42.1

B. Standard Specification for Portland Cement Plaster ASA - A42.3

C. Standard Specification for Interior Lathing and Furring ASA - A42.4

Information Handling Services, 1999
August 12, 1999 05:44:57

2. Gypsum Association

A. Recommended Specifications for Gypsum Plastering, latest edition.

3. Plastering on Foam Insulation

See Section 7G Page 7G-2 Wall Insulation (Plaster Base)

9-A.4 WORK NOT INCLUDED Wood grounds and furring are included under Division 6 - Carpentry, Section 6A. Foam plastic insulation is included under Section 7G.

9-A.5 INCLUDED WORK Metal furring, bearing members, hangers and inserts shall be provided, as required, for any materials that are not attached directly to concrete, masonry or wood furring, and as may be necessary to bring the finished surfaces to the lines and levels shown by the drawings.

9-A.6 HANDLING STORAGE Manufactured materials shall be delivered in the original, unbroken packages, containers, or bundles bearing the maker's name and brand. They shall be kept dry, off the ground, under cover and away from sweating walls and other damp surfaces until put to use.

9-A.7 MATERIALS Materials shall conform to the following applicable Federal Specifications, which are referred to by symbol, and the requirements specified herein:

(a) Gypsum Plaster: ASTM-C-28, Type N (neat) or Type F (Fibered), at the option of the Contractor. Neat plaster shall be fibered for scratch coat.

(b) Calcined Gypsum: ASTM-C-28, Type N, for base coats and Type G, for finish coats; except that the minimum strengths, in pounds per square inch, when fully dry shall be 5000 for compressive and 500 for tensile, when tested in accordance with ASTM Designation C26-52.

(c) Lime: Lime shall be either hydrated lime or finely pulverized quicklime, at the option of the Contractor. None of the lime delivered shall be used in the work until samples taken

Information Handling Services, 1999
August 12, 1999 05:44:57

by the Governments Representative have been tested and approved by the Resident Engineer.

(1) Hydrated: Hydrated lime; ASTM-C-206, except the total free (unhydrated) calcium oxide (CaO) and magnesium oxide (MgO) in the hydrated product as delivered on the site shall not exceed 8 percent by weight.

(2) Pulverized Quicklime: Pulverized quicklime: ASTM-C-5. All shall pass a No. 20 sieve and not less than 90 percent shall pass a No. 50 sieve. After slaking to a putty, it shall show at the end of 72 hours that the total free (unhydrated) calcium oxide (CaO) and magnesium oxide (MgO) in the hydrated product does not exceed 8 percent by weight, calculated on the basis of the lime solids in the putty.

(d) Portland Cement: ASTM-C-150, Type I or III and VI.

(e) Keene's Cement: ASTM-C-61. For finish work it shall be pure white and capable of taking a high polish.

(f) Bond Plaster: Bond plaster shall be factory mixed, specially prepared for use directly on concrete surfaces with the addition ofwater only. It shall contain not less than 60 percent by weight of calcined gypsum calculated from SO_3 content. The remainder shall consist of materials to control the working quality, setting time, bonding property and expansion on setting. It shall set in not less than 1-1/2 hours, nor more than 8 hours and shall have a tensile strength of not less than 150 pounds per square inch after aging seven days in moist air at a temperature of 70 degrees to 100 degrees F. Methods of testing shall conform to ASTM-C-26.

(g) Bond Adhesive: Bond adhesive for use on concrete walls shall be an aqueous resin emulsion, factory prepared for permanently bonding plaster to damp or dry concrete surfaces and tinted to show by visual inspection where it has been applied. It shall be vermin-proof, non-toxic, highly resistant to acids, not affected by alkalies present in concrete and plaster mixes, non-inflammable and shall not support combustion. It shall be dry to touch on concrete in less than 1 hour, remain flexible when dry, develop a minimum bond strength of 150 pounds per square inch and have a performance temperature range of from minus 35 degrees F. to 275 degrees F. without bond failure. A certificate of compliance with this specification, signed by the manufacturer and endorsed by the Contractor, shall be furnished in duplicate to the Government's Representative.

Information Handling Services, 1999
August 12, 1999 05:44:57

(h) Hair and Fiber: Hair and fiber shall be clean and in various lengths from approximately 1/2 inch to 2 inches.

(i) Sand: Sand shall be clean, well graded and free from soluble salts (alkali) and organic matter. When dry, all of the sand shall pass a No. 4 sieve and shall meet the following screen analysis:

Retained on a No. 8 screen.....0 to 5 percent
Retained on a No. 16 screen.....5 to 30 percent
Retained on a No. 30 screen.....30 to 60 percent
Retained on a No. 50 screen.....65 to 85 percent
Retained on a No.100 screen.....95 to 99 percent

A maximum of 5 percent passing a No. 100 screen will be allowed. When measured by volume, 85 pounds of damp sand or 80 pounds of dry sand shall equal 1 cubic foot. Volumes specified are on a dry basis.

(j) Water: Water shall be clean, fresh and free from alkali.

(k) Lath: QQ-L-101, except as otherwise specified. Weights specified are per square yard. For work exposed to the weather, lath shall be zinc-coated either before or after fabrication. Lath not otherwise specified shall be either 24 or 26 gauge, flat, expanded metal lath not lighter than 3.4 pounds, or 2-1/2 mesh per inch 19 gauge woven wire lath not lighter than 2.48 pounds.

(1) Welded Wire Fabric: Welded wire fabric with integral paper backing may be substituted for the expanded metal or woven wire lath specified above, except where plaster is to be applied to both sides of the lath. The fabric shall be 16 gauge wires, not larger than 2 by 2 inch mesh, stiffened or self-furring type, with ribs or stiffeners at intervals of not more than 5 inches. Paper shall be of absorbent quality or shall be perforated.

(2) Flat-Rib: Flat-rib (1/8 inch) expanded metal lath shall weigh not less than 3.4 pounds.

(3) Rib Lath: Rib lath shall have 3/8 inch ribs or equivalent stiffeners and shall be either expanded metal weighing not less than 4 pounds, or 2-1/2 mesh per inch, V stiffened, woven wire weighing at least 3.3 pounds.

Information Handling Services, 1999
August 12, 1999 05:44:57

(l) Accessories: Metal accessories such as grounds, base screeds, casing corner beads, casing channel beads, shall be zinc-coated sheet metal not less than 26 gauge, with expanded or perforated flanges or clips so shaped as to permit complete embedment in the plaster. Spot weld 20 gauge sheet metal closure strips to casing beads. Provide 20 gauge end caps.

(m) Hangers and Inserts: Hangers shall be of ample length. Inserts and other means of attachment, as installed, shall develop the full strength of the hangers used. Steel flats; 1 by 3/16 or 1-1/4 by 1/8 inches with 7/16 inch diameter holes, punched on the center line and equipped with 3/8 inch diameter bolts; no hole less than 3/8 inch from an end. Rods; 3/16 inch diameter. Steel to be zinc coated, cadmium-plated or painted with a rust-inhibitive paint. Wire loops and hangers are specified below.

(n) Metal Furring: Metal furring; either hot-rolled or cold-rolled steel shapes, except where hot-rolled shapes are specified; painted with rust inhibitive paint. Except where zinc-coated (galv.) finish is shown or specified on the drawings.

(1) Cold-Rolled Channels: Cold-rolled channels; flanges not less than 7/16 inch wide and the following minimum weights per 1,000 linear feet: 300 pounds for 3/4 inch, 475 pounds for 1-1/2 inch, 590 pounds for 2 inch.

(2) Hot-Rolled Channels: Hot-rolled channels; the following minimum wieghts per 1,000 linear feet; 300 pounds for 3/4 inch, 410 pounds for 1 inch, 1120 pounds for 1-1/2 inch, and 1260 pounds for 2 inch.

(o) Furring for Irregular Surfaces: Furring beams, cornices and similar irregular surfaces; Brackets; not lighter than 1 inch hot-rolled channels or 1 by 3/16 inch flats. Runners for arched ceilings: 3/4 inch diameter rods. Cross furring for lath; 3/4 inch channels or 3/8 inch diameter rods.

(p) Metal Studs: Hot rolled channels 2, 2-1/2, 3-1/4, 3-5/8, 4 and 6 inch size as required; or not lighter than 18 gauge strips or 7 gauge wire, dip-painted with asphaltum or other rust inhibitive paint. Manufacturers standard width in plus nearest fractional inch is acceptable.

(1) Deflection: When subjected to bending in a plane parallel with the long axis of the section be center loading on a clear span of 5 feet, the deflections of the studs shall not exceed those given below:

Information Handling Services, 1999
August 12, 1999 05:44:57

4 inch and wider; 100 pounds load; 0.10 inch deflection 3-1/4 inch; 100 pounds load; 0.15 inch deflection 2-1/2 and 2 inch; 50 pounds load; 0.20 inch deflection.

(2) Limitation: The above studs shall not be used for load-bearing partitions, or in earthquake-resistant structures.

(q) Wire Accessories: Wire accessories shall conform to applicable Federal Specifications and shall be soft annealed. Steel shall be zinc-coated.

(1) Steel Wire, Corrosion-Resisting: QQ-W-461 (Composition FS 430).

(2) Steel Wire: QQ-W-461, Finish D.

(3) Hangers: Corrosion-resisting steel not less than .135 inch diameter, or steel not less than .162 inch in diameter, U.S.S. Gage.

(4) Loops: Loops for attachment of furring to concrete: Steel, minimum diameters for areas supported; .08 inch up to 8 square feet; .105 inch up to 12 square feet and .120 inch up to 16 square feet.

(5) Ties for Brackets: Ties for attaching brackets and runner channels to steel shapes or inserts; steel not less than .08 inch in diameter, double-wrapped or two strands saddle tied.

(6) Ties for Furring: Ties for attaching furring channels to steel joists; steel loops not less than .062 inch diameter, or a double wrapping of lacing wire.

(7) Lacing Wire: Lacing wire; steel, not less than .047 inch diameter.

9-A.8 OPTIONS

(a) Lime Plaster: Lime plaster may be substituted for gypsum plaster, except (a) for use directly on concrete, (b) for brown coat on gypsum bond plaster (c) as base coats for Keene's cement finish, and (d) for use on foam plastic plaster base.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) Mill-Mixed Gypsum Plaster: Mill-Mixed Gypsum Plaster in the proportion of 1 part gypsum to 2-1/2 parts sand, by weight or 100 pounds of gypsum to 2-1/2 cubic feet of either vermiculite or perlite, may be used instead of the job mixtures of gypsum plaster specified for scratch and brown coats on metal lath.

(c) Mill-Mixed Gypsum Plaster: Mill-Mixed Gypsum Plaster in the proportion of 1 part gypsum to 3 parts sand, by weight, or 100 pounds of gypsum to 3 cubic feet of either vermiculite or perlite, may be used instead of the job mixtures of gypsum plaster specified for brown coat on concrete ceilings and for use on concrete walls and masonry.

(d) High-Strength Gypsum Plaster: High-Strength Gypsum Plaster may be substituted for Keene's cement where Keene's cement is required in base of finish coats. Mixtures for base coats shall be the same as specified for gypsum neat plaster, using sand for aggregate. Mixtures for finish coats shall be in the following proportions by weight: For finish generally, 1 of gypsum and not over 2 of putty. For wainscots and run work, 1 of gypsum and 1 of putty.

9-A.9 MIXTURES AND MIXING

(a) General: Measurement by volume shall be made in containers of known capacity. The amounts of sand specified are on a dry basis. No lumpy, caked or frozen materials shall be used. No mortar that has commenced to set shall be retempered or used in the work. Mixing equipment, boxes and tools shall be cleaned for each batch.

(b) Proportion Control: The materials shall be proportioned as specified, with only such variations as will, under prevailing conditions, improve the quality of the work and as shall be approved by the Government Representative. All ingredients shall be accurately measured using an automatic mechanical measuring device that will consistently maintain the specified proportions within a plus or minus tolerance of not more than 5 percent by weight or volume and thoroughly mixed until evenly distributed throughout.

(c) Lime Putty: Lime putty shall be a stiff mixture of lime and water and shall be kept moist until used. Putty from hydrated lime shall be allowed to soak at least 24 hours before it is used. Putty from quicklime shall be slaked and allowed to soak at least 72 hours after cooling, before it is used.

Information Handling Services, 1999
August 12, 1999 05:44:57

During the slaking of the lime care shall be taken to avoid either burning or drowning the lime.

(1) Lump Lime: Aged lime putty made from lump lime may be used provided the total estimated amount required for the job is slaked, strained and stored in a vat or vats for at least three weeks before any of the lime is delivered to the site. The putty shall be made by a firm regularly engaged in supplying the trade with putty in bulk and with a plant fully equipped with the proper machinery and storage capacity; the plant and methods used to be subject to Government inspection and approval.

(d) Gypsum Plaster: Neat plaster shall be mixed 1 part plaster to 2 parts sand for first (scratch) coat on lath, and 1 part plaster to 3 parts sand for second (brown) coat on lath and concrete walls. Parts are by weight. See plaster on foam plastic insulation.

(e) When vermiculite or perlite is used as an aggregate, the first (scratch) coat on lath shall be mixed in the proportions of 100 pounds of gypsum neat plaster to not more than 2 cubic feet of vermiculite or perlite.

(f) For second (brown) coat on lath the proportions shall be 100 pounds of gypsum neat plaster to not more than 3 cubic feet of vermiculite or perlite.

(g) Wood Fibered Plaster: Wood fibered plaster shall be used without sand for first (scratch) coat on lath, and either without sand or mixed 1 part plaster to 1 part sand, by weight, for second (brown) coat on lath and concrete ceilings and for use on concrete walls and masonry.

(h) Lime Plaster: Lime plaster for first (scratch) coat on lath; 1 volume of putty and not more than 2-1/2 volumes (or 200 pounds) of sand gauged with 10 to 15 pounds of Portland or Keene's cement per cubic foot of lime putty, with 7-1/2 pounds of hair per cubic yard of mortar. For second (brown) coat on lath and for use on masonry; 1 volume of putty and not more than 3 volumes (240 pounds) of sand, with 3-1/2 pounds of hair per cubic yard of mortar. An equivalent bulk of fiber may be susbtituted for the hair specified.

(1) Limitation: Lime plaster shall not be used directly on concrete nor as a brown coat on gypsum bond plaster.

Information Handling Services, 1999
August 12, 1999 05:44:57

(i) Finish Coat: Finish coat, not otherwise specified, for both gypsum plaster and lime plaster shall be prepared gypsum (lime free) white finish, or shall be a mixture of lime putty and calcined gypsum in the proportions of three parts lime putty to one part calcined gypsum by volume. In either case, it shall produce a smooth, hard white finish.

(j) Keene's Cement: Keene's cement finish shall be applied over base coats of gypsum plaster.

(1) Keene's Cement Plaster: Keene's cement plaster shall be mixed 1 part cement, 4 parts lime putty and 13-1/2 parts sand for scratch coat on lath; and 1 part cement, 4 parts lime putty and 18 parts sand for brown coat on lath and for use on concrete walls and masonry. All parts are by weight. Scratch coat shall have 7-1/2 pounds of hair or an equivalent bulk of fiber per cubic yard of mortar.

(2) The first (scratch) coat on concrete shall be gypsum bond plaster without sand.

(3) Keenes Cement Finishes: Keene's cement finishes shall consist of the following parts by weight of cement and lime putty:

Finish generally; 1 of cement and not over 1 of putty.

9-A.10 INSTALLATION OF FURRING, LATH

(a) General: Provide metal furring (other than structural steel) for all lines, contours and planes where lath is required for plastering, and include all necessary hangers, bolts, inserts, clips, fastenings and attachments which shall be of such size, number and design as will develop the full strength of the members.

(b) Workmanship: Metal furring shall be erected to true lines and surfaces and be rigidly supported and fastened in place. Grounds, furring and framing shall be tested and all needed corrections made before lathing or plastering is begun.

Metal furring to which the lath will be attached shall be wired to the brackets, bearing members and other steel supports at every intersection or point of contact. Where attached

Information Handling Services, 1999
August 12, 1999 05:44:57

directly to structural steel and wherever wiring as specified is not practicable, bolts or zinc-coated metal clips of equivalent strength shall be used.

(c) Irregular Surfaces: Brackets for beams soffets, light troughs, and similar irregular surfaces shall be shaped to within 2 inches of the finished profiles, spaced not over 3 feet on centers, cross braced as required and bolted or wired in place. Larger sizes and closer spacing than specified shall be used where so shown. Wire continuous cross furring to the brackets at all principal angles and at points between, not over 12 inches apart.

(d) Access Panels: Provide framed openings in the furring of plastered surfaces for the support of attachments for access panels furnished and located under "Mechanical and Electrical Equipment".

(e) Metal Studs:

(1) General: cuts and drawings showing complete details of assembly and anchorage of metal stud framing shall be submitted, together with samples of each size stud to be used including ceiling and floor channel runner. All samples shall be six feet in length.

(2) Workmanship: Metal studs shall be set to the required dimensions, properly aligned, made plumb and true and have both ends fastened to horizontal members anchored to floor slab and structural ceiling. The connection to ceiling member shall be a metal clip, or similar device, specially formed to fit the stud and long enough to provide for secure wiring thereto and allow for several inches of vertical adjustment. Studs shall be rigidly framed at corners and around openings and fastened to the bucks or frames of openings.

(3) Suspended Ceilings: Where suspended ceilings occur, the studs shall not extend through the ceiling above, but shall be attached to the suspended ceiling grid at all points of contact, unless indicated otherwise.

(4) Bridging Requirements: Studs 8 feet to 12 feet high shall be bridged horizontally near the center. Studs over 12 feet high shall have two rows of horizontal bridging 4 feet apart; the bottom row being not less than 4 feet nor more than 5 feet above the floor.

Information Handling Services, 1999
August 12, 1999 05:44:57

(5) Bridging: Bridging shall consist of 3/4-inch channels passed through openings in the studs and wired to every stud; single channels for 2 and 2-1/2 inch studs; channels in pairs for studs wider than 2-1/2 inches.

(6) Attachment: Provision shall be made in studs for rigidly bolting all blocking and special braces or framing for the attachment and support of electrical outlets, plumbing or heating fixtures or other such equipment indicated to be supported by the stud construction.

(7) Interference: Where piping interferes with the placing of the horizontal members of steel stud partitions, or where such members will interfere with the proper placing of the piping, the horizontal members shall be cut for the piping, or such members (except bridging) may be omitted and each vertical bolted to the floor and ceiling construction through bent ends or steel angle clips.

(f) Lathing:

(1) General: Metal lath shall be used as a base for all plaster work on wood, metal furring or framing on open concrete joist construction and wherever suitable base of masonry or concrete is not indicated or provided under the contract. For lath of the types and weights specified, the maximum allowable spacings of supports are as follows:

Flat expanded and wire lath: 16 inches on walls; 12 in. on ceilings.
Paper-backes wire fabric: 16 inches on walls and ceilings.
Flat rib expanded lath: 19 inches on walls and ceilings.
V-stiffened wire lath: 24 inches on walls; 19 inches on ceilings.
2/8 inch rib expanded lath: 24 inches on walls and ceilings.

(2) Workmanship: Lath generally shall be laid with the long dimension at right angles to the supports, edges lapped 1/2 inch and ends lapped at least 1 inch. Rib lath shall have the ribs "nested" at sides and lapped 1 inch at ends. Wire lath shall be tightly stretched. End joints of sheets shall be staggered. If ends occur between bearings the ends shall be lapped one inch and laced, adequately tied with lacing wire. Lath shall be continuous around the corners of intersecting plaster surfaces.

Information Handling Services, 1999
August 12, 1999 05:44:57

(3) Fastening: Metal lath generally shall be fastened at points not over 6 inches apart along supports, or attached to the metal furring at 10-inch intervals by specially designed steel wire clips of not lighter than 13 gauge which interlock and provide a continuous support for the lath along the furring, and side points shall be wired at least once between supports. Rib lath shall be fastened at all ribs. Lath abutting masonry or concrete surfaces that are to be plastered shall extend on to same at least 4 inches and be fastened every 6 inches.

(4) Lath Reinforcement: Expanded strip lath at least 6 inches wide shall be centered on and secured across all flush joints (vertical and horizontal) between concrete surfaces and abutting partitions; across narrow chases for pipes and conduits in masonry furring and partitions and similar strips 16 inches long fastened diagonally at the head corners of openings in partitions of concrete masonry units. Fasten the strips sufficiently to retain position during plastering.

(5) Cornerites: Expanded cornerites, not less than 3 by 3 inches, shall be installed in all internal angles where non-loadbearing partitions of hollow masonry units that will be plastered intersect unfurred ceilings and abut concrete or masonry walls that also are to be plastered. Cornerites shall be fastened sufficiently to retain position during plastering.

(6) Nails: Lath shall be fastened to wood furring or framing with No. 14 gauge staples, or No. 12 gauge nails with large or hook heads, long enough to penetrate 1 inch into the wood and spaced approximately 6 inches on centers; staples and nails to be zinc-coated.

(h) Accessories:

(1) General: Metal grounds, base screeds, casing beads, and corner beads shall be set to straight, true lines and the flanges securely fastened in place at points nor more than 8 inches apart. Grounds and beads shall be level and plumb and screeds parallel with floors and rake of stairs.

(2) Corner Beads: All exposed external plaster corners shall have metal corner beads.

Information Handling Services, 1999
August 12, 1999 05:44:57

(3) Grounds: The edge of cement wainscot, or wall, of structural facing tile wasinsot, or wall and of cement base, shall finish to metal grounds, except where plastering is omitted above the wainscot, wall, or base.

(4) Screeds: Plaster screeds for the brown coat shall be run around the margins of all ceilings and walls and (where grounds are not available for the purpose), on intermediate lines about 6 feet apart. The screeds shall be brought into perfect line and level to establish the exact surface of the brown coat and allowed to set up, and then used as a guide for rodding the brown coat.

9-A.11 PREPARATION (Surfaces Other than Foam Plastic Insulation)

(a) General: Surfaces to be plastered shall be clean and free from frost, loose particles, paint, efflorescence, grease, oil, acid and similar foreign matter.

(b) Concrete: Concrete walls shall be given one full-covering coat of bond adhesive evenly applied by brush or spray as taken from sealed containers and without adulteration. Masonry, concrete and all under coats of plaster shall be dampened to eliminate excessive suction and permit proper spreader of the plastic materials.

9-A.12 APPLICATION OF PLASTER

(a) Concrete Ceilings:

(1) On Lath: The first (scratch) coat on concrete ceilings shall be gypsum bond plaster and 1/8 inch thick. It shall be scratched in thoroughly and the surfaces made plumb, straight and level by a brown coat of gypsum plaster (neat or wood-fibered), which shall be applied before the scratch coat has set and filled out to a true, even surface and left rough, ready to receive the finish coat. The total thickness of bond coat and brown coat shall not exceed 1/2 inch.

(2) On Concrete: On concrete ceilings which are not more than 1/2 inch out of level the first (scratch) coat of gypsum bond plaster shall be doubled back and filled

Information Handling Services, 1999
August 12, 1999 05:44:57

out to a true, even surface and left rough, ready to receive the finish coat, which shall be applied directly to the bond coat. In no case shall the bond plaster be more than 3/8 inch thick.

(b) Concrete Walls and Masonry:

(1) On Lath: The first (scratch) coat shall be applied with sufficient material and pressure to cause perfect adhesion and to key with or embed in the lath. It shall cover the face of the lath to a depth sufficient to allow for scratching, and shall be cross-scratched in both directions before the mortar has set. The scratch coat for gypsum plaster shall be allowed to set, but not dry out, before the brown coat is applied. The scratch coat for lime plaster and Keene's cement plaster shall be allowed to set hard and dry out before the brown coat is applied. The brown coat shall be brought out to the screeds and grounds, straightened to a true surface with rod and darby and left rough, ready to receive the finish coat.

(2) On Concrete: The first (brown) coat shall be applied with sufficient material and pressure to form a good bond and then doubled back to bring the plaster to the screeds and grounds, straightened to true surfaces with rod and darby and left rough, ready to receive the finish coat.

(c) Finish Coat:

(1) General: The finished work shall be straight, level and plumb, with true surfaces and sharp lines and arises. There shall be no visible joints, cracks, crazing, tool marks or discolorations.

(2) No Finish Coat Required: Where no finish (white) coat is required, the brown coat shall be floated to a true, uniform surface free from irregularities and flush with the screeds and grounds. Elsewhere, the brown coat shall be left as it comes from the darby and allowed to set and dry for the finish coat.

(3) Finish Coat Required: The finish coat shall cover the rough plaster so completely that no part of the undercoat shall show through and shall be not more

Information Handling Services, 1999
August 12, 1999 05:44:57

than 1/8 inch thick. A skim coat of material shall be troweled on with enough pressure to cause perfect adhesion, doubled back before any set has taken place, allowed to draw a few minutes, and then troweled to a dense, close grained surface with a polish. The least amount of water possible shall be carried on the brushes used ahead of the trowels.

(d) Curing: During the application of each coat of plaster, the exterior openings shall be kept closed until the plaster has set, the adjusted for proper ventilation to regulate the drying and curing of the plaster. If proper ventilation cannot be obtained through exterior openings, suitable mechanical ventilation shall be provided. The plaster shall be protected against "Sweat-outs", rapid drying and frost.

9-A.13 * PORTLAND CEMENT PLASTER Portland cement plaster finish, where required, is included herein complete with all accessory items necessary in accordance with best practice in Portland Cement Work.

(a) Materials:

(1) Portland Cement (Gray): for scratch and brown coats.

(2) Sand: for scratch and brown coat same as sand approved for general cement finish work.

(3) White Waterproof Portland Cement: for finish coat.

(4) White Ottawa Sand: for finish coat.

(5) Runner Channels: 1-1/2 inch hot-rolled channels at 4 feet on centers.

(6) Furring Channels: 3/4 inch hot-rolled channels @ 12 inches on centers.

(7) Metal Lath: 3/8 inch expanded galvanized metal lath weighing not less than 4.0 pounds.

(8) Casing Bead: 3/4 inch galvanized casing bead Type 66.

(b) Installation:

(1) Runner Channels: shall be suspended from construction

Information Handling Services, 1999
August 12, 1999 05:44:57

above with No. 8 galvanized annealed wire hangers at 3 feet on centers; runner channels spaced 4 feet on centers. Hanger wire shall have not less than two full wraps around channel with end making minimum three turns on itself.

(2) Furring Channels: shall be placed and tied to runner channels at 12 inches on centers. Furring channels shall be placed perpendicular to runner channels and tied at each intersection with double wire saddle ties.

(3) Metal Lath: Shall be placed with long length perpendicular to furring channels; lap sides to nest ribs and ends overlapped not less than 1 inch. Attach metal lath to furring channels with No. 16 gauge galvanized annealed tie wire at each rib. Provide one tie between supports along side and one tie between ribs at end lap.

(4) Perimeter Casing Bead: Attach No. 66 metal casing channel bead 1/4 inch clear of masonry and aluminum frame; cutting to provide a 1/8 inch open return at each control joint.

(5) Field Area Control Joint: Provide crackage control joints in Portland cement plastered ceilings using two No. 66 channel beads placed back to back with a 1/8 inch wide space between beads. Field area shall be divided into panels not more than 5 feet on any side. After cement plaster is finished the 1/4 inch perimeter joint and 1/8 inch control joint shall be caulked with the finish surface of caulking material pressed back uniformly 1/4 inch from face to bead.

(6) Portland Cement Plaster: Apply a scratch coat over metal lath using a mixture consisting of 1 part gray Portland cement: 2 parts sand with a 10 percent lime (by weight) to cement added.

(7) Brown Coat: Apply brown coat over dry scratch coat using a mixture of 1 part Portland Cement: 2 parts sand and 10 percent lime (by weight) to cement added. Bring brown coat up to within 1/8 inch of face finish surface; darby to a level surface. When brown coat is partially set rake to form a durable keyed surface for finish coat.

Information Handling Services, 1999
August 12, 1999 05:44:57

(8) Finish Coat: Finish coat shall be a mixture of 1 part white Portland Waterproof cement: 1-3/4 part white sand and 15 percent lime added. Apply finish coat with sufficeint trowel pressure to press plaster into all keyed surface forcing out any air pockets and closing all voids. Finish surface with a fine sand rubber float to a uniform fine sand texture.

(9) After each coat of plaster all control joints shall be cleaned of all plaster material.

(10) Curing: After plaster is fully set the surface shall be kept moist for 5 days after completion by a fine water spray.

9-A.14 GYPSUM PLASTER ON FOAM PLASTIC INSULATION

(a) These specifications are intended to describe the minimum requirements for plastering over rigid foam lath board under normal temperature conditions. ASA - No. A42.1 requirements apply to the work herein.

(b) When outdoor temperature is less than 55 degrees F., maintain a uniform temperature of not less than 55 degrees F. continuously throughout the building not less than 10 days prior to the start of plastering, during and after plastering is completed. Temperatures and duration thereof shall be approved by the Resid. Engineer. The heat shall be well distributed in all areas to prevent concentrated or uneven heat on any part of the plastered surfaces.

(c) Ventilation shall be provided to dry the plaster during and after application. In cold weather do not depend upon open windows for ventilation or circulation of air. Temporary circulation shall be provided as required or as directed by the Resid. Engineer. In any event ventilation shall be uniform throughout the plastered area affected.

(d) Base coats shall be mixed with a minimum of water to obtain a workable mix. Plaster shall job set in three hours or less.

(e) All work shall be three coat plaster, scratch, brown and finish. Only sand aggregate shall be used.

Information Handling Services, 1999
August 12, 1999 05:44:57

(f) Base coats shall be proportioned to yield a strong dense membrane. The base mix generally shall be of the following proportions:

Gypsum plaster	100 pounds
Damp Loose Sand	2 to 2-1/2 cubic ft.

(g) Finish coat shall be proportioned: (by volume)

Gauging Plaster	1 part
Lime Putty	3 parts
Silica Sand	1/2 cubic foot per bag of gauging plaster

(h) Total thickness of plaster base coat shall not be less than 5/8 inches and finish coat shall be not less than 1/16 inches nor more than 1/8 inches in thickness.

(i) Application:

(1) Scratch Coat: Apply a nominal 1/4 inch thick scratch coat with firm pressure to insure a good uniform key to the surface cells of the foam board plaster base. Rake surface of scratch coat to provide a rough key surface. Allow a scratch coat to dry firm and hard before applying brown coat.

(2) Brown Coat: Apply a nominal 3/8 inch thick brown coat and bring out to grounds or screeds. Rod and darby brown coat to a true, regular and lightly roughened surface ready to receive a nominal average 3/32 inch thick finish coat.

(3) Finish Coat: Brown coat shall be moderately dry but not bone dry to receive the finish coat of plaster. If brown coat is bone dry, wet the surface by brushing or spraying with clear water, if spray is to be used, only a minimum amount of water shall be used.

The finish coat shall be applied over the brown coat with a scratch coat thoroughly laid on with a well covered surface, double back and fill out to a true even surface. The finish shall be allowed to "draw up" for a few minutes and then hard troweled with water to a smooth finish, free from cat faces, trowel marks or surface blemishes.

Information Handling Services, 1999
August 12, 1999 05:44:57

9-A.15 GENERAL

(a) The Contractor shall coordinate the work of the various trades as their work is affected by the work under this Section. He shall maintain a progress schedule approved by the Resid. Engineer covering this work.

(b) The Contractor shall provide and operate mechanical equipment, if necessary, to control humidity, temperature and ventilation during and after plaster is installed. Equipment shall be maintained and operated until conditions for removal are approved by the Resid. Engineer.

(c) The Contractor shall examine the various drawings, details and Sections of the specification as they affect the work herein. Certain partitions under this Section terminate at the ceiling height line and shall be anchored to the suspended ceiling grid system at each point of contact with a self tapping screw. Ceiling channel for partitions shall have a continuous strip of sponge rubber gasket applied before erection. Gasket shall be 3/16 inches in thickness by 2 inches wide adhesive coated both sides. Tape shall be open faced one side and in rolls with a removable paper separator on one side. Tape shall be applied with adhesive coated side in contact with channel, paper covering will be removed under acoustical Tile Work Section. Adhesive shall be non-setting.

(d) Cleaning Up After plastering work is completed all tools, equipment, scaffolding, dirt and debris shall be removed from the site. Work areas shall be cleaned free from plaster spatter, droppings, and misplaced plaster materials. The work areas affected herein shall be left broom clean and ready for the work of other trades to follow.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 9 FINISHES

SECTION 9C

RESILIENT TILE AND BASE

9-C.1 REQUIREMENTS. The work covered in this Section of the Specifications consists of furnishing all materials, labor, equipment, tools, appliances, accessories and services necessary to complete all Resilient Tile and Base Work required on the drawings and specified herein.

For location and extent of work and the type, size, color, pattern of tiles and base, see applicable drawings and schedule of finishes.

Non-slip nosings at exposed edges of steps and platforms are not included in this Section. Nosings are furnished under Section 5B and installed under Section 3A of these specifications.

9-C.2 MATERIALS. Materials shall meet requirements of referenced Federal Specifications and Standards, and requirements specified herein.

(a) Vinyl Asbestos Tile: L-T-00345, 9 inches by 9 inches by 1/8 inches unless indicated or specified otherwise.

(b) Vinyl Plastic Base: L-F-00450

(c) Adhesive, Primer, and Underlayment: Water dispersed reclaimed rubber base, heavy bodied type for application of floor coverings. Materials shall be suitable for the purpose and the specified structural conditions, delivered in sealed containers bearing the manufacturer's label and shall be without adulteration or reducing. Types for each use shall be approved by the manufacturer of the material.

9-C.3 APPLICATION AND MATERIAL HANDLING

(a) Surface Preparation. Surfaces to receive floor covering shall be cleaned free of dust, foreign matter, and materials not compatible with adhesive.

Information Handling Services, 1999
August 12, 1999 05:44:57

Concrete shall be dry and in suitable condition to receive the flooring. Moisture tests shall be made on all concrete slabs in accordance with the tile and adhesive manufacturers instructions. Test methods shall be submitted to the Resident Engineer for approval before flooring is placed.

(b) Underlayment. Cracks, joints, holes and depressions in floors or walls, to be covered, shall be filled with underlayment, mixed and applied in accordance with flooring and adhesive manufacturer's instructions, to require thickness, well compacted and allowed to become hard and dry. Concrete and underlayment surfaces shall be uniform, level with a smooth finish acceptable as surfaces of the finished covering.

(c) Waterproofing. Concrete floors shall be given a coat of waterproof primer and sealer of a type recommended by the manufacturer of the flooring material and adhesive to be used.

(d) Temperature. A temperature of not less than 70 degrees F. shall be maintained at least 48 hours before, during and 48 hours after laying of flooring is completed. Materials shall be brought into the locations during the initial 48 hour period and allowed to condition at least 24 hours before installation. A minimum temperature of 55 degrees F. shall be maintained after the 48 hour conditioning period after completion of the laying of the flooring.

(e) Laying Method. Lay flooring in accordance with manufacturers printed directions, to true, straight lines and levels. Flooring tiles for each area shall be laid out from center lines and finished with pieces of uniform shape and size against walls, edge strips and thresholds. Tiles shall be placed squarely against each other with joints symmetrical, and in a manner to insure complete contact and adhesion. Adhesive extruding onto the face surface of the flooring tiles shall be cleaned off immediately. Surfaces stained or damaged by adhesives shall be replaced with fresh materials. Flooring tiles shall be thoroughly pressed into place before the adhesive has set (not later than one hour) after the adhesive is installed. Vinyl asbestos tiles shall not be rolled.

(f) Laying Schedule. Laying of flooring tiles shall be deferred until all other work in the space, that

Information Handling Services, 1999
August 12, 1999 05:44:57

might cause damage to the flooring, is completed. Flooring in any one continuous area or that used in replacement of damaged flooring in a continuous area shall be from the same lot and have the same hue, shade and texture. Variation in marbling and mottling in the same area shall be kept to a minimum.

(g) Edge Strips. Provide vinyl edge reducer strips at exposed edges where flooring is terminated at door openings without thresholds and similar conditions. Strips shall be butt type, beveled on exposed edge, with top surface finishing flush with flooring.

(h) Cleaning and Protection. Flooring shall be thoroughly cleaned, buffed and left in condition ready and acceptable for immediate service in its intended use. Spots and soil shall be removed by means that will not damage the face surface of the tiles. Solvents, wetmopping and flood washing is prohibited. As soon as the flooring is completed in each area, it shall be protected with heavy non-staining building paper. Defects which develop, such as damaged, loose, broken or curled tiles, shall be corrected prior to final inspection.

9-C.4 MAINTENANCE STOCK. Furnish a minimum of 50 pieces of vinyl asbestos tiles of each color and type for maintenance purposes. Tiles shall be new and part of the original lot finished.

9-C.5 QUALITY ASSURANCE

(a) Samples. Submit samples for approval showing full sizes, actual colors and patterns to be used in each space or area.

(b) Approval. Flooring tile placing shall not commence before samples of materials and base conditions, to receive the work, have been approved by the Resident Engineer.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 9 FINISHES

SECTION 9D

CERAMIC TILE WORK

9-D.1 REQUIREMENTS. The work covered in this Section consists of furnishing all materials, labor, equipment, tools, accessories and services necessary to provide and install complete all ceramic tile work required on the drawings and specified herein.

9-D.2 MATERIALS

(a) Ceramic Tile. For floor shall be selected natural clay unglazed ceramic mosaics. Size, color and pattern as indicated on the drawings; in combination of 1 inch by 1 inch, 1 inch by 2 inches and 2 inches by 2 inches.

(b) Setting Bed. Shall be minimum 1 inch thick; screeded level. Bed shall be 1 part Portland Cement, 5 parts sand and 1/5 part lime.

(c) Divider Strip. Provide a divider strip of extruded aluminum at all junctions of ceramic tile and resilient tile. Divider strip shall be not less than 1/8 inch thickness width as required for setting bed provided.

(d) Primers, Sealers, Underlayments and Grout: Of type and consistency as recommended by manufacturer of material furnished and approved by the Resident Engineer.

(e) General Material Requirements: All tile shall be "Standard Grade"conforming to applicable requirements of the U.S. Department of Commerce "Simplified Practice Recommendations" R61-61 and Federal Specification SS-T-380b.

9-D.3 FINISH. Unglazed tile shall be nominal 1/4 inch in thickness having same color throughout the body of the tile, and the texture shall be prduced in the burning of the clay.

Plain colored tile shall have as nearly one solid color on each tile or between tiles as is possible to secure within manufacturing limitations.

9-D-4 HANDLING AND STORAGE. Tile shall be kept dry while in packages and shall not be allowed to lie upon wet materials or surfaces. No tile work shall be laid in freezing weather, except where proper temperatures are maintained to prevent freezing. All

Information Handling Services, 1999
August 12, 1999 05:44:57

rooms or spaces in which tile floors are being laid shall be closed to traffic or other work and shall be kept closed until the floors are completed and the tile firmly set. Tile work shall be adequately protected from damage until the completion of the contract.

9-D.5 PREPARATION

(a) General. Concrete fill shall be clean and damp when the tile are set. Surfaces which have dried out shall be wet down with clean water to reduce suction, and the tile shall be set as soon as excess water disappears. Concrete fill shall be dusted with neat cement or brushed with cement grout to insure permanent adhesion of the mortar bed.

9-D.6 MORTAR

(a) Floors. Mortar for floor tile shall consist of 1 part Portland cement and 3 to 4 parts sand, by volume. Dusting the mortar bed with cement as the floor tile are laid will be permitted as necessary to take up excess water and give better adhesion. The proportions actually used shall be those that will produce the best results under prevailing conditions.

(b) Embedded Items. Where other work is shown or specified to be embedded in the tile work, no tile shall be set on surfaces until such work has been installed and approved.

(c) Soaking. Glazed wall tile and dust-pressed tile (except ceramic mosaic) of the natural clay type shall be thoroughly soaked in clean water before being set.

9-D.7 INSTALLATION

(a) General. Tiles shall be firmly secured in place. Joints shall be well filled, lines kept straight and true and finished surfaces brought to true planes. The completed work shall be free from loose, cracked or broken tile.

(b) Workmanship. Intersections and returns shall be perfectly formed. Cutting and drilling of tiles shall be neatly done without marring the surface of the tile. The cut edges of tiles against trim, finish, etc., shall be carefully ground and jointed.

(c) Layout. The tile work shall be laid out on floors and lengthwise on walls so that, wherever possible, no tiles less than one-half full size shall occur. The tiles or sheet units of floors of more than 100 square feet area shall be laid to a straight edge at regular intervals.

Information Handling Services, 1999
August 12, 1999 05:44:57

(d) Pattern. Where the pattern or design specified shows small unit tile in combination with larger tile, all the tile shall be of the same kind unless otherwise noted.

(e) Setting Beds for Floors. Setting beds of floor tile shall be thick enough to bring the top of the tiles to the finish slopes or levels indicated. The mortar shall be spread and worked to a true and even plane, either level, or sloped to drain, as required. For areas of more than 100 square feet, screed strips shall be set as temporary guides to secure these results. As large a floor area as can be covered with tile before mortar has reached its initial set shall be placed in each operation. When more setting mortar has been spread than can be thus covered, the unfinished portion shall be cut back to a clean, beveled edge close to the tile and removed.

(f) Retempering. Under no circumstances shall retempered mortar be used.

(g) Joints. Joints in tile work, not otherwise indicated, shall be 1/16 inch in width.

9-D.8 GROUTING

(a) General. Grouting shall be done as soon as the mortar beds have set sufficiently to prevent displacement when joint grout is installed. All cement shall be Portland cement.

(b) Floors.

(1) Ceramic Tile. Joints of ceramic mosaic tile floors shall be washed with clean water and the joints grouted with neat cement grout. The grout shall be forced into the joints and finished flush and true.

(2) White Cement. Where light colored mortar is required in joints it shall be made with white cement, and non-fading mineral oxides as necessary to produce the desired color. The quantity of mineral oxides used shall not exceed 5 per cent of the volume of the cement used.

9-D.9 CLEANING. After joint grouting is completed and cured the tile shall be thoroughly cleaned and maintained in that condition until completion of the contract.

Information Handling Services, 1999
August 12, 1999 05:44:57

9-D.10 SAMPLES AND LAYOUT PLAN

(a) The Contractor shall submit to the Resident Engineer two sample panels 12 inches by 12 inches square showing actual colors and sizes of tiles to be used in the work, for approval.

(b) The Contractor shall submit a scaled drawing of the pattern layout for the ceramic tile work, in this section, for the approval of the Resident Engineer. No tile installation shall be started before approved drawings and samples have been received by the Contractor.

(c) The Contractor shall submit to the Resident Engineer manufacturers certificate, in duplicate, stating grade of tile furnished. Certificate shall be properly filled in and signed by the manufacturer. The certificate shall state the grade, kind, and full quantities of tile and shall give identification marks for all packages of tile furnished under the contract. Packages shall be branded with corresponding shipping marks and shall be subject to inspection by the Resident Engineer before being opened.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 9 FINISHES

SECTION 9E

SUSPENDED ACOUSTIC TILE CEILING

9-E.1 REQUIREMENTS. The work covered in this Section of the specifications consists of furnishing all materials, labor, equipment, tools, appliances accessories and services necessary to complete all Suspended Acoustical Tile Ceiling work required on the drawings and specified herein.

For location and extent of work, see drawings, details and finish schedule.

9-E.2 MATERIALS

(a) Acoustic Tile. Acoustic tile shall conform to Federal Specification SS-S-118a, flame resistance class 25, light reflection value not less than 64 percent (64%). Noise reduction coefficient shall be 0.70 (grade 3) or better. Tests shall be made at a minimum of 40 (NRC) and coefficient shall be taken from average of 11 frequencies. Minimum density shall be 0.75 pounds per square foot. Tile for lay-in system shall be 24 inches by 24 inches (nominal). Color shall be as called for in the finish schedule and as approved by the Resident Engineer. Pattern will be selected from samples submitted to the Resident Engineer for approval.

(b) Suspension System. The suspension system Standard used in this specification is based on Series 400 Exposed Grid System of Chicago Metallic Corporation. Grid system that equal or exceeds the requirements specified and manufactured by the following are acceptable.

1. Down Products Incorporated

2. Flangeclamp Corporation

The suspension system shall be an exposed grid, for 24 inches by 24 inches, in size tiles. Suspension system shall include all necessary accessory items for a complete installation of exposed tile support and attachment.

(1) The suspension shall consist of all tees, angles, clips and supporting members having section properties in the range of "Heavy Duty" classification, which shall be designed to carry the ceiling loading, including lighting fixtures and air diffusers,

Information Handling Services, 1999
August 12, 1999 05:44:57

and shall be fabricated from steel treated to resist corrosion.

(2) Suspension system shall meet or exceed the requirements of the current bulletin of Acoustical Materials Association rating for heavy duty strength. The grid components shall equal or exceed the following requirements.

A. - Main Runner. - Main runner shall be fabricated from .024 steel with 1 inch wide flange face and 1½ in.^{4}, section modulus .0520 in.^{3}. Main runner shall have A.M.A. recommended spacing for hanger holes. Cross tee slots shall be 6 inches on centers and identical interlocking ends. Main runners shall be in longest practicable lengths and 2 foot spacing on centers.

B. - Cross Tees. - Cross tees shall be fabricated from .024 gage steel with 1 inch wide flange face and 1-3/8 inches high. Moment inertia .0262 in.^{4}, section modulus .0520 in.^{3}. Cross tees shall be 2 feet long with identical ends. Ends of cross tees shall be fabricated for use of intersection locking clips to join and lock cross tees to main runners.

(3) Hanger wire shall be 9 gage galvanized and annealed steel wire. Hanger shall be spaced in a manner that not more than 16 square feet of ceiling will be supported by a single hanger.

9-E.3 INSTALLATION

(a) Manufacturers Requirements. Acoustical ceiling units shall be installed with metal suspension system by an approved erector in accordance with the directions of the manufacturer of the acoustical tile units and suspension system to be used in the work, and as specified.

(b) Suspension System shall be installed complete over the room or area, to receive the suspended ceiling; leveled and properly secured in place before erection of the acoustical tile units; shall be approved by the Resident Engineer before covering up with tile units.

(c) Temperature. No acoustical tile units shall be installed until concrete and masonry are completely dry, windows and doors are in place and glazed. Room temperature shall be approximately 70 degrees F. and relative humidity approximately 55 percent (%), for at least 48 hours, before,

Information Handling Services, 1999
August 12, 1999 05:44:57

during and 72 hours after installation of all tile is completed.

(d) Edges. Each ceiling tile shall have positive support along all four sides to prevent displacement of plane of face surface. Provide suitable metal channel or angle edge support at walls or other vertical surfaces against which tiles abutt.

(e) Supports. The tops of hanger wires shall be securely attached to the structural framing by approved and accepted hangers,clips or anchorage devices used in top quality work. Hanger tabs shall be located and placed so that the superimposed load will in no way cause deflection or displacement of the bearing member. Hanger wire tie loops shall be tightly closed at all tie points with not less than three full tight turns on itself. Friction or grip type inserts or hanger tabs are prohibited.

(f) Coordination. The installation of the suspended acoustical ceiling system shall be fully coordinated with the installation of mechanical and electrical work as ducts, diffusers, lighting fixtures, and other devices and includes ceiling height partitions. Any hanger wires required for supporting the work of other trades shall be furnished and installed under this Section, and approved by the Resident Engineer.

9-E.4 DEFECTS

(a) Tile surfaces exposed to view shall be cleaned and left free of defects. Off-sized,soiled, stained, or otherwise damaged tile shall be removed and replaced with new units.

(b) Joints between suspension frame units shall be close fitting and any unit with chipped, broken or cracked edge shall be replaced with new and acceptable units.

9-E.5 QUALITY ASSURANCE

(a) Samples and Drawings. Samples of acoustical tile units and suspension system members shall be submitted for approval. Drawings showing section properties of the members, connection and supporting details, and general layout of the suspension system shall be submitted for approval of the Resident Engineer. No material under this Section shall be delivered to the job site before approval has been issued by the Resident Engineer.

Information Handling Services, 1999
August 12, 1999 05:44:57

9-E.6 CONCEALED SUSPENSION

(a) Suspension system other than the exposed grid system specified in 9-E.2 is required in this section of the specification.

(b) Areas and spaces where concealed suspension system is required is so indicated on the drawings.

(c) Concealed suspension system consists of 1½ inch runner channels at 48 inches on centers maximum spacing. Nailer Channels shall be installed perpendicular to runner channels at 16 inches on centers attached with four strands of No. 18 gauge galvanized tie wire at each intersection. Runner channels shall be suspended from construction above with No. 9 gauge hanger wires at 36 inches on centers maximum. Hanger wire shall be wrapped around runner channel with not less than two tightly twisted wraps and four full turns on itself. Top end of hanger wire shall be looped about structural supporting member above and four turns on itself.

(d) Suspension system over some areas require vibration isolators manufactured from slow aging neoprene or fiberglass units installed in accordance with details and notes indicated on the drawings.

(e) Regular gypsum core wallboard 5/8 inch thickness shall be applied over nailer channels. Wallboard shall be applied with length of sheet perpendicular to direction of channels with end joint between sheets at midspan of nailer channels. End joint shall be secured with a back-up strip 12 inches wide by 48 inches long cut from same 5/8 inch thickness gypsum wallboard. Back up strip shall be adhesive applied. Attach wallboard sheets to nailer channels with annular nails spaced 6 inches on centers.

(f) Acoustical tile shall be applied directly to gypsum wallboard backing. Tile shall be 12 inches by 12 inches and 3/4 inch in thickness mineral fiber with Noise Reduction Coefficient (NRC): .65 to .75 and with minimum sound absorbing coefficient of .25 at 250 HZ. Type of adhesive used in this work shall be in accord with the recommendations of the manufacturer of the tile used. Tile face surface shall be medium to heavy fissure or large perforations of a non-directional pattern.

Information Handling Services, 1999
August 12, 1999 05:44:57

(g) Tile units shall be firmly pressed into position with sufficient pressure to provide firm bond at not less than five points of applied adhesive spots. Tile units shall be pushed into place against adjacent tile to form tight edge joints and true face plane of abutting tile units.

(h) Tile shall be installed symetrically, about the room center lines with perimeter tile units scribed to wall. Tile layout shall provide for equal width of the perimeter tile units.

9-E.7 ACOUSTICAL BLANKET INSULATION

(a) Acoustical blanket insulation is required and shall be furnished and installed under this section of these specifications.

(b) Acoustical blanket insulation shall be minimum 2 inch thickness, minimum density 2 pounds per cubic foot glass fiber or rock wool. Acoustical blanket shall be installed above suspended ceiling construction in accordance with the requirements on the drawings and over spaces and rooms where called for in the Finish Schedules.

9-E.8 COORDINATING OF WORK

(a) The Contractor shall schedule and coordinate the work under this Section with the work under the various Sections affected by the work.

(b) Interior partitions and walls where indicated in the drawings terminate at the finished ceiling line and are attached to the steel grid system. Sponge rubber gasket seal is provided under other Sections of the specifications. When tile units are placed the paper backing shall be removed from the sponge rubber tape and tile firmly pressed in contact with the adhesive face of tape. Provide hold down clips to retain tile in full contact position.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 9 FINISHES

SECTION 9F

PAINTING OF STRUCTURES

9-F.1 REQUIREMENTS.

(a) The work covered in this Section of the specification consists of furnishing all materials, labor, equipment, plant, tools, accessories and services necessary to complete Painting Of Structures as required in the drawings, schedules, specified and included in the publications listed.

(b) For location and extent of work see the various drawings and Schedules of Painting and Finishes.

(c) All exterior and interior work, except work specified to be finished by the manufacturer, and work shown or noted to be left unfinished, shall be painted and finished in accordance with this Section and FAA-STD-003 publication.

(d) Touch-up of all painted and finished surfaces at completion of work, of other trades, is included herein and consists of restoring damaged finish to match adjacent surfaces.

9-F.2 APPLICABLE DOCUMENTS

(a) The requirements of the following document shall apply to all work herein subject to amendments thereto and revised and later editions.

(b) Publication:

FEDERAL AVIATION AGENCY STANDARD.

FAA-STD-003
JUNE 11, 1965

PAINT SYSTEMS FOR STRUCTURES

(c) Amendments

Requirements. - Painting shall be performed in accordance with FAA-STD-003 and is revised as follows:

A. Page 2, Section 4.1, paragraph 2: Delete first sentence and substitute the following therefor: "Colors, tints, and finishes shall conform with the designated colors as shown in Federal Standard No. 595, and as specified in the drawing finish schedules."

Information Handling Services, 1999
August 12, 1999 05:44:57

B. Page 11, Section 6.1: Add: "Exposed metal accessories in connection with mechanical and electrical work, except of aluminum alloys, shall be painted in accordance with finish schedule in the drawings, unless otherwise directed. Exposed metal surfaces shall be primed and finished in color to match work to which they are attached, unless otherwise directed."

C. Page 20: Delete "System El-6"entirely.

Page 25: Delete "System M-3" entirely, and substitute therein, "Paint interior concrete equipment pads with two coats of a 2-compound epoxy-polyamide chemical and solvent coating conforming to MIL Specification, MIL-P-23377.

9-F.3 FINISH SCHEDULE: Submit to the Resident Engineer for his approval a complete schedule of room and space finishes. Schedule shall be submitted in triplicate and two approved copies will be returned to the Contractor for his use in the work distribution. Schedule shall clearly indicate the finishing material, brand name and applicable Federal Specification of material to be furnished, number and type of coats to be applied and the color of each coat.

Paint samples or manufacturer's color chips shall be furnished for each color used.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 10 SPECIALITIES

SECTION 10A

FINISH HARDWARE

10-A.1 REQUIREMENTS

(a) The work covered by this Section consists of furnishing all materials, labor, plant, equipment, accessories and services necessary to complete the work under Finish Hardware as required in the drawings and specified herein.

(b) Items of hardware not definitely specified herein and necessary for completion of the work shall be provided under this Contract. Such items shall be of type and quality suitable to the service required and comparable to adjacent hardware. Where size or shape of members is such to prevent the use of types specified, hardware shall be furnished of suitable types having as nearly as practicable the same operation and quality as the type specified. Sizes shall be adequate for the service required.

(c) Modifications All modifications in hardware necessary to meet any special features of the project shall be made to provide the required operative or functional requirements.

(d) Templates Hardware that will be attached to metal shall be made to standard templates so far as practicable. However, to meet special conditions, special templates or actual samples shall be furnished to the manufacturer of metal items requiring template hardware.

(e) Manufacture Insofar as practicable, and unless otherwise specified, all hardware for each function or operation shall be the product of the same manufacturer.

10-A.2 FITTINGS AND INSTALLING

After the lock and latch sets, including exposed trim and strikes (except hinges), have been fitted, they shall be removed. After the final coat of painter's finish has been applied, the hardware shall be installed.

10-A.3 COORDINATION

Door and frame manufacturer shall be supplied with templates at the earliest opportunity. The Resident Engineer's approval of hardware items necessary for metal door fabrication shall be secured in order to eliminate any delay in delivery of doors and frames to the job site.

Information Handling Services, 1999
August 12, 1999 05:44:57

10-A.4 MATERIALS

(a) Applicable Specifications The type numbers specified are taken from the following Federal Specifications and all hardware shall conform to the applicable requirements of the specifications cited, except as modified herein:

(1) FF-H-106a (1) - Hardware, Builders; Locks and Door Trim.

(2) FF-H-111a - Hardware, Builders; Shelf and Misc.

(3) FF-H-116A (I) - Hardware, Builders; Hinges

(4) FF-H-121c - Hardware, Builders; Door Closing Devices.

*(b) Finishes Exposed surfaces of hardware shall have U. S. Standard Finish US26D, Dull chrome - for bronze or brass material, as prepared and recognized by the National Builder's Hardware Association, New York, N.Y.

(c) Type Numbers Materials generally shall be as required by the Government type numbers specified.

(d) Fastenings Supplementing the Federal Specifications, hardware shall be attached to concrete, stone or masonry with tampin shields and machine screws, or other approved method; to metal with machine screws and to wood and wood cores with wood screws; all of the same material as the hardware, except as otherwise specified. Screws for door closers and template leaves of hinges shall be of steel, cadmium plated, and with heads finished to match the hardware. So far as practicable, all screws normally exposed shall have countersunk oval heads except for mortise hinges, lock fronts and lock strikes.

(e) Hinges Hinges are specified by type in accordance with Federal Specifications. Generally they are descriptive of the types required. All hinges for the project shall be the porduct of one manufacturer, and shall be of the flush ball-bearing type. Hinges for interior and exterior doors equipped with locks shall be so constructed that the pins cannot be removed when the door is closed.

(1) Screws shall be of suitable type and size and finished to match hinges.

(2) Hinges for exterior doors shall be type T2112, unless otherwise specified.

(3) Hinges for interior doors shall be type T2106.

(4) Unless otherwise specified, the number of hinges per opening shall conform to the Federal Specification requirements.

Information Handling Services, 1999
August 12, 1999 05:44:57

(5) The sizes of hinges per opening shall conform to Table I, Federal Specifications, unless otherwise specified.

(6) Spring hinges shall be type 2331.

(f) Door Closing Devices The devices shall be of suitable sizes applicable for each type as indicated in Federal Specifications, except as herein specified.

(1) Where types 3009 closers are scheduled in the hardware schedule, the closer shall have a narrow modern designed body, maximum projection 2" from face of door.

(2) Corner brackets and soffit brackets shall not be used.

(g) Keys and Keying Provide 3 masterkeys for construction cores in all locks to the Contracting Officer or his representative.

(h) Lever Extension Flush Bolts Provide type 1045 at top and bottom of standing leaf of double doors having locks or latches. Provide dustproof strikes, type 1048, except where thresholds occur. Locations for the operating mechanism shall be about six feet from the floor for the top bolt and about 12 inches from the floor for the bottom bolt. Install both bolts in the edge of the inactive leaf of pairs of doors having locks.

(i) Door Holders Overhead type door holders shall be furnished to hold doors open at 90° unless otherwise required. Holders shall be proper sizes to conform to the manufacturer's recommendations for size of the opening indicated.

(j) Locks, Locksets, and Latchsets Lock and latch sets shall be types 160 and 182 as specified herein. Fronts and strikes of locks and latches shall fit the details.

(1) All locks shall be provided with seven pin removable and interchangeable cores manufactured by Best Universal Lock Co., Inc., Indianapolis, Indiana.

(2) Each lock shall be provided with a construction core to be replaced by the Government with a special FAA core.

(3) Locks and latches for Underwriters' labeled doors shall carry Underwriters' approval for the "Class" required.

(4) The fronts, strikes, knobs and roses shall be of Bronze or Brass, finished as specified.

Information Handling Services, 1999
August 12, 1999 05:44:57

(5) Knobs and rose shall be Cornet Design as manufactured by Best Universal Lock Co., or approved equal.

(6) Locks, locksets and latchsets of one manufacturer shall have standardized faces, cases and strikes, so that locks with varying functions will be interchangeable. The locksets and latchsets, except as otherwise specified, shall be semi-heavy duty cylindrical locks and latchsets, having operation and function as specified herein.

(k) Silencers Type 1337A for hollow metal frames with hollow metal doors, not carrying Underwriters' label.

(1) Three silencers for single doors placed on strike jambs; two for double doors placed on head jamb. Doors less than 5 feet high shall have two silencers.

(l) Stops Floor stops, types 1330A or 1320E as applicable, shall be provided for all doors.

10-A.5 INSTALLATION

(a) Location Where locations of hardware are not indicated on the drawings, the following requirements shall apply.

(b) Height Door knobs shall be located 38 inches from the finished floor to the center of the knob.

(c) Active Leaf The active leaf of pairs of doors will be the LHRB, unless otherwise designed.

10-A.6 SCHEDULE OF ITEMS

(a) The following schedule of Finish Hardware items is divided into numbered headings describing items required and location of doors where indicated in the drawings.

(b) Items of toilet room accessories are grouped for each room and numbered according to the room identification in the drawings.

(c) Package and label items as grouped under headings in the following schedule of items to be furnished herein:

Information Handling Services, 1999
August 12, 1999 05:44:57

Heading 1

Drs. 122, 123-1 124- 2

1 1/2 Pr. Butts	T2112 x NRP
1 Panic Device	810 H
1 Rim Cylinder	
1 Closer	PA 3009
1 Kickplate	1227 10 x 2 LDW
1 Threshold	833A
1 Set Weatherstrip	Head & Jambs alum. housing-neoprene insert

Heading 2

Drs. 222-2

1 Set Bi Fold Dr. Hardware & Track
2 Dummy Knobs

Heading 3

Drs. 10- 1, 11- 1, 12- 1, 38, 115, 123-2, 124-2 230-2 & 231

1 1/2 Pr. Butts	T 2106
1 Lockset	161R
1 Closer	3009
1 Stop	As required

Heading 4

Drs. 14- 1, 14-2, 22-1, 22-2, 23, 24-1, 24 2, 25, 26, 111, 112, 212, 225, 226-1, 226-2 & 227

Information Handling Services, 1999
August 12, 1999 05:44:57

Heading 4 (con't)

1 1/2 Pr. Butts	T 2106
1 Lockset	161B
1 Stop	As required

Heading 5

Drs. 27, 30, 113, 116, 118, 120, 211, 213, 214, 215, 216, 219, 220, 221, 222-1, 223 & 228

1 1/2 Pr. Butts	T 2106
1 Lockset	161 R
1 Stop	As required

Heading 6

Drs. 10-2, 110, 121 & 230- 1

3 Pr. Butts	T 2106
1 Lockset	161 R
2 Closers	PA 3009 HFL
2 Flush Bolts	1045 - 12" inactive
1 Dust Proof Strike	1048
1 Stop	As required
1 Threshold	1/2" x 4" AL

Heading 7

Drs. 37, 119 & 218

1 1/2 Pr. Butts	T 2106
1 Privacy Lock	161 L - 2 3/4 BS
1 Stop	As required

Heading 8

Drs. 21-2, 32, 33, 217

Information Handling Services, 1999
August 12, 1999 05:44:57

Heading 8 (con't) H

1 1/2 Pr. Butts	T 2106
1 Closer	3009
1 Push Plate	465
1 Pull Plate	455
1 Kickplate	1227 10" x 2" LDW
1 Stop	As required

Heading 9

Drs. 11-2, 12-2, 210-1, 224

3 Pr. Butts	T 2106
1 Lockset	161 R
2 Closers	3009
2 Flush Bolts	1045-12" inact. leaf
1 Dustproof Strike	1048
1 Threshold	1/2" x 7" alum. - Drs. 11-B, 12-B

Heading 10

Drs. 21-1

1 1/2 Pr. Butts	T 2106
1 Lockset	161 A
1 Closer	3009
1 Threshold	1/2" x 4" alum.

Heading 11

* Drs. 29, 31, 34, 117

1 1/2 Pr. Butts	T 2106
1 Latchset	161 N
1 Overhead Stop & Holder	1161
1 Kickplate	1227 10" x 2" LDW

Information Handling Services, 1999
August 12, 1999 05:44:57

Heading 12

Drs. 35 & 36

1 Set Pivots	L 117
1 Latchset	161 N x lead lined rose
1 Kickplate	1227 10" x 2" LDW
1 Stop	As required

Heading 13

Drs. 13 & 20

1 1/2 Pr. Butts	T 2106
1 Lockset	161 A
1 Closer	3009
1 Kickplate	1227 10" x 2" LDW
1 Stop	As required
1 Threshold	1/2" x 4" alum. - Dr. 20 1/2" x 7" alum. - Dr. 13

Heading 14

Drs. 125

1 1/2 Pr. Butts	T 2106
1 Latchset	161 N

Information Handling Services, 1999
August 12, 1999 05:44:57

10-A.7 QUALITY ASSURANCE

(a) Samples and Schedules Before any hardware schedule is prepared, submit to the Resid. Engineer for approval, a complete sample list of each of the different items of hardware, in the required number of copies and prepared in the following manner:

HARDWARE SAMPLE LIST

ITEM:	PROJECT SPECIFICATION:	MRF'S NAME & CATALOG
NO.:	Type or Catalog No.	NO. OF ITEM FURNISHED

In addition to the sample list, a sample of each different item in the finish required,and properly labeled, shall be submitted to the Resident Engineer. After approval of all samples and sample list, the Contractor shall furnish to the Resident Engineer a schedule of hardware showing the quantities, type and location of all items of builders hardware, required for the project, in the quantity of copies required for the Government records. Approval of the hardware schedule is not required; only the sample list, Any hardware provided or installed that does not conform to the specification requirements shall be promptly replaced with the proper hardware.

Approved samples will be returned to the Contractor for installation in the finally finished work. The Contractor shall submit to the Resident Engineer a list of locations where the returned approved samples will be installed in the final work.

10-A.8 GUARANTEE

Items of hardware shall be guaranteed, by the Contractor, in writing, for a period of two years after acceptance of the building against defects in material and workmanship.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 10 SPECIALTIES

DIVISION 10B

METAL TOILET COMPARTMENTS

10-B.1 REQUIREMENTS. The work covered in this Section of the specifications consists of furnishing all materials, labor, equipment, tools appliances, accessories, plant and services necessary to complete all work in connection with Metal Toilet Compartments as indicated on the drawings and specified herein.

10-B.2 GENERAL. For location and extent, arrangement, dimensions, type of support and color of finish, see drawings and applicable details. Partitions, pilasters, and doors shall be of sheet steel, flush construction, with paper board cores and baked enamel finish. The work shall inclued fittings, hardware, fastenings and finish for a complete and satisfactory installation.

10-B.3 SHOP DRAWING. Shop drawings are required showing details of construction, metal thicknesses, hardware, fittings and fastenings.

10-B.4 SAMPLES. Samples of hardware and fastenings and metal color sample showing base metal and the prime and finish coats of enamel shall be submitted. Approved hardware samples in good condition may be used in the work if labeled for identification. Color will be selected by the Resident Engineer.

10-B.5 MATERIALS. Materials shall comply with the following requirements:

(a) Sheet Steel. Sheets for face plates; cold-rolled, zinc-coated, bonderized and stretcher leveled steel. Strip for edge binding; cold-rolled steel, tight-coat zinc-coated and bonderized, suitable for die-drawing without fracture of coating.

(b) Cores

(1) Partitions and Doors. Cores of partitions and doors; not less than six "A" flute corrugations, interlined and faced with chip liners built with all surfaces thoroughly glued into boards compressed to approximately one inch thickness. Straw flute corrugations and chip liners shall be .009 caliper, 34 pounds per M square feet of paper.

Information Handling Services, 1999
August 12, 1999 05:44:57

(2) Cores of pilaster and urinal partitions; not less than seven straw "A" flute corrugations compressed to approximately 1¼ inches finished thickness; otherwise constructed the same as specified for partitions and doors.

(3) At the option of the Contractor, cores may be pads of hexagonal honeycomb expanded to 1 inch maximum cell size, with cell walls of .009 caliper craft paper, 26 pounds per M square feet, maximum.

(c) Reinforcement. Reinforcement in urinal partitions for wall supports, kiln dried hardwood, or steel channels.

(d) Wall Supports. Wall supports for partitions and pilasters; cast or extruded brass or die-cast zinc alloy. For urinal partitions; cast brass.

(e) Wing Brackets. Wing brackets for partitions: cast brass or die-cast zinc alloy.

(f) Stirrup Supports. Stirrup supports; cast or extruded brass; or die-cast alloy.

(g) Sex Bolts. Sex bolts; brass with cadmium-plated, threaded steel rod.

10-B-6 THICKNESSES. Minimum thickness of sheet steel in U.S. Standard gauge without zinc-coating and prior to fabrication, and of stainless steel in inches, shall be as follows:

(a) 22 Gauge. Face plates of doors

(b) 20 Gauge. Face plates of partitions (except urinal partitions) face plates and edge locking strips of overhead-braced pilasters, edge locking strip.

(c) 18 Gauge. Overhead bracing, edge locking strip for floor-supported pilasters.

(d) 16 Gauge. Face plates of urinal partitions, face plates of floor-supported pilasters.

(e) 14 Gauge. Concealed hooks and reinforcement for tapping.

(f) 12 Gauge. Concealed reinforcement for anchoring devices.

(g) 0.031 Inch. Stainless steel pilaster bases or caps according to type of support.

Information Handling Services, 1999
August 12, 1999 05:44:57

10-B.7 FABRICATION. Doors, partitions and pilasters shall be made up of two face plates with formed edges, cemented under pressure over the core and joined at edges by die-drawn slip-lock binding strips, or by welds concealed by slip-lock edge facing strips. The edge strips shall hold the plates with a tension grip, conceal all cut metal edges, and be mitered and welded at corners with welds ground smooth; the outer face of strips to be uniformly rounded except that contact edge between pilaster and partition shall be flat. Doors shall have reinforced cut-outs for hinges and be strengthened by internal welding or brazing.

Doors and partitions (except urinal) shall finish one inch thick; pilasters and urinal partition shall finish 1¼ inches thick; subject to a permissible plus or minus tolerance of not more than 1/32 inch at edges and a permissible plus tolerance at or near the center of not more than .30 of one percent of the diagonal dimension of the face. Edges shall be straight, on the square and out of wind. Doors and pilasters shall have concealed tapped reinforcement for the attachment of hardware, fittings and accessories where machine screws are specified for fastenings.

10-B.8 ANCHORAGE

(a) Partitions to Pilasters. Partitions shall be anchored to pilasters by not less than three hooks in shear built into contact edge of partition and inserted into pilaster through vertical openings, then forced downward; the hooks being designed to draw the pilaster and partition together with a tension grip. At the contractor's option, partitions may be anchored to pilasters by two stirrup supports, each through-bolted to the partition or pilaster with a sex bolt and fastened to pilaster by two machine screws. Stirrup supports shall provide ½ inch clearance between the edge of the partition and the face of the pilaster.

(b) Partitions to Walls. Partitions and pilasters shall be anchored to walls by two stirrup supports, each through-bolted to the partitions or pilaster with a sex bolt and fastened to wall by two bolts appropriate to wall construction.

(c) Top and Bottom. All pilasters shall have concealed anchoring devices at bottom or top according to type of support. See Standard Details.

10-B.9 OVERHEAD BRACED

(a) General. Where the drawings require overhead bracing, the requirements shall be as follows: ¼ inch diameter screws and expansion shields, cadmium-plated or zinc-coated,

Information Handling Services, 1999
August 12, 1999 05:44:57

1½ inches minimum penetration into finished floor, may be substituted for stud bolts. Wing brackets are not required for partitions that are anchored to pilasters by hooks. Top edges of doors shall be level with the top of wall pilasters, or (if no wall pilaster is required) with the top of partitions, when doors are closed.

(b) Pilaster Bracing. Pilasters so indicated shall extend 12 inches above the tops of partitions and be braced to the walls by tubular bracing approximately 1 by 1½ inches in cross section, reinforced and clamped or through-bolted to the top of each pilaster with sex bolts and anchored to wall through clamp flange fitting attached by two bolts appropriate to the wall construction.

10-B.10 FINISH

(a) Enamel. Finish on exposed surfaces of steel and of wall supports and wing brackets; factory finished by spraying one coat of a properly formulated synthetic primer followed by a coat of low gloss synthetic enamel and oven baked the length of time commensurate with oven heat sustained in excess of 275 degrees F. to cause polymerization. Exposed heads of wall bolts shall be brush enameled at the site after erection.

(b) Plated. Exposed surfaces of bases, hardware and their fastenings shall be polished, nickel plated and finished in bright chromium plate, except parts specified to be stainless steel and hinge anchorage on doors.

10-B.12 HARDWARE

(a) General. Doors shall be hung on double-acting gravity hinges and top pivots. Hinges to have roller bearings riding on inclined cams and actuated by gravity or under spring tension, adjustable so that doors can be made self-closing, self-opening, or ajar at time of installation, and have operating parts encased or concealed within the door. Top pivot guide pins shall be secured above and below the point of bearing, with the bearing concealed in a supporting member placed in a cut-out near top of door. Top pivots of gravity actuated hinges shall compensate for the vertical movement of the door. Pivot guide pins, ball bearing rollers and cams shall be hardened stainless steel. All moving parts shall operate in graphite bronze, self-oiling, needle or thrust frictionless bearings. Non-operating, supporting or encasing members may be die-cast zinc alloy. All hardware shall be plain, heavy pattern, wrought or cast brass, unless otherwise specified herein. Machine screws and sex bolts shall have theft-resistant heads.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) Hinges. Hinges o enclosure doors that swing in shall be adjusted to hold the doors open at 30 degrees. Hinges of doors for screen partitions and of enclosure doors that swing out shall be adjusted to make doors self-closing.

(c) Accessories. Each enclosure door shall be fitted with a throw latch and a combination coat and hat hook with rubber tipped bumper; all attached with machine screws. The latch shall include combination keeper and bumper on pilaster. Coat and hat hooks shall project 3-1/8 inches. Enclosure doors shown to swing out shall be fitted with a cast or extruded pull, in addition to the other hardware specified; the pull to be attached with machine screws or through-bolts and opposite the latch. Doors opening against walls shall have rubber-tipped bumper secured to the door or wall.

(d) Clamp Flanges. Hinges, pivots, bumpers and keepers shall have clamp flanges which transmit the strain of the slam of the door to the pilasters and shall be applied with 3/16 inch sex bolts.

10-B.12 WORKMANSHIP. The enclosures and partitions shall be erected in a rigid and substantial manner, straight and plumb with all horizontal lines level. The clearance at wall shall be 1 inch minimum. All evidence of drilling, cutting and fitting of wall, ceiling, and floor finish shall be concealed in the finished work. The clearance at vertical edges of doors shall be uniform from top to bottom and shall not exceed 3/16 inch. Doors shall be out of wind and hardware shall be carefully adjusted and left in perfect working order. Finished surfaces shall be cleaned and left free from imperfections.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 10 SPECIALITIES

SECTION 10E

MOVABLE PARTITIONS

10-E.1 REQUIREMENTS The work covered under this Section of the specifications consists of furnishing all materials, labor, plant, tools, equipment, accessories and services necessary for completing installation of Movable Partitions as required in the drawings and specified.

10-E.2 STANDARDS

(a) This specification, the details and drawings indicate movable partitions manufactured by Donn Products, Inc., as standard of quality products of the other manufactures are acceptable provided they meet or exceed the requirements specified herein.

1. Virginia Metal Products
2. Mills
3. Penn Metal Corporation, or equal.
4. Hauserman

(b) Doors for all movable partitions under this Section are furnished under Section 8B of this specification.

(c) Location and extent of work and construction details are indicated on the drawings and specified herein.

(d) Partitions shall be of thickness and fabrication indicated with framing members securely anchored to floor, abutting walls and ceiling. Special wiring studs shall be provided as required to accommodate the necessary electrical wiring and wiring devices shown on the drawings.

(e) Panels, trim, doors and accessories shall be finished as required in the drawings, finish schedules and specified herein.

(f) Fabrication, assembly and installation of the movable partitions shall be performed by only mechanics, thoroughly experienced in this type of work and familiar with the partition system to be installed.

Information Handling Services, 1999
August 12, 1999 05:44:57

(g) Cutting, fitting and alignment shall be true to a line, plumb, square and level. Tool marks on finally exposed surfaces shall be cause for rejection and replacement with new and undamaged parts, at the Contractor's own expense.

10-E.3 CONSTRUCTION

(a) Partitions shall be skeletal-type roll formed steel structural frame with inserted panels and hollow core. Net out to out thickness shall conform to dimensions indicated in the drawings.

(b) Partition studs shall extend from floor to ceiling and shall adjust to variations in height by means of an upper stud extension. Studs shall be formed of two 24 gauge cold rolled steel members punched together and clinched 6 inches on centers to accommodate the passage of utility lines. Each stud shall be formed to provide a positive mechanical interlock with the panel units. Studs shall be exposed 30 inches on centers and at each door frame jamb.

(c) Floor and ceiling attachment shall be manufacturer's standard units to comply with the drawings and details.

(d) Door frames shall be flush type and conform to details and drawing requirements. Door frames shall be formed of minimum 18 gauge steel sheet stock and width as indicated. Door frames shall be reinforced, and fitted for finish hardware templates furnished by hardware supplier. Finish hardware is furnished under Section 10A but is installed and adjusted herein. Hollow metal doors are furnished under Section 8B but are installed, fitted and adjusted herein.

(e) All exposed metal parts of movable partitions shall be factory finished with a prime coat and finish coats of hard enamel baked on at a temperature of 900 degrees F. Finish color shall be as indicated in the color schedules in the drawings.

(f) Base shall be standard manufacturers' steel unit clad with matte black vinyl of 6 miles in thickness permanently bonded to the exposed face. Base shall be applied without the use of exposed fasteners.

Information Handling Services, 1999
August 12, 1999 05:44:57

(g) Partitions shall be constructed to control sound transmission loss to a level of not less than 40 STC rating. Sound transmission loss shall be controlled by installing a glass fiber on rock wool blanket in the void between face sheets. Sound control blanket shall have a density of not less than 2½ pounds per cubic foot and not less than 2 inches in thickness. Use only adhesive recommended by the manufacturer of the blanket for installation.

10-E.4 INSTALLATION

(a) Installation of the work under this Section of the specification shall be performed in accordance to the manufacturers directions and as specified herein. Finished installation shall show no evidence of soiled, stained, damaged or defaced finally exposed surfaces.

(b) Panel units shall consist of a 24 gauge steel face panel laminated to a ½ inch thick for backed incombustible core board. Vertical edges of panels shall have continuously roll formed edges to automatically and mechanically interlock and align to studs. Standard panels shall assemble into a partition with tight single joints 30 inches on centers. When partition run lengths are not in multiples of 30 inches a pair of panels shall be cut vertically down at a termination, intersection, corner or opening frame. Horizontal cutting down of panels to accommodate lower elevations shall be provided for in the fabrication of the panel units. Special width full panel transom units and door side filler panels shall be available to create modular door units up to 60 inches in width.

Glass panel framing shall be of aluminum channel member stock with glazing recess. Framing shall be secured to the partition framing with concealed fasteners. Glass shall be retained by aluminum glazing channels without the use of screws or applied stops.

The face surface of all panels shall be factory finished to the color indicated in the Room Finish Schedule on the drawings. Finish on exposed steel face surfaces shall be one coat of sprayed on synthetic primer followed by a coat of low gloss synthetic enamel and oven baked the length of time commensurate with oven heat sustained in excess of 275 degrees F. to cause polymerization. Finish face surface shall be uniform and of proper depth and texture.

Information Handling Services, 1999
August 12, 1999 05:44:57

Sample of finally finished surfaces shall be submitted to the Resident Engineer for his approval before factory finishing is started.

Shop drawings shall be submitted to the Resident Engineer for approval before fabrication is commenced. Shop drawings shall include a complete wall and space layout, details of construction and properly dimensioned in accordance with the requirements on the contract drawings.

(c) Double coated sponge rubber tape 3/16 inches in thickness and 2 inches wide shall be applied to top side of ceiling channel and outer face of terminal channel abutting or intersecting other walls. End wall channel shall be pressed firmly against abutting wall to provide a firm full contact seal between members. Do not remove backup of tape at top of ceiling channel before ceiling tile is placed.

10-E.5 SHOP DRAWINGS The Contractor shall submit shop drawings for approval of the Resident Engineer in accordance with the requirements in Section 1A Special Conditions.

10-E.6 SAMPLES The Contractor shall submit to the Resident Engineer a sample section of each component that will be furnished in this work. Each sample section shall be not less than 16 inches long. Fabrication of any work shall not be started before approval of samples has been issued by the Resident Engineer.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 10 SPECIALITIES

SECTION 10H

TELEPHONE BOOTH

10-H.1 REQUIREMENTS The work covered in this Section of the specifications consists of all materials, labor, equipment, tools, plant, accessories and services necessary for the complete installation of the interior Telephone Booth as indicated in the drawings and specified herein.

10-H.2 TELEPHONE BOOTH

(a) The Telephone Booth shall be a complete factory assembled unit shipped set up ready for placement, where indicated in the drawings. The unit shall be free standing REA approved, SM 18 Series, fire-proof steel construction.

(b) Telephone Booth shall be top quality manufacture and shall equal or exceed the following descriptions and specifications:

(1) Booth Unit shall be complete enclosure with full sides, back, roof, base, floor and door.

(2) Construction shall be acoustic type or model using interior steel perforated panels backed by sound absorbing materials for upper half panels, other panels solid.

(3) Door shall be equal leaf folding type with integrally constructed full length center hinge and manufacturer's standard full length glass panels. Overhead stainless steel track and bronze roller bearings shall be spaced for finger tip control and operation.

(4) Dimensions The outside dimensions of unit shall be 30 inches by 30 inches by 83-3/4 inches high, overall outside dimensions. Unit shall weigh not less than 385 pounds net weight.

(5) Equipment Features Telephone Booth shall be factory equipped with adjustable steel backboards

Information Handling Services, 1999
August 12, 1999 05:44:57

and corner shelf, flat roof, standard light fixture, door switch, decal telephone sign, hinged translucent panel ceiling, linoleum covered steel floor, stainless steel trimmed linoleum covered seat, stainless steel exterior and interior base and door kick plates 4 inches high.

(6) Color Factory applied and finished in color selected from the manufacturers standard range of colors.

10-H.3 SHOP DRAWINGS The Contractor shall submit to the Resid. Engineer complete shop drawings of the equipment required herein. The shop drawings shall show the basic dimensions and complete construction details. Five copies of shop drawings shall be submitted.

10-H.4 SAMPLES The Contractor shall submit to the Resid. Engineer two samples of steel sheets used in the construction of the body and door, section of door track and roller, section of base and section of ceiling panel. Sample color chips of manufacturers standard color range applied to actual sections of material used in the unit construction shall be submitted with the shop drawings for selection and/or approval. Color chips shall be not less than 3 inches by six inches in size.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 10 SPECIALTIES

SECTION 10I

TOILET ROOM ACCESSORIES

10-I.1 REQUIREMENTS The work covered by this Section consists of furnishings all materials, labor, tools, plant, equipment, accessories and services necessary to complete all work under Toilet Room Accessories required in the drawings and specified herein.

10-I.2 STANDARDS Accessories items required under this Section, indicated in the drawings, listed, named or numbered are for the purpose of establishing a standard of quality. Items by American Manufacturers other than those specified will be considered provided their products and items are equal or exceeds the requirements of this specification.

10-I.3 ACCESSORIES

(a) Mirrors

Provide one mirror above each lavatory as indicated in the drawings. Mirror shall be fabricated of ¼ inch thick silvering quality plate glass electrolytically copper-backed, set in a stainless steel frame with shelf. Mirror shall be 18 inches wide by 26 inches high with stainless steel shelf 5 inches wide.

Form backs of 22 gauge zinc-coated steel applied over corrugated paper backing and plywood or masonite lining. Provide theft-proof mountings.

Mirror unit shall be Architectural Metalcraft Industries, Incorporated catalogue No. 175SS or Hall-Mack No. 1826SS Engineered Products Company No. 132, or equal.

Mount mirror unit on wall with manufacturer's theft-proof, tamper-proof mounting devices. Locate mirror units in accordance with the requirements in the drawings unless directed otherwise by the Resident Engineer.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) Soap Dispenser

Provide at each lavatory one soap dispenser - shall be American Dispenser Company No. 53 RMG Lathurn, or Bobrick No. B-829 MG, or equal. Dispenser body shall be chrome plated brass with stainless steel working parts; soap container below lavatory shall be refillable from top by unscrewing push button without need for removing container.

(c) Towel Dispensing Cabinet

Provide one towel dispensing cabinet in each room having a lavatory and lavatories as indicated and required in the drawings.

Towel dispensing cabinet shall be No. 310 manufactured by Architectural Industries, Inc. or No. CFT by American Dispenser Company, or equal. Construction shall be of 20 gauge stainless steel sheet stock complete with all items of hardware, attachment devices and theft proof fastening and with bottom hinged top locked door front.

(d) Toilet Paper Holder

At each water closet provide one toilet paper holder.

Scott Paper Company No. 964 Architectural Industries Inc., No. 932, or equal. Unit shall be die cast, chrome plated with one arm hinged for filling. Install as indicated on the drawings.

(e) Towel Dispensing and Waste Receptacle Unit

Furnish and install one combination unit in Mens Toilet Room 217A. Combination unit shall be Bobrick Dispensers Incorporated No. B630, American Dispenser Company Model 5, Architectural Metalcraft Industries Inc., No. 861, or equal. Unit shall be fabricated from type 302 stainless steel, all welded construction. Exposed surfaces are 22 gauge with satin finish. Flange shall be drawn one piece seamless construction without mitered corner construction. Both upper and lower doors shall have full length piano hinges and are of enclosed double pan back construction.

Install where indicated in the drawings unless directed otherwise by the Resident Engineer.

Information Handling Services, 1999
August 12, 1999 05:44:57

(f) Grab Bar

Provide a grab bar unit in the following toilet rooms:

Mens Toilet No. 217A
Mens Toilet No. 33A
Womens Toilet No. 32A

Grab bar shall be: Bobrick Dispensers Inc., No. B550X30, Watrous Incorporated No. W-1401, Architectural Metalcraft Industries Inc., No. 955, or equal.

Grab bars shall be fabricated from 1¼ inches outside diameter by .062 thickness wall; type 302 stainless steel tubing polished to a No. 4 satin finish. Tube shall be hydraulically bent with a mandrel to a 2½ inches radius. Grab bar shall be knurled .005 for sure grip to within 4 inches from each end.

Flange shall be machined and beveled from type 302 stainless steel and heliarc welded to the tubing, finished and polished.

Mounting case shall be fabricated from case hardened steel to form a tenon plate with flared edge. Mounting case tenon plate shall be attached to wall as indicated in the drawings and in no case shall mounting bolt be less than 3/8 inches in diameter. Flange shall be attached to tenon plate with 3 No. 10-32 socket type set screws.

(g) Feminine Napkin Vendor

Provide one feminine napkin vendor in Womens Toilet 32A as indicated on the drawings. Unit shall be:

Bobrick Dispensers Inc., No. B-3502
American Dispenser Company, No. Model 45
Watrous Incorporated, No. W-1058, or equal

Cabinet shall be constructed from 22 gauge type 302 stainless steel; welded construction. Door shall be of 18 gauge type 302 stainless steel with satin finish. Edge shall return 5/8 inches for rigidity; door equipped with full length stainless steel piano type hinge. Coin mechanism shall be adjustable for 5 cents, 10 cents or for free operation. Door lock shall be tumbler type with double locking device at side and at top.

Information Handling Services, 1999
August 12, 1999 05:44:57

Unit shall be installed in a recessed wall opening anchored in place in accordance with the manufacturer's directions.

(h) Feminine Napkin Disposal

Provide one feminine napkin disposal unit in Womens Toilet 32A. Unit shall be mounted where indicated in the drawings unless directed otherwise. Feminine Disposal Unit shall be:

Bobrick Dispensers Inc., No. B-270
Architectural Metalcraft Industries Inc., No. 626
Watrous Incorporated, No. W-1079, or equal.

Disposal units shall be constructed from 22 gauge type 302 stainless steel with satin finish. Cover shall have full length stainless steel piano hinge and compartment attached to bottom side to hold deodorant crystals. Bottom of unit unlocks with key provided for servicing.

10-I.4 QUALITY ASSURANCE

The Contractor shall submit catalogue sheets of all items under this Section to the Resident Engineer for his approval.

Submittals shall be in duplicate and no items herein shall be delivered to the job site prior to return of approval sheets.

In the event the Resident Engineer shall request actual samples of any one or all items, under this Section, the Contractor shall be prepared to deliver each item requested.

Sample items submitted for inspection shall be new and in specific condition for use. Each item submitted that is approved shall be accepted and used in the scheduled work.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 10 SPECIALTIES

SECTION 10J

FOLDING PARTITIONS

(Vinyl Finish)

10-J.1 REQUIREMENTS The work covered in this Section of these Specifications consists of all materials, labor, equipment, tools, plant, accessories and services necessary for the complete installation of the Folding Partitions as indicated on the drawings and specified herein.

10-J.2 WORK NOT INCLUDED Track support structure, hangers, steel beam header, bracing, required wood blocking and nailers are furnished and installed under other sections of these Specifications.

10-J.3 SUB CHANNEL

(a) Sub channel for track cover shall be furnished and delivered to the site by the partition manufacturer and is installed under Rough Carpentry Section 6A of these Specifications.

(b) Sub channel shall provide a suitable carrier flange to receive the finish ceiling for flush construction.

10-J.4 DOOR TRACK AND TROLLEY SYSTEM

(a) Folding partition unit shall be suspended from overhead track attached to wood header blocking, without floor guide.

(b) Track shall be not less than .078 inch wall thickness extruded aluminum 1-3/4 inches by 1-3/8 inches with splice alignment configuration to provide smooth operation.

(c) Unit carriers shall be equipped with one inch diameter nylon tired ball bearing trolleys. Unit carrier on lead post shall have four ball bearing rollers and two matching rollers on alternate panels. Unit carriers shall be firmly attached to panels with metal yokes and sex bolts.

Information Handling Services, 1999
August 12, 1999 05:44:57

10-J.5 HARDWARE Finish hardware shall be heavy duty metal with blade type pulls, finished in bronze color enamel. Closing lead post shall be fitted with a latch set with privacy catch operation on one side only.

10-J.6 PANELS

(a) Panel sections shall be minimum 7/16 inch in thickness by 11-3/4 inches in width and connected full length by extruded vinyl hinge of harmonizing color. Vinyl hinge performance shall be certified by independent laboratory test to equal 700,000 cycles of operation during a continuous period, without failure.

(b) Panel sections shall consist of medium density particle board core with exposed surface finished with poly-vinyl chloride film, which has been laminated to the core under heat and pressure. Panels shall be completely factory finished, assembled with all hardware and accessory items applied.

10-J.7 SHOP DRAWINGS The Contractor shall submit to the Resident Engineer, for approval, shop drawings and detail sheets showing basic dimensions and construction features.

10-J.8 SAMPLES

(a) The Contractor shall submit to the Resident Engineer, for approval, two samples of vinyl veneer not less than six inches square, two six-inch lengths of vinyl hinge and two complete trolley units with twelve-inch length of track.

(b) One of each samples will be returned to the Contractor in accordance with the requirements under Section 1B of these Specifications and fabrication shall not start before approved samples are returned to the Contractor.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 11 EQUIPMENT

SECTION 11D

CHALKBOARD UNIT

11-D.1 REQUIREMENTS

(a) The work covered by this Section of the specification consists of furnishing all materials, labor, equipment, plant, tools, accessories and services necessary to complete the work required in the drawings and specified herein, for Chalkboard Units.

(b) Chalkboard units required herein shall be factory assembled and installed as complete units by one manufacturer.

11-D.2 MATERIALS

(a) Chalkboard units shall be identified by manufacturer's name and number as follows:

1. "Korok" F-217
   8'-3" x 47-3/8" - 2 panels

2. "Korok" F-307
   12'-3" x 47-3/8" - 3 panels

(b) All sliding panels shall be chalk board surface.

(c) Fixed back panel shall be full size projection screen surface.

(d) Wall mounting shall be 3 inch long channels recessed into unit channel frame.

11-D.3 STANDARDS

(a) The standard of quality used in this specification is based on "Korok" sliding manually operated combination units "Series F" as manufactured by Greensteel - Korok, Inc., Dixonville, Pennsylvania.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) Similar and at least equal units manufactured by the following will be acceptable:

1. Nelson-Adams Company
2. Claridge Products and Equipment, Incorporated
3. Gotham Educational Equipment Company, Inc.

11-D.4 LOCATION AND EXTENT OF WORK The location and extent of the work included herein is indicated in the drawings; floor plans, elevations and descriptive notes.

11-D.5 MATERIAL

(a) All chalkboard writing surface shall be porcelain on steel consisting of three coats as follows:

1. Nickel deposition coat of 2 grams per square foot of surface.

2. Cobalt primer coat of .003 inches minimum thickness.

3. Chalkboard writing surface coat of .003 inches minimum thickness.

(b) The opposite side of writing surface shall have two coats consisting of the following:

1. Nickel deposition coat of 2 grams per square foot.
2. Cobalt primer coat of .003 inches minimum thickness.

Note: Surface texture on reverse side finish coat shall be No. 50 grit coarseness for lamination bonding.

(c) Chalkboard writing surface shall be fabricated from 18 gauge steel enameling grade of low metaloid and copper content, especially manufactured for high temperatures necessary for porcelain coating.

Porcelain coating shall be vitreous ceramic finish coat, each fired in excess of 1500 degrees F.

(d) Core shall be 1/2 inches in thickness plywood with a .015 inches in thickness aluminum sheet adhesive applied onto back. All edges of core shall be sealed and covered.

Information Handling Services, 1999
August 12, 1999 05:44:57

(e) Color of chalkboard writing surface shall be selected from the manufacturer's standard range of colors, by the Resident Engineer.

(f) Projection screen back panel shall be fabricated with Glass Beaded, Matte White, Lenticular screen material. Screen material shall be stretched and secured to backing to an absolutely smooth even surface for undistorted projection image.

(g) Chalkboard shall be standard two panel, two track, for shorter length units and three panel, two track, for the longer length units. All units shall have manufacturer's chalk tray.

11-D.6 INSTALLATION Installation shall be made by skilled mechanics experienced in this type of work. Units shall be installed level and in a true face plane to provide free moving panels full length and direction of unit.

11-D.7 GUARANTEE The Contractor shall submit to the Resident Engineer a standard manufacturer's guarantee covering the units installed herein. The guarantee shall state that any unit in which the original surface writing quality, erasing quality and the visual acuity fails to retain the original qualities and surfaces for a period of ten (10) years will be replaced by the manufacturer at his own cost. This guarantee is in addition to the general one year guarantee furnished by the Contractor.

11-D.8 CLEAN-UP The Contractor shall remove all cartons, crates, wrapping paper, dirt and debris from the affected work areas immediately after the work is installed.

All exposed surfaces of the units installed, adjacent areas that may have become soiled during this work shall be cleaned, ready for use and approved by the Resident Engineer.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 12 SPECIAL CONSTRUCTION

SECTION 12A

FOLDING PARTITION

12-A.1 REQUIREMENTS

(a) The work covered under this Section of the specifications consist of furnishing all materials, labor, equipment, tools, plant, accessories and services necessary to complete the installation of Folding Partitions as incidental in the drawings and specified herein.

12-A.2 EQUIPMENT STANDARD
*

(a) The Contractor shall provide and install sound retarding folding partitions as indicated on the drawings: R-W No. 380 Lever Jamb Folder-Way unit with Type No. 250 panels as manufactured by Richards-Wilcox Manufacturing Company or I.A.C. Trackwall or equal.

(b) Operation shall be for all panels folding toward a single jamb, hinged together, operating as a single unit. Alternate units shall be top supported at center by a ball bearing hanger operating in a concealed overhead track unit. Operation shall provide for the manufacturer's recommended operating clearance between the partition panels and the floor and the operating clearance between top of the partition and head trim assembly during opening and closing cycle to assure smooth functioning of the units.

(c) The unit shall be provided with a manually operated device that will automatically cause the entire partition to seal the top and bottom clearance against transmission of sound by compressing a moulded rubber floor seal and a double neoprene head seal; compressing all vertical door joints; locking the entire unit as a panel in a fully closed position without the use of floor bolts or similar floor devices.

Information Handling Services, 1999
August 12, 1999 05:44:57

*(d) The panel type unit shall have a minimum laboratory Sound Transmission Class rating of 47 and which will provide field performance of minimum Sound Transmission Class rating - 42. The Contractor shall furnish to the Resident Engineer a manufacturer's certificate from an independent acoustical laboratory conducted in accordance with ASTM-E90-66T which substantiates the required STC-47 laboratory performance. In addition, thereto, shall be attached a manufacturers certified test reports from at least two field installations which indicate that in-place performance of STC-43 or better can be anticipated.

(e) Finish hardware shall be furnished and installed under this Section after schedule of hardware has been approved by the Resident Engineer.

(f) Finishing of the folding partition shall be in accordance with the requirements under Section 9F and performed under that Section and approved by the manufacturer of the folding partition and the Resident Engineer.

12-A.3 INSTALLATION

(a) All rough bucks, track supports, filling, true to a line floor surface shall be performed by other trades than installer of folding partition.

(b) Folding partition shall be installed by the manufacturer and includes all unit items of operating mechanisms, tracks, hangers, seals and finish hardware, necessary to complete the unit adjusted for proper operation.

12-A.4 GUARANTEE The Contractor shall submit t· the Resident Engineer the Manufacturer guarantee covering that part of the work, for one year from date of acceptance, against defective workmanship, materials.

The Contractor shall, on his own letterhead, furnish a guarantee of his part of the installation against defective workmanship, materials, (other than covered by the manufacturers guarantee), and installation for a term equal to that furnished by the manufacturer. The Contractor guarantee shall be attached to the manufacturer's guarantee and furnished to the Resident Engineer.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 12 SPECIAL CONSTRUCTION

SECTION 12B

RAISED FLOOR SYSTEM

12-B.1 REQUIREMENTS

(a) The work covered under this Section of the specification consists of furnishing all materials, labor, equipment, plant, tools, accessories, appliances and services necessary to complete the installation of Raised Floor System as required in the drawings, schedules, specified; and included in the publications listed herein.

(b) The location and extent of the work affected herein is indicated in the drawings, sections, details and schedules.

12-B.2 APPLICABLE DOCUMENTS

(a) The requirements of the following documents shall apply to all work herein subject to amendments thereto and/or revised and later editions thereof.

(b) Publications Department of Transportation, Federal Aviation Administration Specification for Floor Systems, Raised.

FAA - E-2223A
November 24, 1967

Superceeding
FAA - E-2223 8/27/68
Amend. -1 5/9/67

12-B.3 PANEL OPENINGS The Contractor shall provide for cutting openings for floor grilles as shown on the mechanical drawings. In addition, the Contractor shall provide for cutting openings for electronic equipment cabling as shown on Drawing D5895E - 8L or 8R.

12-B.4 UNDERSTRUCTURE The raised floor system shall be designed for stringer supporting system framework.

Information Handling Services, 1999
August 12, 1999 05:44:57

12-B.5 FLOOR COVERING The floor covering shall be finished as indicated on the drawings and required in the finish schedule.

12-B.6 SEISMIC DESIGN The entire raised floor system shall be designed and installed to conform to the requirements of seismic zone III.

12-B.7 SUB-FLOOR PREPARATION The sub-floor shall be finished with a monolithic smooth steel troweled integral finish. Finished floor shall be cured in accordance with the requirements in Section 3 paragraph 3-A.13 and hardened in accordance with the requirements in Section 3, paragraph 3-A.14 of the specifications.

12-B.8 PRESSURE LAMINATED FLOOR TILE The floor surfaces that require pressure laminated floor tile in accordance with the requirements on the drawings are included herein.

Floor tile shall be a single piece of high pressure laminated material similar and equal to "PERMA-KLEEN" manufactured by General Electric. "NEVAMAR", manufactured by Enjoy Fibers and Laminates Company, "DOUBLE-WEAR MICARTA", manufactured by Westinghouse, or approved equal.

Floor tile shall be installed on panels with vinyl trim edge at all edges of panel. Installation of tile shall comply with the instructions furnished by the manufacturer of the tile.

12-B.9 SPARE FLOOR PANELS The Contractor shall furnish twenty extra floor panels for replacement and maintenance.

12-B.10 PANEL LIFTERS The Contractor shall furnish two suction cup panel lifting devices suitable for removal and replacing the panel sections in the raised floor system.

12-B.10 UNDER FLOOR CLEARANCE The raised floor system shall be designed to provide a clear space height between floor slab and raised floor framing system of not less than 14 inches for floors raised 18 inches and 8 inches for floors raised 12 inches.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 12 SPECIAL CONSTRUCTION

SECTION 12D

ACOUSTICAL METAL PANELS

12-D.1 REQUIREMENTS

(a) The work covered under this Section of the specifications consists of furnishing all materials, labor, equipment, tools, plant, appliances, accessories and services necessary to complete the installation of Acoustical Metal Panels as required in the drawings and specified herein.

(b) The Contractor shall examine the various drawings and conditions as they affect the work herein. Field measurements where necessary for proper fabrication shall be furnished by the Contractor when requested to do so for use by supplier's and fabricators whose work is affected herein.

12-D.2 MATERIALS

(a) Material used as a base for the panels to be furnished herein shall be cold-rolled, zinc-coated, bonderized and stretcher leveled sheet steel, suitable for forming without fracture of the coating.

(b) Acoustic material back-up shall be 2 inches in thickness fiberglas or mineral wool open face blanket: Johns-Manville "microlite". U.S.G. "Thermofiber", Certainteed "Ultralite", or equal.

(c) Adhesive for metal pan support hangers shall be Miracle Adhesive Co., Minnesota Mining Co., Dow Chemical Company products or equal. Adhesive shall be the type and grade recommended by the manufacturer for the purpose and performance required in this Section of the Specification.

12-D.3 FABRICATION

(a) Metal Wall Panels The metal wall panels shall be fabricated from 20 gauge sheet steel with sides and ends formed as detailed to provide a one inch by one inch border at all joints between panels. Joint pattern is indicated in the drawings and details. Steel sheets shall be perforated with 3/32 inch in diameter holes in a scatter pattern to provide a 32 percent open face area.

Information Handling Services, 1999
August 12, 1999 05:44:57

After fabrication metal panels shall be primed with a rust-inhibitive baking type of metal primer applied to all sides and edges of panels. The primer shall be a properly formulated synthetic material, heavy body undercoat.

The prime coat shall be followed by a coat of low gloss synthetic enamel and baked the length of time commensurate with oven heat sustained in excess of 275 degrees F. to cause polymerization. Color shall be selected by the Resident Engineer from the manufacturer's standard range of colors.

Exposed clips, nails, screws or appliances shall be brush touch-up coated in the field in a color to match panel field color.

(b) Ceiling Grid Panels The ceiling grid panel system shall consist of a metal panel mounted in each concrete "waffle pan" ceiling system. Metal pan shall be suspended by a metal hanger at each corner as shown in the detailed drawings.

Metal pan shall be fabricated from 24 gauge sheet steel in size to provide a 1-½ inch wide clear space between the sides of metal pan and concrete grid beams. Metal pan shall be turned up with a 2 inch high flange to retain the acoustical pad. On two sides a 3/4 inches wide return hem shall be provided as a receiver for hemmed end of strap hanger.

Metal pans shall be welded at corners and free from twist.

Metal pans shall be perforated and finished same as Metal Wall Panels in (a) above.

(c) Strap hangers shall be fabricated as indicated in the details and provided with a perforated base plate and a hemmed lower end to carry metal pan and acoustic pad insert.

12-D*.4 INSTALLATION

(a) Acoustic material back-up pad shall be installed in the wall betweenstudds by staple attaching or adhesive application against wall sheathing on opposite side of wall studds. Acoustic material shall be close fitting without open spaces between pads, studds, headers and sills.

Metal wall panels shall be erected and attached to studds, sill runner channel and head channel with blind clips and fasteners in all practicable attachment points. Exposed fasteners shall be kept to a minimum.

Information Handling Services, 1999
August 12, 1999 05:44:57

Strap hangers for ceiling panels shall be attached to the concrete slab with a heavy coat of adhesive in accordance with the instructions of the manufacturer of the adhesive used. Adhesive shall be allowed to cure before ceiling panels are installed.

*Into each ceiling panel shall be neatly fitted a full size one piece pad of the specified acoustic material; full 2 inches in thickness.

12-D.5 CLEANING-UP

(a) After the metal pans are in place any damaged finished surfaces shall be touched up with a touch up paint furnished by the fabricator of the panels. Touch-up paint shall be neatly done without pile-up of paint materials on the adjacent panel surface.

(b) The Contractor shall leave all work areas affected by this work clean ready for occupancy and use; approved by the Resident Engineer.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 12 SPECIAL CONSTRUCTION

SECTION 12E

FIREPROOFING

12-E.1 REQUIREMENTS

The work covered under this Section of the Specification consists of furnishing all materials, labor, tools, plant, equipment, accessories and services necessary to complete the installation of Fireproofing as indicated in the drawings and specified herein.

12-E.2 LOCATION AND EXTENT OF WORK

(a) Work included is shown in the drawings by general reference and shall not be construed as a complete coverage of all work affected herein.

(b) The work specified, listed, named or described in the specification is a partial listing of major items and not a restricted schedule of work to be included. The work affected herein includes fireproofing of all new structural steel framing, struts, bracing, and accessories. Portions of existing construction that is indicated to remain in place shall be fireproofed herein. Work to remain in place consists of the existing exterior wall construction and includes metal siding, struts, bracing and framing.

12-E.3 MATERIALS

(a) Materials shall be Zonolite Mono-Kote as developed by Zonolite Division, W. R. Grace & Co. specifically for fast application, high fire resistance and durable, or equal.

(b) Material shall meet or exceed the requirements set forth in Technical Data Bulletin MK-112 A.I.A. No. 21-G, Dated July 1966.

(c) Materials shall be mill-mixed and delivered to the project site in Manufacturers original, unopened packages bearing the name of the product, the Manufacturer's name and applicable Underwriters Laboratories, Inc. Label.

Information Handling Services, 1999
August 12, 1999 05:44:57

(d) Material shall be stored off the ground or floor and away from any damp surfaces. Material shall be kept bone dry until ready for use. Materials that have been exposed to water before actual use shall be discarded and removed from the site immediately.

(e) Materials shall be completely mill-mixed, requiring only addition of water to complete conditioning for application.

(f) Mixing water added at the project site shall be clean, fresh and free from organic or mineral impurities which would be harmful to the sprayed fireproofing materials.

12-E.4 PREPARATORY WORK

(a) The Contractor shall thoroughly examine all surfaces to be fireproofed herein. Oil, dirt or heavy rust crust shall be removed before any material is applied to any structural steel member.

(b) All equipment to be used in the application of fireproofing materials shall be delivered to the project free from set materials from previous operations.

(c) Equipment used in the work specified herein, shall be in first class mechanical and operating condition when delivered to the project. All equipment shall be maintained in the required condition above during the entire construction period.

(d) Painted surfaces of existing metal siding shall be covered with galvanized expanded metal lath weighing not less than 3.4 pounds per square yard.. Lath shall be attached to metal siding with self tapping screws, twist wire clips or other method approved for 3 hour fire protection rating.

(e) A suitable scratch coat shall be applied over metal lath surface where necessary to provide a base for the specified rated fireproofing.

12-E.5 INSTALLATION OF THE WORK

(a) The applicator upon starting this work accepts the basic materials, conditions and installations provided by others but intended to receive his work specified herein. Should this applicator discover any conditions existing that would be detrimental to the proper installation of his work, he shall notify the General Contractor in writing of those conditions before his work is started.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) Application of fireproofing shall be Direct-To-Steel, sprayed on, machine applied. Spray equipment shall be of type and size recommended and approved by the Manufacturer of the fireproofing material used.

(c) Application of sprayed fireproofing shall be in accordance with the printed instructions of the material manufacturer and fire test report information. Thickness of fireproof coating over steel shall be the average of all surfaces level off to provide a minimum 4 hours fire rating for the entire work under this Section.

(d) Only experienced applicators, approved by the materials manufacturer shall be allowed to place the materials or supervise the mixing of same.

(e) When this applicator has established his date to start the application of the fireproofing work, specified herein he shall notify the manufacturer or a manufacturers qualified representative of that date, allowing them a reasonable time to arrive at the project site. Manufactuers representative shall approve applicators method of procedure and equipment proposed to be used as well as handling of the materials from mixing operation to finally applied finish surfaces.

12-E.6 CLEAN UP

(a) After completion of the fireproofing work,all equipment tools, empty container, waste or surplus material, and all debris caused by this work, shall be removed from the project site. All walls, floor or other surfaces that may have become soiled or spattered by this work shall be cleaned by the applicator before he shall be given a final approval of his work.

12-E.7 CUTTING AND PATCHING

(a) Any damage to or cutting of fireproofing by other trades shall be patched in by the original fireproofing materials applicator. The trades causing any damage to or cutting of finished fireproofed surfaces shall pay for the repair or replacement of same.

12-E.8 STANDARDS

The standard of quality used in this Section of the Specifications shall be the minimum requirements for this work. Materials of other manufacturers and installation by other applicators will be considered provided all minimum requirements are equal or exceeds those specified herein.

Information Handling Services, 1999
August 12, 1999 05:44:57

12-E.9 ACCEPTANCE The Contractor shall submit to the Resident Engineer duplicate copies of manufacturers catalogue sheets, performance data report, application method, manufacturer's name, trade name of material and samples. The Resident Engineer's approval is necessary before any work under this Section shall commence.

12-E.10 CERTIFICATE

When all work under this Section is completed the Contractor shall furnish and submit to the Resident Engineer a certificate signed by the manufacturer, the applicator and by himself stating that all materials and methods used in the work affected under this Section of the specifications are at least equal to, or exceeds, the requirements to provide a three hour Underwriters Laboratories Inc., rating.

The certificate shall state that the fireproofing cover will not flake, dust or develop a surface of loose particles that can become air-borne.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 12 SPECIAL CONSTRUCTION

SECTION 12 F

LEAD PROTECTIVE SHIELDING

12-F.1 REQUIREMENTS

a. The work covered in this Section of the specifications consists of furnishing all materials, labor, equipment, tools, accessories, appliances and services necessary to complete all Lead Protective Shielding indicated in the drawings and specified herein.

b. The area affected is noted in the drawings, Finish Schedules. Doors and frames identified in the Door Schedules.

12-F.2 WORK NOT INCLUDED

a. Wall framing, suspended ceiling and floor construction is furnished and installed under other Sections of the specifications. See the applicable drawings and Sections as they affect the work herein.

12-F.3 MATERIALS

a. Lead Backed Lath All wall areas shall have lead backed gypsum lath applied to wall studs for plaster finish. Lead backed lath shall be 16 inches wide, 48 inches long and 3/8 inches in thickness with standard perforations. Back of lath shall have a sheet of 1.5 m m thickness unpierced sheet of lead bonded to the back (studd) face.

Special lead wire ties shall be furnished for installation of lath.

b. Lead Lined Hollow Metal Frames Hollow metal door frames for door openings in lead protective shielded area shall be lined with a continuous barrier of sheet lead 1.5 m m in thickness.

Information Handling Services, 1999
August 12, 1999 05:44:57

Retaining clips and attachment devices shall be provided to hold lead in proper position without piercing.

c. Lead Lined Wood Doors Doors in lead protective shielded walls shall be solid wood doors with No. 1 birch face panels.

Size of doors required in this Section shall be 36 inches wide; 84 inches high and 2 inches in thickness.

Doors shall be center lined with a barrier of sheet lead with a minimum thickness of 1.5 mm.

12-F.4 STANDARDS The standard of quality used in this specification is based on the following lead protective shielded products:

"Nelco" Hollow Metal Frames
"Nelco" Solid Wood Door
"Nelco" Plasterboard Lath

Manufactured by:

New England Lead Burning Service
Woburn, Mass. 01801

12-F.5 OTHER MANUFACTURERS Products manufactured by the following manufacturers will be acceptable, provided, specified minimum requirements are equal or exceed those required in the specified Standard of Quality:

a. Ray Proof Corporation.

b. Bar-Ray Products, Inc.,

c. Ameray Corporation or equal.

12-F.6 INSTALLATION

a. Lead backed plasterboard lath shall be attached to studd wall framing with clips, fasteners or other retaining devices in accordance with the instructions of the manufacturer.

b. Hollow metal door frame shall be carefully handled and installed without displacement of lead liner. Installation shall be made without open piercing the lead shield except where a lead back-up sheet is provided.

Information Handling Services, 1999
August 12, 1999 05:44:57

Fasteners, clips and retaining devices shall be furnished by the lead manufacturer and installed in accordance with the methods recommended by that manufacturer.

c. Lead lined door shall be fitted and hung by the conventional door hanging standard in accordance with the manufacturer's instructions.

12-F.7 FINISHING Plastering is covered under Section 9A, painting is under Section 9F and other finish work is covered under Sections 6B of the specifications.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 12 SPECIAL CONSTRUCTION

SECTION 12G

ACOUSTICAL WALL TREATMENT

12-G.1 REQUIREMENTS The work covered under this Section of these specifications consists of furnishing all materials, labor, plant, equipment, tools, accessories, appliances and services necessary to complete Acoustical Wall Treatment work as required on the drawings and specified in this Section.

12-G.2 LOCATION AND EXTENT OF WORK

The work under this Section consists of covering wall areas in various rooms and spaces. As indicated on the drawings the extent of coverage varies from space to space.

12-G.3 MATERIALS

(a) Furring strips shall be of kiln dried No. 1 white pine or clear No. 1 Douglas fir.

(b) Anchors for attaching furring strips to wall shall be "tamp-in" type for concrete or masonry and "Molly" type for hollow walls or plastered walls. Bolts shall be counter sunk head machine screws. Furring strips shall be shop sized to comply with the detailed drawings.

(c) Acoustical insulating board shall be a dense type of glass fiber base board of a density of not less than 6 pounds per cubic foot.

(d) Adhesive shall be a type recommended by the Manufacturer of the insulating board for application over walls types affected in this work.

(e) Adhesive for cementing vinyl coated fabric edge and intermediate furring strip contact use a cement type that is recommended by the Manufacturer of fabric used.

(f) Metal batten shall be mill finished aluminum extrusion, "snap-on" type without exposed face attachment devices. Size is indicated on the drawings. Snap-in clips shall be installed at maximum 12 inches on centers.

Information Handling Services, 1999
August 12, 1999 05:44:57

(g) Vinyl coated fabric cover shall be "Vicrtex" manufactured by L. E. Carpenter and Company, Smooth Dado wall-Heavy Duty Duotone, or equal.

Vinyl coated fabric shall be perforated with .045 diameter holes in a diagonal pattern at a rate of 113 holes per square inch of surface. Area of perforations shall provide fifteen percent (15%), minimum, of open area for the finally finished panel surface.

(h) Fasteners for edges and center contact of fabric to wood furring shall be chisel point flat staples minimum 3/8 inches long and spaced at 3 inches on centers at perimeter and 6 inches on centers at intermediate.

12-G.4 INSTALLATION

(a) Wall areas to be covered shall be spaced out as indicated on the drawings with location of furring strips marked off for equal size panel sections.

(b) Install anchors on the centerline of furring strips and at 16 inches on centers. Cut insulating panels to fit snug within the openings framed by wood furring. Apply adhesive to back of insulating board in continuous 3/8 inch beads in rows 6 inches on centers at long length of board and immediately install board into place with firm pressure at lines of adhesive for firmly bedding of board against wall surface.

(c) After insulating board panels have been installed vinyl fabric shall be installed vertically over entire surface. Fabric shall be applied with edges and center contact cemented and stapled to the wood furring. When fabric installation is completed with joints trimmed retaining clips for aluminum battens shall be installed to a true line, plumb and level. Aluminum batten shall be installed with mitered outside corners and butt joints for intermediate vertical members.

12-G.5 SAMPLES

The Contractor shall submit to the Resident Engineer a sample of metal batten not less than 12 inches long with one retaining clip. A sample of insulating board and of the vinyl coated fabric not less than 12 inches square shall be submitted for approval of the Resident Engineer.

Information Handling Services, 1999
August 12, 1999 05:44:57

12-G.6 CLEAN-UP

After all work under this section is completed all exposed surfaces shall be cleaned free from soil, hand marks, adhesive smears or other surface markings.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 12 SPECIAL CONSTRUCTION

SECTION 12H

CORK WALL COVERING

12-H.1 REQUIREMENTS

(a) The work covered under this Section consists of furnishing all materials, labor, tools, plant, appliances, equipment, accessories and services necessary to complete all cork wall covering as required in the drawings and specified in these Specifications.

(b) Installation of all cork wall covering and accessories shall be in accordance with the manufacturer's instructions.

(c) Adhesive used for installation shall be a type approved by the manufacturer of the cork used in the work.

12-H.2 WORK NOT INCLUDED

The base surfaces to be covered with sheet cork shall be furnished and properly prepared to receive the work specified under this Section by the various trades affected by the construction indicated on the Drawings. Base surfaces shall be prepared by others ready to receive the work specified in this Section.

12-H.3 MATERIAL

(a) Sheet cork shall be dense close grain smooth finished face surface tack board 1/4 inch thickness with burlap back.

(b) Adhesive to be furnished by the manufacturer of the cork to be used in the work.

(c) Aluminum trim shall be "snap-on" type molding as required on the drawings.

(d) Samples of sheet cork not less than 12 inches x 12 inches and aluminum trim molding 18 inches long shall be submitted to the Resident Engineer for his approval.

12-H.4 INSTALLATION

(a) Surfaces to be covered with cork shall be examined for surface irregularities that would prevent a satisfactory

Information Handling Services, 1999
August 12, 1999 05:44:57

installation. Surface to be covered shall be dry and free from surface soil that will cause failure of the adhesive bonding.

(b) Cork sheet shall be applied in full length vertical strips as indicated on the drawings. Horizontal joints will not be accepted in cork covering. Each strip shall be installed with the recommended amount of adhesive applied in accordance with the manufacturer's instructions. Sheet cork strips shall be rolled into place to provide a smooth surface and uniform bond to wall panel section.

(c) Aluminum trim molding shall be mitered at all corner joints: fitted to a hair line joint. Snap on retainer clips shall be attached to back-up surface with self tapping screws or insert type fasteners that will permit removal and replacement of trim retainer clips. Aluminum trim molding shall be full length single piece from corner to corner.

12-H.5 CLEANING UP

(a) After all sheet cork wall covering is completed and trim in place the exposed surface of cork covering shall be inspected and any defective material or installation shall be corrected as directed by the Resident Engineer.

(b) The exposed surface of cork wall covering shall be cleaned in accordance with the directions furnished by the manufacturer. Aluminum trim shall be cleaned and polished to remove all hand prints, adhesive or soil. Should any sections of aluminum trim be damaged by tool marks, scratches, or similar defects, that section shall be replaced by new full length trim sections.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 13 FURNISHINGS

SECTION 13 A

CARPETING

13-A.1 REQUIREMENTS

(a) The work covered under this Section consists of furnishing all materials, labor, tools, plant, appliances, equipment, accessories and services necessary to complete all carpeting as required in the drawings and as specified.

(b) Installation of all carpeting shall be made under the supervision of a manufacturer's authorized representation with a wide experience in work similar and equal to the work required herein.

(c) The carpet manufacturer's representative shall inspect all surfaces over which his work will be installed and the application of carpeting shall be an indication of his approval and acceptance of the base surface as satisfactory insofar as his guarantee will apply without further qualification.

(d) The carpet manufacturer's representative shall notify the Contractor and the Resident Engineer, in writing, of any conditions that will prevent him from completing his work in accordance with the detailed instructions of the manufacturer.

(e) The carpet manufacturer's representative, in the presence of the contractor, shall take all quantity measurements in the field. The contractor shall be responsible for coordinating other work as it is affected by the work herein in a manner that all the work shall be acceptable to, and approved by, the Resident Engineer.

13-A.2 WORK NOT INCLUDED

The surface upon or against which carpet is to be installed will be provided by other trades and will be left ready except for ordinary cleaning for the installation of carpet. Immediately prior to the installation of carpet the Contractor shall prepare all sub-surfaces to be thoroughly dry broom cleaned, free of springiness, droppings, grease, oil, paint, varnish, hardeners, sprinkled cement, plaster

Information Handling Services, 1999
August 12, 1999 05:44:57

droppings, or any material that would interfere with the proper adhesion between sponge rubber and sub-floor surface. All sub-floor shall be leveled and free of irregularities to assure on constant floor height after carpet is installed. Any unavoidable changes in the floor height shall be gradually raised and troweled to create a ramp like effect.

13-A.3 DISTRIBUTION OF THE WORK

(a) The Contractor shall furnish, and pay for, all carpet, padding, adhesives, accessories and installation materials necessary for the covering of all raised floor areas in accordance with the requirements on the drawings and Finish Schedules.

(b) The Government will furnish and deliver to the site, at no cost to the Contractor, all carpet, padding, adhesives and installation materials necessary for covering of all other surfaces in accordance with the requirements on the drawings and Finish Schedules.

(c) The Contractor shall provide storage space for materials furnished by the Government until time for its installation in the finally finished work.

(d) The Contractor shall install all carpet, padding, adhesives, materials and accessories furnished and delivered by the Government in accordance with the requirements under this Section of these Specifications.

(e) The Contractor shall install all carpet, padding, adhesives, accessories and installation materials furnished by himself in accordance with the requirements under this Section of these Specifications.

13-A.4 MATERIALS

(a) Materials furnished by the Contractor shall be only the type and kind recommended by the carpet manufacturer.

(b) Carpet shall be POWERBOND MARK II as manufactured by Collins and Aikman 210 Madison Avenue, New York, N.Y. 10016, or equal.

(c) Carpet furnished shall be 54 inches in width, continuous filament, high density round cross section nylon 30 percent (30%) delustered pile and shall meet or exceed the following minimum requirements:

Information Handling Services, 1999
August 12, 1999 05:44:57

1.	Vinyl Solid Back	
2.	Pitch:	351
3.	Rows Per Inch:	10
4.	Pile Height:	.135 (inches)
5.	Face Yarn Weight:	20 (ounces)
6.	Denier:	1050/2
7.	Interliner:	Polypropylene
8.	Sealant Coat:	Polyvinyl Chloride
9.	Integral Cushion:	Cellular Vinyl 5/32 inches
10.	Back Plate:	Sheet Polyvinyl Chloride Gauge 70 mils.
11.	Loop Lock:	Minimum 24 Pounds Draw Pull
12.	Static Control:	The carpet

Static Control: The carpet specified herein shall be manufactured with a static control system which will reduce the level of electrostatic voltage build up, below the threshold of sensitivity. The threshold of sensitivity is defined as that level of electrostatic voltage below which the average individual will not encounter an objectionable shock. It will be calibrated at a range from 2500 to 3500 volts. It shall be measured according to the standard method of test established by industry at 20 per cent humidity relative to 70 degree temperature.

13-A.5 INSTALLATION OVER RAISED FLOORS

Carpet installation on the raised floor panels shall be done under the supervision of the carpet manufacturer's certified professional carpet installer. Installation of the carpet on raised floor panels may be installed in the shop or on the site, at the option of the Contractor.

Cutting and fitting of carpet shall be done to close tolerance joints using specially designed cutting tools to prevent cutting of pile loops or loop lock in back.

The exact amounts and types of cements and/or adhesives to permanently secure the carpet to each floor panels in accordance with the instructions of the manufacturers of both the carpet and the adhesive shall be carefully applied as directed.

Information Handling Services, 1999
August 12, 1999 05:44:57

13-A.6 CARPET INSTALLATION (GENERAL)

(a) Carpet Over Concrete Floor
Concrete surface shall be dry, smooth and dust free before carpet installation shall be started. The concrete surface shall be examined and any defects that would prevent a durable bond and/or carpet base shall be repaired.

(b) Carpet Over Particleboard Wall
Wall surfaces shall be checked for soundness, proper set of nail heads or other defects that would prevent permanent bond between carpet back and wall.

(c) Method and Materials
Method and materials used in the installation of carpet over concrete floor and wall surfaces shall be adhesive system application. Manufacturer's instructions shall be followed and only materials recommended by Manufacturer shall be used.

(d) General Instructions
Movable partitions, telephone and electrical outlets shall be roughed in but not finally installed before carpeting is in place. The carpet installer shall cooperate with the other trades whose work is affected herein and he shall be responsible for all cutting and fitting of carpeting necessary thereto.

13-A.7 GUARANTEE

The Contractor shall submit to the Resident Engineer a Manufacturer's five year guarantee against excessive surface wear. Excessive wear shall be qualified by the guarantee to mean more than ten percent loss of pile fiber per square yard. If the carpet fails to perform as guaranteed, the affected area will be replaced by the Manufacturer at his own cost. This guarantee is in addition to the Contractor's general overall guarantee, however, carpet guarantee applies only to carpet furnished by the Contractor.

13-A.8 CLEAN-UP

(a) Spots, smears, soil and stains caused by this work shall be removed immediately when they occur using a solvent or cleaning agent recommended by the carpet manufacturer.

(b) All rubbish, wrapping paper, salvages, crate materials, dirt and debris caused by this work shall be removed from the site on completion of the work.

(c) All excess pieces of usable carpet shall be left with the Resident Engineer, for future repair.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 15

SECTION 15A

GENERAL REQUIREMENTS FOR MECHANICAL AND ELECTRICAL WORK

15-A.1 GENERAL

(a) APPLICATION This Section applies to and forms a part of those Sections covering the plumbing, heating, ventilating, air conditioning, and electrical systems.

15-A.2 PLANS

(a) EXTENT OF WORK Drawings numbered with an "M", "E", or "ME" prefix show the extent of the work contemplated by the plumbing, heating, ventilating, air conditioning and electrical Sections.

(b) INTENT The plans are intended to show the general arrangement and the extent of the work contemplated. The exact location and arrangement of all parts shall be determined after equipment has been approved by the Resident Engineer as the work progresses, to conform in the best possible manner with the surroundings, and as directed by the Resident Engineer.

(c) DIMENSIONS Figured dimensions shall be followed without regard to scale; where no figures or notations are given, the plans shall be followed.

15-A.3 SYMBOLS

(a) SYMBOL INTERPRETATION Symbols for the various outlets, piping, and wiring systems are noted on the plans, and shall be strictly adhered to in connection with all work. Should the Contractor be in doubt regarding the real meaning and intent of the various symbols used, he shall confer with the Resident Engineer for interpretation whose decision shall be final.

15-A.4 MATERIALS AND WORKMANSHIP

(a) MATERIALS All materials shall be new and the best of their respective kinds, and shall bear

Information Handling Services, 1999
August 12, 1999 05:44:57

the label of the NFPA, ASME Code, AGA, and UL where such standard has been established for the particular item of equipment used.

(b) WORKMANSHIP All workmanship shall in all respects be of the highest grade, and all construction shall be done according to the best practice of the trade. Work shall be done by mechanics experienced and skilled in the trade involved. All work shall be completed to the entire satisfaction of the Resident Engineer.

(c) EQUIVALENCE Naming a manufacturer, brand, or model number as part or all of the description of manufactured items shall be deemed to include any description or specifications of such items in that manufacturer's published catalog as of date of submission bid. Indication on drawings and/or naming in specifications of model numbers of a particular manufacturer shall not be construed as excluding from consideration similar and essentially equivalent items produced by other manufacturers, subject to the procedure outlined below and to the following provisions:

(1) Size and Function - Each item of equipment shall fit the plan and space allowed, shall conform to the surrounding conditions, and shall fulfill completely the functions for which it is intended as well as or better than the item named on the drawings or in the specifications.

(2) Approval Before Purchase - Full and complete catalogue illustrations, specifications, and descriptive data and/or shop drawings defining in detail each item shall be submitted for approval, before placing any order for such item.

(3) Availability and Service - The availability of equipment and service personnel representing the manufacturer in the area will be a factor for consideration of the submittals. Manufacturer's service organization and stock of replacement parts at a reasonably close location (within a one-hundred (100) mile radius of the project) will be required.

Information Handling Services, 1999
August 12, 1999 05:44:57

15-A.5 SHOP DRAWINGS

(a) PROCEDURE Detailed shop drawings, manufacturers' catalogue data, and certified capacity data shall be submitted in accordance with the procedures set forth in the Special Conditions Section, for all items of mechanical and electrical materials and equipment to be furnished under this contract.

15-A.6 ORDINANCES, PERMITS, FEES AND CERTIFICATES

(a) CODES AND AUTHORITIES All labor and materials shall be in strict conformance with the rules and recommendations of the National Fire Protection Association, municipal and state codes and regulations, local electric, telephone, and gas companies, American Gas Association, National Electrical Code, or any other authorities that may have lawful jurisdiction pertaining to the work.

(b) PERMITS, FEES AND CERTIFICATES Contractor shall procure all necessary permits, licenses, or inspections to carry out his work and shall pay the lawful fees therefor. Contractor shall procure and pay for all necessary certificates of approval, which must be delivered to the Resident Engineer before final acceptance of the work.

15-A.7 INTERFERENCES

(a) COORDINATION The plans are generally diagrammatic, and the Contractor shall harmonize the work of the different trades so that interferences between the mechanical and electrical work and the architectural and structural work will be avoided. All piping, ductwork, and electrical raceways shall be installed as close as possible to walls, floors, columns, ceilings, and beams, and offsets or special fittings shall be installed in lines as required to accomplish this end whether or not shown on plans.

15-A.8 LARGE EQUIPMENT

(a) INSTALLATION Large pieces of equipment which are to be installed in the building, and which are too

Information Handling Services, 1999
August 12, 1999 05:44:57

large to permit access through doorways, stairways, or shafts, shall be brought to the job by the Contractor and placed in the spaces before the enclosing structure is completed. Where existing walls, etc., must be removed to permit installation of large equipment removal work and replacement shall be handled in the same manner as specified for Cutting and Patching. Equipment shall be cribbed up from the floor by the Contractor and covered with tarpaulins or other protective covering where necessary or directed.

15-A.9 PROTECTION OF WORK AND MATERIALS

(a) WEATHER All work, materials, and equipment, whether incorporated in the building or not, shall be protected at all times against the weather (rain, windstorms, frost, ice or heat) so as to maintain them free from injury or damage. At the end of each day's work, all work likely to be damaged shall be covered.

(b) BUILDING OPENINGS Building openings shall be covered to protect the building from the weather.

(c) DAMAGE Finished floors, step treads, Government owned or furnished equipment, and all finished surfaces, exterior or interior, shall be protected against damage by workmen or equipment during the work. Wherever materials are hoisted to roof or carried into building, surfaces must be covered with a layer of heavy building paper.

(d) EQUIPMENT Equipment shall be kept in out of the weather, and shall be kept covered. Where work is to be done above equipment, the Contractor shall provide full and solid wood platforms above such equipment, to prevent its being damaged or soiled.

(e) REPAIR Any and all equipment, piping, motors, insulation, etc., which in the opinion of the Resident Engineer becomes damaged, abused, inundated, or otherwise harmed beyond normal and minor repair, shall be replaced with new equipment or material at no additional cost to the Government.

Information Handling Services, 1999
August 12, 1999 05:44:57

(f) RESPONSIBILITY The Contractor shall be responsible for all damage done to Government property or adjacent properties during the construction. The above protection shall be maintained while the work is being done, and in no case shall dirt or grit be ground into floor finishes or floor coverings.

15-A.10 STORAGE OF MATERIALS

(a) GENERALLY The Contractor shall be responsible for the transportation of his materials to and on the job, and shall provide space for storage of his materials and equipment at ground level. Roof surfaces shall not be used for storage of materials or equipment. Any storage within the building shall be approved by the Resident Engineer prior to use of the space.

(b) EXTERIOR Pipe, fittings, or other materials stored outside of buildings shall be set on wood or steel racks or platforms at least 12" above grade. All necessary provisions shall be made to keep water and debris away from such stored material. Ends of pipes and valves shall be kept sealed until used.

(c) WAREHOUSING Equipment subject to rusting shall be kept warehoused until just prior to setting.

15-A.11 TEMPORARY USE OF EQUIPMENT FOR CONSTRUCTION PURPOSES

(a) PERMISSION REQUIRED The permanent equipment installation shall not be used for temporary purposes by the Contractor without express permission in writing signed by the Resident Engineer.

(b) ACCEPTABLE USE WITHOUT SPECIFIC AUTHORIZATION Temporary use shall not be construed to mean "bumping" of electric motors on equipment to verify rotation direction nor short time operation of systems for test purposes, operation of refrigeration systems for short periods to adjust controls and temperature regulation, or the operation of fans for air balance tests.

Information Handling Services, 1999
August 12, 1999 05:44:57

(c) USE FOR COMFORT OF WORKMEN Where the use of the permanently installed heating, ventilation or air conditioning systems is used for extended periods to maintain ventilation, heating or cooling in the building for the purpose of comfort of workmen in accordance with established trade union regulations, such use shall be strictly governed in accordance with the provisions contained in Division 1.

15-A.12 UTILITIES

(a) CONNECTIONS The Contractor shall connect all mechanical and electrical utilities at the manholes or other points indicated on the drawings, and extend such utilities to the building and to all equipment or facilities requiring same.

15-A.13 EXCAVATING AND BACKFILLING

(a) MAINTENANCE OF TRENCHES All excavating and backfilling necessary for the installation of work is specified under another Section. The Contractor shall shore, bail, and pump all trenches for lines laid in ground and shall maintain said trenches dry until the work has been tested and approved. After piping has been approved, trenches shall be immediately backfilled.

(b) PAVED AREAS Where graveled or paved areas are disturbed, restoring same to prior existing conditions shall be at the Contractor's expense.

15-A.14 LOCATION OF PIPES, OUTLETS, APPLIANCES, ETC.

(a) SPECIFIC LOCATIONS The location of all pipes, outlets, appliances, etc., shown on plans, if not specifically dimensioned are approximate only, and understood to be subject to such minor revision as may be found necessary or desirable at the time work is installed. With regard to electric outlets in particular, the Resident Engineer reserves the right to move any outlet and/or fixture as much as six feet horizontally and/or vertically without additional charge, until such time as the outlets have been roughed in.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) COORDINATION Generally, all outlets shall be properly centered in rooms, panels, and other finished work, and shall not interfere with outlets or equipment of other trades, and shall meet the dimensioned or large scale architectural and structural drawings.

15-A.15 CUTTING AND PATCHING

(a) GENERALLY The Contractor shall be responsible for all cutting required for the proper installation of his work, and shall obtain permission from the Resident Engineer before doing any cutting. Cutting shall be done in such a manner that the surrounding work will be restored to its original condition.

(b) STRUCTURAL MEMBERS No structural member may be cut without written permission from the Resident Engineer.

(c) OCCUPIED SPACES When cutting and patching is done in equipment occupied spaces within the building, the Contractor shall provide a dust-tight enclosure and any other necessary protection around his operation in order to protect equipment and finishes.

(d) EXTERIOR SURFACES Openings cut through the roof or exterior walls shall be provided with a temporary watertight cover during construction or until equipment installation or repair has been made.

(e) CHASES, SLOTS, ETC. The Contractor shall provide chases, as indicated on the drawings. The Contractor shall also be responsible for coordinating and obtaining from all Subcontractors the correct sizes and locations of all such chases, slots, etc., in sufficient time that they may be built in as the building construction progresses.

15-A.16 MECHANICAL EQUIPMENT VIBRATION CONTROL

(a) GENERALLY All vibration isolators for machine mounting and pipe suspension shall be supplied by a single manufacturer. This manufacturer shall assume responsibility for isolator selection based on the exact mechanical equipment to be furnished.

Information Handling Services, 1999
August 12, 1999 05:44:57

The isolator manufacturer shall be Mason Industries, Consolidated Kinetics Corporation, Vibration Mountings and Controls, Inc., Korfund Dynamics Corporation or approved equal.

(b) MACHINE RESILIENT MOUNTING SYSTEMS

(1) Except where otherwise specified, all rotating mechanical equipment shall be mounted on free standing, unhoused, steel spring vibration isolators. Spring assemblies mounted under mechanical equipment shall include leveling bolts and elastomer or glass fiber pads for high frequency noise control. Spring hangers for suspended mechanical equipment shall include a double deflection elastomer or thick precompressed molded glass fiber pad at the top of the hanger assembly.

(2) The static deflection of spring assemblies shall be as specified hereinafter for each type of equipment. Where mechanical equipment is mounted in locations other than in the lower level mechanical equipment room with slab on grade, the deflection of the structure supporting the mechanical equipment shall be added to the specified deflection to obtain the spring isolator deflection required.

(3) Care shall be taken to provide equal deflection for all springs supporting a particular machine. Springs shall have a minimum additional travel of 50% between deflected design height and solid height. To assure proper lateral stability, the ratio of spring diameter to deflected spring height shall not be less than 0.9.

(4) Water Pumps: Mount on minimum 6 inch thick reinforced concrete inertia bases and steel spring isolators with minimum static deflection of 1 inch. The inertia bases shall be formed with steel channel framing with attached brackets for spring isolators and shall be large enough to support the piping elbows. Inertia base framing and spring assemblies

Information Handling Services, 1999
August 12, 1999 05:44:57

shall be Mason Industries type K with type SLF springs or equivalent as furnished by other specified isolator manufacturers.

(5) Centrifugal Chiller: High quality rubber sandwiched between two steel plates that are sealed at the edges with oil resisting neoprene, "Vibration Eliminator Co." Type FP, or approved equal.

(6) Air Handling Units: Mount on steel spring isolators with minimum static deflection of 1 inch but with deflection as required to provide maximum 10% transmissibility at the speed of the slowest rotating part for machines mounted in the lower level mechanical equipment room and a maximum transmissibility of 5% for machines mounted in other locations. Springs shall be Mason Industries type SLF or equivalent as furnished by the other specified isolator manufacturers. Provide prefabricated steel fan bases or saddles with spring mounting brackets, Mason Industries type WF or ICS or equivalent as furnished by other specified isolator manufacturers, if required for proper mounting of the exact air handling units furnished.

(7) Boiler: Mount on double deflection elastomer mounts with minimum static deflection of 0.25 inches, Mason Industries type ND, precompressed molded glass fiber pads with minimum static deflection of 0.25 inches, Consolidated Kinetics type KIP-O, or 1 inch thick cord and rubber pads, Korfund "Elasto-rib". Elastomer mounts shall be fabricated of slow aging neoprene.

(8) Vacuum Cleaning Unit: Same as for water pumps except without inertia base.

(c) RESILIENT PIPE HANGERS Piping which connects to resiliently mounted mechanical equipment shall be suspended with steel spring hangers providing at least 1/2 inch static deflection for a distance of at least 100 pipe diameters from the associated machine except that spring hangers shall be used

Information Handling Services, 1999
August 12, 1999 05:44:57

within each mechanical equipment room even if at greater distances than 100 pipe diameters from the machine. Spring hangers shall include a double deflection elastomer or precompressed glass fiber pad at the top of each spring hanger assembly. In addition, spring hangers shall have facilities for holding the piping at fixed elevations during installation with capability of transferring the load to the spring while maintaining the same pipe elevation. Spring hangers shall be Mason Industries type PDNHS or equivalent as furnished by the other specified isolator manufacturers.

(d) RESILIENT PIPE CONNECTORS Pipe connections to resiliently mounted machines shall be made with butyl hose type connectors for pipe 2-1/2 inches in diameter and smaller and with teflon expansion joints for pipe larger than 2-1/2 inches. Hose type connectors shall have a length of at least six pipe diameters. Control rods or cables shall be supplied with rubber or neoprene washers to prevent metal-to-metal contact. Resilient pipe connectors shall be mounted horizontally whenever possible. Hose type connectors shall be Mason Industries type BRFH, RMM, RMF, or RCIF or equivalent as furnished by other specified isolator manufacturers or by Goodall Rubber Company or Mercer Rubber Company. Expansion joints shall be molded teflon expansion joints as furnished by Resistoflex, Mason Industries, or approved equal.

15-A.17 PIPING, HANGERS, SUPPORTS, ETC., GENERALLY

(a) ROUTING AND SPACING All piping, electrical raceway, ductwork, etc., except electrical raceway where run concealed, shall be installed parallel or perpendicular to the lines of the building, unless distinctly shown or noted on plans otherwise. Spacing of lines shall be such as to provide not less than 1/2" clearance between finished coverings on the various services.

(b) FOUNDATIONS AND SUPPORTS The Contractor shall furnish all foundations or supports for the work installed. All bell and spigot soil pipe shall have

Information Handling Services, 1999
August 12, 1999 05:44:57

hangers not more than 5' on centers. All other piping smaller than 2" shall have hangers spaced not more than 5' on centers, and all piping larger than 2" shall have hangers spaced not more than 10' on centers. In any case, pipe deflection shall not exceed 1/4". Hangers shall be provided at concentrated load points and at all changes in direction of piping.

(c) SUPPORTS TO WALLS Supports to walls, other than poured concrete, shall be made with "molly" bolts.

(d) SUPPORTS TO CONCRETE Supports to overhead concrete shall be made with approved concrete inserts. Supports to vertical concrete surfaces shall be made with expansion bolts and shields.

(e) STRAP HANGERS Perforated strap hangers shall not be used for any work.

(f) SADDLES Insulation protection saddles shall be used at each hanger for all insulated lines. All saddles shall be not less than 14 gauge galvanized steel jackets, covering at least the lower half of the insulation and not less than 10" long. Saddles shall be secured with copper or aluminum wire.

(g) PIPE HANGERS Hangers for piping shall be adjustable split ring malleable iron similar and equal to "Fee & Mason" #215 or #361 with threaded rod and turnbuckle in rod where hanging height permits. Except for insulated lines, hangers shall be sized to fit the pipe. Copper piping hangers shall be copper plated. Resilient pipe hangers shall be as specified hereinbefore.

(h) CONDUIT HANGERS Exposed electrical raceway shall be supported with hangers same as specified for piping, except that hangers may be solid-ring type similar and equal to "Fee & Mason" #198. Concealed electrical raceway not in concrete shall be supported as best suited by conditions with steel or cast iron supporting hangers or wall clips secured to construction.

(i) TRAPEZE HANGERS Trapeze hangers may be used for multiple parallel piping runs where specifically indicated on the plans, or elsewhere with permission of the Resident Engineer.

Information Handling Services, 1999
August 12, 1999 05:44:57

(j) EXPANSION OR CONTRACTION All piping shall be installed so as to allow for expansion and contraction using offsets, swing joints, etc., as shown or as may be required to prevent undue strain on piping.

(k) FEDERAL SPECIFICATION The requirements of Federal Specification WW-H-171c will be considered limiting requirements for hangers and attachments and subject to specific methods and materials specified herein.

15-A.18 DRAINAGE All water piping shall be arranged for draining through fixtures, or to floor drains where necessary, by means of 1/2" lockshield valves.

15-A.19 PIPE JOINTS

(a) CAST IRON SOIL PIPE Joints in cast iron soil pipes shall be caulked joints made with spun oakum and molten lead, 12 ounces of which shall be used for each inch in diameter of the pipes, at each joint, and must be poured in at one time. The lead to be used for this purpose shall be soft "pig" or "bar". After cooling and shrinking, the lead shall be thoroughly caulked and the joints made impermeable to gases and liquids and also be capable of withstanding the tests applied. The face of the lead joints shall be left without putty, paint, or cement. Wherever joints are made on the floor or surface, they shall be recaulked after being placed in position.

(b) THREADED PIPE Joints in threaded piping shall be made with Teflon joint tape or approved equal compound, applied on the male thread only. The ends of pipes shall be square cut, reamed, and wiped clean before being made up into fittings.

(c) CLAY PIPE Joints in clay pipe shall be made with picked oakum caulked into place and sealed with hot poured bituminous compound, equal to "GK" sewer joint compound. At the Contractor's option, premolded compression joints conforming to ASTM C425 may be used.

(d) COPPER TUBING Joints in copper tubing, except refrigerant piping, shall be soldered with 95%

Information Handling Services, 1999
August 12, 1999 05:44:57

tin, 5% antimony solder. Before making up joints, all copper shall be cleaned to bright metal with emery cloth, and treated with "No-Kerrode" or equal flux. Joints in copper refrigerant piping shall be made up with silver solder, "Silfos" or equal.

(e) OPENINGS, ETC. The openings of all pipe shall be capped during construction. All steel pipe, before installation, shall be stood on end and pounded to remove dirt and scale, and shall be properly reamed before joints are made up.

(f) FERRULES Where lead connections are made to soil pipe, brass ferrules of same size as pipes shall be used, and the joints shall be full wiped.

(g) DIELECTRIC PROTECTION All ferrous to non-ferrous pipe connections shall be made with approved dielectric couplings or flange union isolating joints, to prevent any electrolytic action between dissimilar metals.

(h) THREADED PIPE TO SOIL PIPE All connections between threaded pipe and cast iron soil pipe shall be made using tapped openings, or shall be caulked with lead and oakum. When joints are caulked, the end of the screwed pipe shall be fitted with a ring or part of a coupling screwed on to form a spigot.

(i) NIPPLES Any piece of threaded pipe 8" or less in length shall be considered a nipple. All nipples with unthreaded portion 1-1/2" or less shall be extra-heavy; all other nipples shall be of weight corresponding to balance of pipe line and fitting connected. Only shoulder nipples shall be used; close nipples will not be acceptable.

15-A.20 UNIONS

(a) ACCESSIBILITY No unions are to be placed in any pipe in a location which will be inaccessible after completion of the building unless specifically shown on plans or specified otherwise.

(b) NUMBER REQUIRED Unions shall be installed on each side of all special valves, regulators, etc., and

Information Handling Services, 1999
August 12, 1999 05:44:57

at pieces of equipment such as pumps, heating units, tanks, etc., so that such equipment may be readily disconnected.

(c) FLANGED JOINTS Where joints are made up with bolted flanges, separate union fittings as such will not be required.

15-A.21 SLEEVES

(a) GENERALLY The Contractor shall provide sleeves for all piping, conduits, or ductwork passing through walls, floors, beams, foundations, and roof slabs, subject to approval of the Resident Engineer.

(b) MATERIALS All sleeves through suspended floors and slabs shall be constructed of 22 gauge, zinc-coated, sheet iron or 18 gauge aluminum. All sleeves in walls, beams, and foundations shall be black, standard weight steel pipe, or cast iron soil pipe.

(c) INSTALLATION All sleeves through below-grade or exterior building surfaces shall be thoroughly caulked and waterproofed. Where waterproofing membrane is penetrated, install Josam No. 1870, or approved equal sleeve and caulk watertight with oakum and lead. All sleeves shall be installed with ends flush with the finished surfaces, except floor sleeves shall project 2" above finished floor.

15-A.22 FLOOR AND CEILING ESCUTCHEONS

(a) LOCATIONS AND MATERIALS All exposed piping and electrical raceway passing through walls, ceilings, and floors shall be provided with set-screw held, floor and ceiling escutcheons. Escutcheons shall be chrome plated brass.

15-A.23 ELECTRIC MOTORS AND CONNECTIONS, GENERALLY

(a) MOTORS Unless otherwise noted, all motors shall be of the squirrel cage, NEMA standard for temperature rise, 40 degree C, NEMA Class B rated type, and the horsepower, speed, phase, and voltage hereinafter specified or shown on the plans. Motors shall be "Wagner", "Century", "Allis Chalmers", "Electro-Dynamic", or approved equal.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) STARTING AND CONTROL EQUIPMENT Motors shall be furnished and installed under the Section calling for such motor. The furnishing of motors shall include the furnishing of all starting and control equipment, except that specifically noted to be furnished as an integral part of electric systems. Each and every motor shall have a starter with overload and undervoltage protection.

(c) SWITCHES AND CONNECTIONS The erection and connection of all detached switches, starting and control equipment, including the furnishing and installation of disconnect switches as indicated or required, shall be done under the Electrical Section. Conduits from controllers to motors shall be flexible for not over two feet, and shall be attached to the terminal housing of the motor.

(d) HORSEPOWER REQUIREMENTS All motor horsepower or amperage ratings called for on the plans or in these specifications are minimum acceptable ratings based on the original design and on the use of the equipment exactly as detailed or specified. Any change in motor size and associated wiring changes brought on directly or indirectly by substitution of equipment shall be the responsibility of the Contractor furnishing the motor, unless the substitution was initiated by the Government.

(e) RELATED RESPONSIBILITY The responsibility of the Contractor as mentioned in the previous paragraph shall include the furnishing and installing of the proper size motor and drive, subject to the approval of the Resident Engineer and free of any additional cost to the Government. It shall also include responsibility for any increase in electrical equipment and installation costs, over and above that required to comply with the original design.

15-A.24 MOTOR STARTERS

(a) SINGLE PHASE STARTERS Starters for single phase non-electrically interlocked motors shall be flush mounted single or double pole switches as required, with red filament type pilot lights and stainless steel face plates, equal to "Allen-Bradley" #62P or "Cutler-Hammer" #9101.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) SINGLE AND THREE PHASE STARTERS Starters for single phase electrically interlocked motors, and three phase 208 or 460 volt motors up to 15 horsepower, shall be one, two, or three pole, 60 cycle, 600 volts, across the line magnetic contactors, with general purpose enclosures, thermal overload protection for each phase, and with undervoltage protection when used with momentary contact pilot devices or undervoltage release when used with maintained contact pilot devices.

(c) INTERLOCK CONTACTS Starters requiring electrical interlock contact points shall be so furnished as indicated or required.

(d) WEATHER PROTECTION Starters installed outside the building, or otherwise exposed to the weather, shall be furnished with weather-resistant NEMA Type 3 enclosures in lieu of general purpose enclosures.

(e) COMMON MANUFACTURER All starters or contactors of any one type furnished under this contract shall be of the same manufacturer.

(f) INTEGRAL EQUIPMENT COMPONENTS Starters or contactors furnished as integral parts of factory-assembled pre-wired equipment shall conform to above requirements except as may be waived in writing by the Contracting Officer.

15-A.25 PUSHBUTTON STATIONS

(a) GENERALLY All magnetic contactors shall be provided with heavy duty type pushbutton station, rated for 10 amperes continuous load at 600 volts or less.

(b) ENCLOSURES Enclosures shall be general purpose NEMA Type 1, except that pushbutton stations installed outside the building or otherwise exposed to the weather shall be dust and weather-tight, NEMA Type 4. Enclosures shall be provided for surface mounting, except as otherwise indicated.

(c) TYPE OF OPERATION Pushbutton stations shall be of the maintained contact type with start button, stop button, and red indicator light.

Information Handling Services, 1999
August 12, 1999 05:44:57

(d) SELECTOR SWITCHES Pushbutton stations for electrically interlocked contactors shall be provided with "hand-off-automatic" selector switches, and both red and green indicator lights.

(e) SPECIAL FEATURES Pushbutton stations requiring other special features shall be provided as required or otherwise indicated.

15-A.26 ACCESS PANELS

(a) GENERALLY Except where "lift-out" ceilings are installed, the Contractor shall furnish and install a steel access door for each of his valves, group of valves, or other controlling mechanism which would otherwise be concealed in the building construction.

(b) WALLS Access doors in walls shall be similar and equal to "Milcor" steel access doors and shall be Type "M" for masonry and Type "K" for lath and plaster, as the condition requires. Each door shall be furnished with a flush screwdriver-operated lock and shall be furnished with one prime coat of gray rust inhibitive paint. Each access door shall be approximately 12" wide and 18" high.

(c) CEILINGS Access doors in ceilings shall be similar and equal to "Milcor" Type A, 24" x 24", and otherwise similar to those for walls.

15-A.27 CLEANING, TESTING, AND ADJUSTING

(a) GENERALLY The Contractor shall at his own expense, during the progress of the work, or upon its completion make such tests of his work as are hereinafter specified under the various sections, or as required by the Resident Engineer and local or state bureaus having jurisdiction, and under their supervision. Tests of piping systems shall be made before backfilling, insulating or concealing pipe.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) EXPENSE The Government will furnish all fuel, electricity and water for tests, free of charge to the Contractor. The Contractor shall furnish and pay for all necessary labor, apparatus and piping, as required for tests. Contractor shall take all precautions necessary to prevent damage to the building during the tests, and shall be liable for any damage caused during the tests.

(c) DEFECTS All leaks and defects discovered by the tests shall be immediately repaired or replaced and tests conducted over until tests prove the systems are satisfactory. No caulking of threaded piping or any accelerated rusting of any piping will be permitted to stop leaks.

(d) CLEANUP The Contractor shall remove daily from building, lot, sidewalks, streets, and alleys, all rubbish, dirt, and debris as it accumulates during process of work. At completion of the work all areas inside shall be broom cleaned, and all obstructions and surplus materials shall be removed.

15-A.28 THERMAL INSULATION, GENERALLY

(a) MATERIAL The Contractor shall cover all piping and apparatus, and cover or line ductwork as specified hereinafter, with insulation as manufactured by "Johns-Manville", "Keasby & Mattison", "Armstrong Cork Company", "Owens Corning", "Gustin Bacon", or approved equal.

(b) INSTALLATION All sectional covering shall finish round and smooth without lumps or depressions, and all ends and joints shall butt evenly and tightly together and to the covered surface. No damaged or broken sections shall be used. When covering is formed from blocks, they shall be carefully and evenly applied, securely wired in place, and joints shall be closed with cement insulation.

(c) SLEEVES All insulated lines passing through walls or floors shall be provided with metal sleeves large enough to pass a full thickness of insulation.

(d) PAINTING After being painted as hereinafter specified, any insulation showing signs of coming

Information Handling Services, 1999
August 12, 1999 05:44:57

loose or tendancy of the covering pulling shall be removed and reapplied.

(e) WORKMANSHIP The application of all insulation shall be made strictly in accordance with the manufacturer's directions and by experienced craftsmen in a neat, careful, and workmanlike manner.

15-A.29 PAINTING

(a) GENERALLY All finish painting will be performed under another Section, except for standard factory finishes.

(b) DAMAGE Where standard equipment factory finishes have been damaged or scratched, the damaged area shall be repainted by the Contractor to match original finish.

(c) PREPARATION The Contractor shall thoroughly clean by wire brushing or use of cleaners, all rust, scale, cement, and dirt from all equipment, piping, and leave ready for finish painting.

(d) COLORS Colors for exposed work shall match those of existing building equipment, piping, etc. If in doubt, consult the Resident Engineer for color selection.

15-A.30 IDENTIFICATION OF EQUIPMENT

(a) STENCILING All items of major mechanical equipment, such as refrigeration machines, air handling units, fans, etc., shall be neatly and clearly stenciled in letters not less than 1" high, with the same designation as appears on the drawings. Location and color of such stenciling shall be appropriate for ready identification, and as directed by the Resident Engineer. One set of compatible metal interlocking stencil letters and numbers shall be turned over to the Government at the completion of the job.

(b) NAMEPLATES All motor starters and panelboards shall be provided with engraved plastic laminated nameplates, listing the designation, horsepower

Information Handling Services, 1999
August 12, 1999 05:44:57

(or load), voltage, phase and number of wires of the equipment. Nameplates shall be bolted to the face of the enclosure, and names shall correspond to those used on the drawings.

15-A.31 PIPE CODING

(a) GENERALLY All piping, raceway, etc., both insulated and bare, shall be color-coded, and stenciled as to service and characteristic on 20 ft. centers and/or as directed. Black directional flow arrows not less than 1/2" wide and not less than 6" long, shall be permanently stenciled on each pipe line at each stencil location. Stenciling shall be so located as to be clearly visible by a man standing on the floor. Pipe coding shall match existing codes and methods, as limiting requirements.

15-A.32 VALVE IDENTIFICATION

(a) MATERIALS The Contractor shall attach by key ring onto the handle of each valve installed under his contract a bronze or brass disc not under 1" diameter, stamped with the prefix "P" or "AC" followed by an identifying number not less than 1/2" high.

(b) IDENTIFICATION SCHEDULE The number, location, and purpose corresponding to each valve shall be listed in sequence, properly typewritten on a schedule sheet and submitted to the Resident Engineer for approval. The approved schedule shall be framed under glass and mounted, where directed.

(c) QUALITY Valve tags and schedule sheets shall be as manufactured by "Seton Name Plate Company", New Haven, Connecticut or equal.

15-A.33 SPECIAL TOOLS

(a) GENERALLY All special tools required for proper operation or maintenance of any mechanical or electrical equipment provided under this contract shall be delivered to the Resident Engineer at the completion of the contract.

Information Handling Services, 1999
August 12, 1999 05:44:57

15-A.34 GUARANTEES

(a) OVERALL GUARANTEE In addition to the guarantees on the individual items of equipment, the Contractor shall guarantee all equipment and work performed under his contract to be free from defects in material and workmanship for a period of twelve (12) months from the date of final acceptance by the Government.

(b) RESPONSIBILTY If within the guarantee period, such equipment or work performed under this contract is found to be defective in material or workmanship, it shall be replaced or repaired by Contractor free of any additional charges to Government.

15-A.35 INTENT It is the intention of the Government that the Contractor shall provide a complete mechanical and electrical installation. Correction or adjustment for proper operation and the testing of the work shall be supplied and done by the Contractor and included in the contract price.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 15 MECHANICAL

SECTION 15B

PLUMBING

15-B.1 GENERAL

(a) WORK INCLUDED This Section includes all labor and materials required for the complete and finished installation of plumbing fixtures, equipment, facilities, and systems.

(b) SYSTEMS Involved in the classification of plumbing work above are the following systems:

(1) General sanitary drainage

(2) Storm water drainage

(3) Gas supply and distribution

(4) Domestic cold water, hot water and hot water circulating systems

(5) Standpipe system

(6) Roof washdown system

(7) Plumbing fixtures, equipment, and accessories

(8) Rough-in for and connect up equipment furnished by others

(9) Vacuum cleaning system

(10) Carbon dioxide fire protection equipment

15-B.2 REFERENCE

(a) ADDITIONAL REQUIREMENTS Particular attention is called to the "General Requirements for Mechanical and Electrical Work" preceding this Section which covers certain important procedures, materials, and labor applying directly to the plumbing Section.

15-B.3 UTILITY CONNECTIONS

(a) VERIFICATION The Contractor shall, before commencement of the job, verify the exact location, depth,

Information Handling Services, 1999
August 12, 1999 05:44:57

size, pressure and/or grade of all existing water, sanitary sewer, gas and storm sewer lines to which he is to make connections for services to this project. If for any reason conditions should appear that will adversely affect the proper installation and operation of the systems proposed for installation, such conditions shall be reported to the Contracting Officer in writing for his decision.

(b) EXPENSE All charges for connections, extensions, temporary services, cutting and patching of paving, as may be required for connection to the various utility lines shall be included in the bid.

15-B.4 EQUIPMENT FURNISHED BY OTHERS

(a) GENERALLY Certain items of equipment will be furnished and set in place as specified under other Sections of this specification or by the Government under a separate contract.

(b) CONNECTIONS The Contractor shall rough in and make final connections to such equipment as indicated on drawings and as directed. All water connections to equipment shall be provided with gate valves. All direct waste connections shall be provided with P-traps or drum traps as required.

(c) ROUGHING-IN Exact rough-in locations and requirements for all such equipment shall be verified before starting work.

15-B.5 PIPING MATERIALS

(a) GENERAL Pipe and fittings shall be of nominal diameter as designated, with inner and outer surfaces concentric, smooth inside, straight, free from weld flaws, blisters or other defects. Each length of pipe and each fitting shall have cast, stamped or indelibly marked on it the maker's mark or name and the weight and quality of the product where such marking is required by the approved standard that applies.

(b) PIPE

(1) All sanitary waste and drain pipes above ground and vents above ground shall be

Information Handling Services, 1999
August 12, 1999 05:44:57

galvanized steel, Schedule 40, conforming to ASTM Designation A120 or A53.

(2) At the Contractor's option, above-ground soil, waste, and vent systems may be copper tubing. Copper drainage tubing shall be Type M, in accordance with Federal Specification WW-T-799a or Type DWV. Type DWV tubing shall be as specified for Type M tubing, except that thicknesses shall be as follows:

NOMINAL SIZE INCHES	ACTUAL OUTSIDE DIAMETER INCHES	THICKNESS INCHES
1-1/4	1.375	.040
1-1/2	1.625	.042
2	2.125	.042
3	3.125	.045
4	4.125	.058
5	5.125	.072
6	6.125	.083

(3) Chemical waste and vent lines, to limits shown, shall be extra heavy cast silicon iron, mechanical joint, acid resisting pipe, "Duriron", or equal, or "Corning" Pyrex glass. Fittings, flanges, gaskets and joints shall be installed in accordance with the manufacturer's recommendations.

(4) All sanitary and storm waste lines below ground to points 5 feet outside building and vent lines below ground shall be extra heavy weight, bell and spigot, sand spun cast iron pipe conforming to ASTM Designation A74 and CS-188 and shall bear the mark of the Cast Iron Institute. Pipe shall be coated inside and outside with heavy coal tar varnish. When approved by the Resident Engineer cast iron pipe may be used for above ground sanitary and storm waste and vents.

(5) All sanitary and storm waste lines outside building, from points five feet beyond building walls, shall be vitrified clay pipe, bell and spigot, conforming to ASTM Designation C13 for lines 6-inch and smaller and to Designation C200 for lines 8-inch and larger and shall be equipped with factory fabricated, pre-molded,

Information Handling Services, 1999
August 12, 1999 05:44:57

compression joints or couplings on the bell and spigot ends of the pipe.

(6) Footing drain pipe shall be perforated clay installed as shown on the plans or shall be perforated cement asbestos with plastic couplings, Johns-Manville, or approved equal, installed in accordance with manufacturer's recommendations.

(7) All domestic cold water lines, hot water lines, hot water circulating lines and condensation drain lines inside building shall be Type L hard temper copper tubing conforming to ASTM Designation B88.

(8) Gas piping shall be Schedule 40 black steel pipe conforming to ASTM Designation A120. All gas piping below ground shall be coated with high density polyethylene in coating thickness of 25 to 60 mils. Adhesive shall be modified rubber blend in 10 mil thickness. Bending of pipe shall not break bond between pipe and coating. "X-Tru-Coat" or approved equal.

(9) Standpipe water piping shall be schedule 40 black steel pipe conforming to ASTM Designation A120 or A53.

(10) Roof washdown piping shall be rigid polyvinyl chloride, Schedule 80, high temperature (180°F), "Cabot" Type CPVC, "Certainteed Plastics", or approved equal.

(c) FITTINGS

(1) Fittings for cast iron soil pipe shall be cast iron conforming to USA Specification B-16.12 and CS-188, extra heavy weight, coated inside and out with heavy coal tar varnish.

(2) Fittings for steel drainage and waste lines shall be cast iron screwed drainage fittings conforming to USA Specification B-16.4, standard weight.

(3) Fittings for steel vent lines shall be cast iron screwed fittings, steam pattern, Type I Class A, Federal Specification WW-P-501C.

Information Handling Services, 1999
August 12, 1999 05:44:57

(4) Fittings for copper drainage tubing shall be recessed solder-joint, drainage pattern fittings of wrought copper or cast brass. Recesses shall be smooth and correctly sized to provide proper clearance over the tubing.

(5) Fittings for gas lines above ground shall be black malleable iron screwed fittings, 150 lb. class, conforming to USA Specification B16.3. For below ground gas lines, fittings 2" and larger shall be welding type, same material and Schedule as the pipe, and conforming to ASTM Designation A-234. Fittings 1-1/2" and smaller shall be socket welding type, forged steel, 2000 lb.

(6) Fittings for Type L copper tubing shall be wrought copper, soldered fittings conforming to USA Specification B16.22.

(7) Fittings for vitrified clay pipe shall conform to pipe specifications and shall be of the same weight as pipe with which they are installed.

(8) Fittings for steel water lines shall be black cast iron, Type I, Class B, Federal Specification WW-P-501C.

(9) Fittings for PVC lines shall be threaded, schedule 80, of same material as the pipe.

15-B.6 JOINTS

(a) SCREWED PIPE JOINTS shall have full clean cut threads conforming to USA Specification B-2, with ends of pipe reamed, filed and all burrs removed. Joints shall be made with Teflon tape or approved equal compound. Not more than three exposed threads will be permitted. Fittings and pipe shall be free from oil or grease.

(b) ALL PLASTIC COATED STEEL PIPE JOINTS AND FITTINGS shall be welded in accordance with pipe manufacturer's recommendations. Joints and fittings shall be covered with primer and then wrapped with 10 mil polyethylene tape as recommended by tape manufacturer. X-Tru-Tape and primer, or approved equal.

(c) CAST IRON BELL AND SPIGOT PIPE JOINTS shall be caulked with spun oakum and then poured with lead

Information Handling Services, 1999
August 12, 1999 05:44:57

conforming to ASTM Designation B-29 or CS-94, to a minimum depth of 1". At least 12 ounces of lead per inch of pipe diameter shall be used at each joint. In lieu of cast-iron pipe with caulked joints, the Contractor may furnish cast-iron pipe of the same weight and general dimensions but modified to use a neoprene or similar elastic gasket. Pipe shall be manufactured to close tolerances and shall be without beads on the spigot ends. Hubs shall be modified to receive the gaskets. Gaskets shall be capable of maintaining a tight seal with any joint deflection up to 10 degrees. Joints shall be assembled by means of special tools.

(d) COPPER TUBING JOINTS shall be soldered with 95% tin and 5% antimony solder, using a non-corrosive flux. Tubing ends and fitting recesses shall be thoroughly cleaned. Tubing shall be cut square and shall be reamed before being made up. Tubing ends shall enter the full depth of the fitting recesses without binding. Solder shall penetrate fully and shall fill the joint completely.

(e) VITRIFIED CLAY PIPE JOINTS and joints between cast iron and clay pipe shall be made with compression joints of couplings which conform to ASTM C425.

(f) JOINTS IN LEAD PIPE or between lead and brass, copper, ferrules, nipples, bushings or traps shall be full wiped.

15-B.7 UNIONS

(a) UNIONS are required for connecting up all equipment.

(b) UNIONS 2" AND SMALLER shall be screwed or solder type, with spherical ground joint. Unions 2-1/2" and larger shall be of the bolted flanged type. Unions shall be as manufactured by "Crane", or approved equal.

(c) INSTALL INSULATING TYPE UNIONS for connecting ferrous to non-ferrous metals, Crane, or approved equal.

Information Handling Services, 1999
August 12, 1999 05:44:57

15-B.8 GASKETS

(a) GASKETS shall be full face, asbestos composition, 1/16" thick, "Cranite" or approved equal. Coat gaskets with thread lubricant.

15-B.9 VALVES

(a) SCREWED AND FLANGED VALVES shall be rated 200 lbs. for cold water service. Solder joint valves shall be rated 150 lbs. for water service at 200° F. Unless otherwise specified or indicated, all stop valves shall be gate valves. Valves shall be "Crane Company" as specified, "Jenkins", "Walworth", or approved equal.

(b) VALVES FOR STEEL PIPE

(1) Gate Valves - 2" and smaller: bronze wedge disc, rising stem, Crane #428
2-1/2" and larger: wedge disc, iron body, bronze trimmed, flanged pattern, outside screw and yoke, Crane #465-1/2

(2) Globe Valves - 2" and smaller: brass, composition disc, Crane #7
2-1/2" and larger: iron body, bronze trimmed, flanged pattern, Crane #359

(3) Check Valves - 2" and smaller: bronze swing check, bronze disc, Crane #37
2-1/2" and larger: iron body, bronze trimmed swing check, Crane #373

(c) SOLDER JOINT VALVES FOR COPPER TUBING

(1) Gate Valves - bronze, wedge disc, non-rising stem, Crane #1320

(2) Globe Valves - bronze, composition disc, Crane #1310

(3) Check Valves - bronze, swing check, Crane #1342

Information Handling Services, 1999
August 12, 1999 05:44:57

(d) GAS VALVES - 2" and smaller: iron plug cock with brass plug and washer, Crane #1228
2-1/2" and larger: lubricated plug valve, semi-steel, 175 lb. WOG rating, wrench operated, Nordstrom #143 or approved equal

(e) STANDPIPE AND WASHDOWN SYSTEM VALVES shall be Underwriter's pattern, 175 lb. standard, O.S. and Y. type and shall be provided with means for locking in the open position. Locking means may be either a lock shield or padlock eyes and padlock, with two keys for each valve required.

15-B.10 CLEANOUTS

(a) GENERALLY Cleanouts shall be installed at points noted on the drawings, at the foot of each soil and waste stack, not over 50 feet apart in any run of 2" and smaller horizontal waste lines, not over 100 feet apart in any run of horizontal waste lines larger than 2" and at other points where required for easy system maintenance. All shall be accessible. Cleanouts shall be full size of the pipe up to 4". Manufacturer shall be "Zurn", of types specified, "Josam", "Wade", or approved equal.

(b) CONSTRUCTION Cleanouts shall be internal wedge type plug with lead seal or tapered shoulder with straight thread plug and lead seal and cast iron cutoff ferrule.

(c) CLEANOUTS IN FLOORS IN FINISHED ROOMS shall have polished nickel bronze white metal, scoriated frame and access cover and shall be completely adjustable. Cover shall be square for cleanouts in tile covered floors and shall be round for all other floors. Furnish clamping collar where membrane is penetrated. This Contractor shall rough-in and install all cleanouts flush with the finished floor construction. Cleanouts shall be "Zurn" Z-1324 series, or approved equal.

(d) CLEANOUTS IN WALLS IN FINISHED ROOMS shall be "Zurn" Z-1300 or approved equal for soil pipe; "Zurn" Z-1329-20 plug for threaded pipe; with flush access box and cover of polished nickel bronze metal. Covers shall be square for tile

Information Handling Services, 1999
August 12, 1999 05:44:57

or block walls and round for plaster walls, "Zurn" Z-1375-1, or approved equal for square covers; "Zurn" Z-1370-3, or approved equal for round covers. Omit covers in unfinished areas.

(e) CLEANOUTS IN FLOORS IN UNFINISHED ROOMS AND IN OUTSIDE AREAS shall be "Zurn" Z-1326-10, or approved equal, with non-slip scoriated cover, set flush with floor, or in non-surfaced areas set in concrete 14" x 14", 6" deep, flush with finished grade.

15-B.11 SANITARY DRAINAGE SYSTEM

(a) GENERALLY Complete drainage system of cast iron and steel pipe on interior of building shall be extended 5 ft. outside building line. Mains shall be true to line, uniformly graded not less than 1/8" per foot, bedded in dry earth and clean and unobstructed inside. Proper curved fittings shall be used for branch connections and changes in line or grade.

(b) PIPING shall be concealed in construction in all finished spaces and offset to clear beams, ducts or other obstructions.

(c) ELBOWS from vertical to horizontal lines shall be pitched to proper grade of horizontal lines.

(d) BRANCHES shall be run in straight lines and pitched uniformly with grade of 1/4" per foot where possible, but in no case less than 1/8" per foot.

(e) BUILDING DRAIN LINES shall be extended in vitrified clay pipe outside building as shown on plans.

15-B.12 TRAPS

(a) GENERALLY Each fixture and each piece of equipment requiring connection to the sanitary drainage system shall be equipped with a water-sealed trap. Each trap shall be placed as near the fixture as possible.

(b) EXPOSED TRAPS Where exposed to view in finished

Information Handling Services, 1999
August 12, 1999 05:44:57

spaces, traps shall be chromium plated cast brass with cleanout. Traps installed on bell and spigot pipe shall be extra heavy cast iron. Traps installed on threaded pipe shall be recess drainage pattern.

(c) OTHER EQUIPMENT Traps for fixtures or equipment furnished by others and connected under this Section shall be furnished and installed under this Section.

15-B.13 STORM DRAINAGE SYSTEM

(a) GENERALLY Exterior downspouts will be furnished and installed under another Section. The Contractor under this Section shall furnish and install cast iron boots, caulk downspouts into boots watertight and extend storm water lines in cast iron and vitrified clay pipe as shown on the plans. Materials and construction shall be as specified hereinbefore for sanitary drainage system.

15-B.14 VENT LINES

(a) EVERY TRAP SHALL BE INDIVIDUALLY VENTED

(b) MINIMUM SIZES OF FIXTURE VENTS shall be installed as shown in Schedule of Branches hereinafter. Connecting vents shall be sized and run through roof as shown on plans. Vents must be connected into stack vents above highest fixture. Vent stacks shall be supported at each floor by approved wrought iron clamps and brackets.

(c) VENT PIPES SHALL BE EXTENDED a uniform height of 1'-0" above roof line.

(d) EXPOSED VENT CONNECTIONS in finished rooms shall be chromium plated brass.

15-B.15 FLASHING

(a) GENERALLY All vent piping through roof shall be flashed at roof with 4 lb. per sq. ft. sheet lead extending not less than 12" in all directions from pipe along roof line and joined with wiped joint to piece of 4 lb. lead soil pipe extending from roof line up to 2" above top of vent pipe and turned down 1" inside of pipe to permit expansion.

Information Handling Services, 1999
August 12, 1999 05:44:57

15-B.16 NATURAL GAS SERVICE

(a) GENERALLY Connect to existing gas main, extend branch service to new building and install gas pressure regulator station as shown on the plans.

(b) RULES AND REGULATIONS of the local Gas Company shall be strictly adhered to in every detail.

15-B.17 GAS PIPING LAYOUT

(a) GENERALLY A diagrammatic gas piping layout is shown on the drawings. Gas service line shall enter building above grade.

(b) APPLIANCE STOPS AND REGULATORS This Contractor shall furnish and install, if not furnished by others, a gas shutoff cock and a gas pressure regulator for each gas fired appliance installed in the project.

15-B.18 DOMESTIC WATER SERVICE

(a) GENERALLY Connect to and extend existing domestic cold water, hot water and hot water circulating systems as shown on the plans.

15-B.19 WATER PIPING INSTALLATION

(a) GENERALLY Diagrammatic water piping layouts are shown on the drawings. Piping shall be installed with regard to structural features, ductwork and other piping. Additional drops, risers, swings, etc., shall be provided where necessary. Parallel lines shall be straight, truly parallel and regularly spaced. Piping shall be concealed in utility spaces pipe shafts, wall voids, ceiling voids, partitions, etc., in finished portions of building. Piping may be exposed in unfinished areas.

(b) VALVES Furnish and install shutoff valves in main water supplies to each fixture group. Install 1/2" valves with hose ends for drains in all low points of systems. Pitch piping down to drains.

(c) CONNECTIONS Water supplies shall be extended and connected to all fixtures, appliances and

Information Handling Services, 1999
August 12, 1999 05:44:57

fittings requiring water. Piping shall be sized as required by number and type of fixtures supplied.

(d) EXPOSED PIPING All branch piping and connections exposed to view in finshed areas shall be chromium plated.

15-B.20 HOT WATER CIRCULATING PUMP

(a) CONSTRUCTION Centrifugal, in-the-line, bronze body, booster pumping unit of horizontal, oil lubricated, sleeve bearing design and with pipe connections, bronze impeller and spring type flexible coupling between pump and motor, "Bell and Gossett", or approved equal.

(b) MOTOR 115 volt, 60 cycle, single phase, 1750 rpm.

(c) CONTROL Immersion type, reverse acting, adjustable thermostat "Honeywell" No. L-6008 or approved equal, shall be installed in return line and set at 110° F. Thermostat shall start pump at water temperature below 110° F. and stop pump at water temperature above 120° F.

15-B.21 GAS PRESSURE REGULATOR

(a) CONSTRUCTION Regulator shall be of the diaphragm type, with cast iron body, large pliable diaphragm, spring loaded, adjustable over wide range of outlet pressures. Regulator shall have a capacity of not less than 6,000 cubic feet per hour at 8 oz. differential pressure. Regulator shall be "Rockwell" No. 120, or approved equal, 2" in size.

15-B.22 CARBON DIOXIDE FIRE APPARATUS

(a) GENERALLY Furnish and install where shown on the drawings manually operated carbon dioxide hose reel systems connected to rack mounted cylinders. The systems shall comply with Military Specification MIL-D-26355, Paragraph 3.10.

(b) HOSE REELS shall be arranged for wall mounting and shall be installed with centerline 7'-0" above floor. Units shall be complete with mounting brackets, gooseneck connection, 100 feet of 1/2-inch flexible hose, horn valve for temporary shutoff, discharge horn and wall mounted horn clip.

Information Handling Services, 1999
August 12, 1999 05:44:57

(c) CYLINDER ASSEMBLIES shall consist of two 100 pound capacity carbon dioxide cylinders per unit, floor mounted with cylinder supporting rack secured to wall. Cylinders shall stand in their normal upright position. Cylinders shall be standard shipping type made, tested and marked in accordance with current I.C.C. regulations for carbon dioxide containers. Each cylinder shall be equipped with cylinder valve, safety disc and cutter valve, and shall connect to manifold by means of a discharge head and flexible metal loop. Cylinders shall be fully charged.

(d) DISCHARGE Cylinders shall discharge simultaneously by operating the local manual control head.

(e) PIPING Hose reel gooseneck shall be connected to cylinder manifold fitting with standard weight galvanized steel, seamless pipe, Type I, Federal Specification WW-P-406 and galvanized malleable iron or steel screwed fittings.

(f) TESTS of the systems shall be made in accordance with the recommendations of the manufacturer, and in the presence of the Resident Engineer, and without any expense to the Government.

15-B.23 DUPLEX SEWAGE EJECTOR

(a) GENERALLY Unit shall be heavy duty, non-clog centrifugal duplex sewage ejector complete with vertically mounted ball bearing motors, pedestal mounted float switches, cast iron basin and cover-plate. Capacity and head shall be as shown on the plans.

(b) PUMPS Each pump shall have a close grained heavy cast iron volute type casing with a stuffing box and gland on the back, non-clog type cast iron impeller, large diameter stainless steel shaft, grease lubricated sleeve type bottom bearing, extra heavy steel column pipe threaded into the stuffing box assembly at the top and the bearing housing at the bottom, sturdy cast iron motor pedestal with a raised grease lubricated thrust bearing, flanged stuffing box bolted to motor pedestal and flexible coupling.

Information Handling Services, 1999
August 12, 1999 05:44:57

(c) MOUNTING The unit shall be mounted on a heavy steel bolted coverplate with an 11" x 14" manhole. The coverplate shall be bolted to the cast iron basin, with gasket.

(d) SUMP shall be constructed of cast iron, of dimensions and with connections shown.

(e) CONTROL Adjustable float switches and alternator for pumping units shall be installed in the coverplate. Switches shall be pedestal mounted with a bronze rod guided above and below the coverplate, adjustable stops and a sliding copper float ball. Float mechanism shall be installed within a non-ferrous sleeve, extending below "low liquid level" and vented to basin at top.

(f) MOTORS shall be equipped with magnetic starters having overload protection and "hand-off-auto" switch in cover. Motors shall be wound for 460 volts, 3 phase, 60 cycle A.C., and shall be 1150 rpm, vertically mounted ball bearing type, mounted on the driver pedestal.

(g) ALARM Furnish Square D Class 9018 or approved equal diaphragm actuated compression type high water alarm with switch, 2-1/2" bell and transformer. Mount bell on wall above pump.

(h) LUBRICATION Furnish and install an automatic oiler with one quart reservior and separate corrosion resistant oil lines to each bearing. Oil shall be permitted to flow to bearings only when respective motor is operating.

(i) MANUFACTURE The unit shall be as manufactured by "Weil", "Chicago", or approved equal.

15-B.24 DUPLEX STORM WATER SUMP PUMP

(a) GENERALLY Unit shall be heavy duty centrifugal, duplex, non-clog, sump pump complete with cast iron basin, coverplate, factory wired duplex control panel and float switches. Capacity and head shall be as shown on the plans.

(b) PUMPS shall have close grained cast iron, single suction, volute casings, open impellers,

Information Handling Services, 1999
August 12, 1999 05:44:57

self-aligning thrust bearings, stainless steel shafts, renewable bronze bearings with oil lines for lubrication, heavy steel column pipes, cast iron motor pedestals and flexible couplings.

(c) MOUNTING Units shall be mounted on heavy steel coverplate with 11" by 14" manhole, bolted to cast iron basin of dimensions and with connections shown.

(d) CONTROL Adjustable float switches and alternator for pumps shall be pedestal mounted on coverplate, with heavy copper floats, bronze rod, adjustable stops and float guide pipe.

(e) MOTORS shall be heavy duty, rated for continuous duty, open drip-proof, 1150 RPM, vertically mounted, ball bearing type, wound for 460 volts, 3 phase, 60 cycle A.C. Motors shall have magnetic starters, overload protection, and "hand-off-auto" switches in covers.

(f) ALARM Furnish Square D Class 9018, or approved equal, diaphragm actuated compression type high water alarm with switch, 2-1/2" bell and transformer. Mount bell on wall above pump.

(g) LUBRICATION Furnish and install an automatic oiler with one quart reservoir and separate corrosion resistant oil lines to each bearing. Oil shall flow to bearings only when respective motor operates.

(h) MANUFACTURE Unit shall be Model B-700 as manufactured by "Weil", "Chicago" or approved equal.

15-B.25 VACUUM CLEANING SYSTEM

(a) GENERALLY Furnish and install, as shown on the drawings, a central vacuum cleaning system complete with stationary vacuum power unit, vacuum piping system, wall and floor outlets, flexible hoses and cleaning tools.

(b) VACUUM POWER UNIT The unit shall consist of vacuum producer, separator and filter unit factory assembled and mounted on a common structural steel base.

Information Handling Services, 1999
August 12, 1999 05:44:57

(1) The vacuum producer shall be a multi-stage, centrifugal type of two-bearing, standard overhung impeller type, direct driven by a standard open motor, not less than 10 horsepower, wound for 460 volt, 3 phase, 60 cycle A.C. Unit shall be constructed of heavy gauge steel, welded and reinforced and carefully balanced. Bearings shall be of the self-lubricating type.

(2) The collector shall be of welded steel construction and shall operate on the principle of cyclonic separation in combination with filter bags. The collector shall be complete with inlet and exhaust connections, filter bags, filter access door, and easily removable dirt can. Dirt capacity shall be not less than 7-1/2 cubic feet. Exhaust connection shall have a 3-stage muffler, "Burgess", "Maximum", or approved equal.

(3) Unit vacuum shall be not less than 5.0" Hg at machine, 4" Hg at end of 50 feet of 1-1/2" hose with 5/8" orifice and 2.6" Hg with 7/8" orifice. The system shall be capable of operating at least four 1-1/2" hoses simultaneously at standard cleaning vacuum.

(c) PIPING Vacuum piping system shall be constructed of nominal 2 inch, 20 gauge, zinc-coated steel tubing with formed, slip-joint, long radius fittings installed with adhesive or taped joints as recommended by the manufacturer. Inlet assemblies shall consist of valve, mounting bracket, adapter and ring lock. Inlets shall be flush wall or floor mounted and shall be located as shown. Easily accessible cleanout plugs shall be installed where shown and as recommended by the manufacturer. Piping under raised floors shall terminate in floor outlets as shown on the plans, connected with 10 foot lengths of vinyl plastic flexible hose.

(d) ACCESSORIES Furnish all standard accessories including:

(1) Four 25 foot lengths of 1-1/2" vinyl plastic flexible hose (non-wire type) with zinc-plated valve adapter, chromium plated handle and hose couplings.

Information Handling Services, 1999
August 12, 1999 05:44:57

(2) Two four foot wands.

(3) Two sets of floor, rug, upholstery, crevice and dusting tools.

(4) Two wall mounting cartons for accessories. Install cartons where directed by the Resident Engineer.

(e) TEST The completed system shall be tested and proved tight by the Contractor to demonstrate all vacuum and operating capacities and proper operation of the entire system to the satisfaction of the Resident Engineer.

(f) MANUFACTURE The system shall be the following products of the "Spencer Turbine Company", or approved equal.

(1) Vacuum power unit: Catalog No. P-191 (stationary).

(2) Outlets: Type "D" semi-flush wall valves for concealed pipe; Type "E" valves for exposed pipe; Type "F" flush floor standard valves.

15-B.26 ROOF WASHDOWN SYSTEM

(a) GENERALLY The system shall consist of a fixed arrangement of piping, with static and rotating nozzles, together with a two-outlet fire hose connection, arranged as indicated on the plans.

(b) NOZZLES

(1) Static nozzles shall be "Spraying Systems Co." (Bellwood, Ill.), 1/2" No. U8150 or approved equal. Capacity shall be 11.0 gallons per minute at 50 psig, with 80° spray angle.

(2) Rotating nozzles shall be "Junior Ranier No. 856 G2 as manufactured by "Buckner Mfg. Co." (Fresno, Calif.), or approved equal. Capacity shall be not less than 5.2 gallons per minute at 50 psig with 5/32" nozzle.

(c) PIPING Pipe and fittings shall be as specified hereinbefore. Supports shall be as detailed on

Information Handling Services, 1999
August 12, 1999 05:44:57

the plans. Support spacing shall be as recommended by the pipe manufacturer and such that pipe deflection between supports will not exceed 1/4" at ambient temperatures up to 120° F. Piping shall be installed for complete gravity drainage as shown.

(d) FIRE HOSE CONNECTION Furnish and install roof mounted two-way fire hose connection as shown on the plans. Unit shall be sidewalk siamese type, cast brass, 90° body with independent drop clappers, Underwriter's pattern 175 lb. standard shutoff valve in each outlet so that one stream or both streams may be closed, and brass hose caps with chains. Size: 2-1/2" by 2-1/2" by 5". Finish shall be polished brass. Install center of outlets 2'-6" above roof. Flash and counter flash riser to roof, watertight. Hose threads shall match existing building roof hose connection threads, for use of existing hose with new unit. Fire hose connections shall be No. 211 as manufactured by "Seco", "Elkhart", "Allenco", or approved equal.

15-B.27 CLEANING, TESTING, AND ADJUSTING

(a) GENERALLY Cleaning, testing, and adjusting shall conform to the GENERAL REQUIREMENTS FOR MECHANICAL AND ELECTRICAL WORK. The following tests of all work performed under this contract will be required by the Contracting Officer unless otherwise directed, and shall be made in the presence of the Resident Engineer. Existing systems shall not be subjected to test pressures.

(b) DRAINAGE SYSTEMS The drainage and vent piping systems throughout shall be tested upon completion of the rough work and without fixtures or traps connected. All openings, except at the top of stack shall be tightly closed by screw plugs or equivalent devices, and the system shall be entirely filled with water which shall stand without leak or loss of level for a period of four (4) hours.

(c) DOMESTIC WATER SYSTEMS All hot, cold, and hot water circulating water piping, prior to being insulated, shall be tested in place to a hydrostatic pressure of 125 pounds per square inch

Information Handling Services, 1999
August 12, 1999 05:44:57

at the lower floor level, which pressure shall be maintained without pumping for a period of one (1) hour.

(d) STANDPIPE SYSTEMS AND ROOF WASHDOWN SYSTEM shall be tested in place to a hydrostatic pressure of 200 pounds per square inch at the lower floor level, which pressure shall be maintained without pumping for a period of one (1) hour.

(e) GAS SYSTEMS All gas piping shall first be subjected to an air pressure test of 60 psi for a period of 30 minutes, and made tight at this pressure. Then all gas piping shall be given a final test by means of an air pump and a mercury gauge equal to the maintenance of a column of mercury 20" high for a period of twenty minutes, and made tight under said conditions, and the test repeated if any leaks are indicated.

(f) THE ROOF WASHDOWN SYSTEM shall be operationally tested in the presence of the Resident Engineer. The system shall be capable of completely washing to drain 350 pounds of sand passing a No. 50 sieve, uniformly spread over the entire roof, within a period of ten minutes.

(g) ADDITIONAL TESTS The Contractor shall conduct operating tests of equipment and other apparatus installed by him to demonstrate the satisfactory operation of same and the fulfillment of the specified requirements. He shall make any additional tests that may be required by other authorities.

15-B.28 THERMOMETERS

(a) CONSTRUCTION Thermometers shall have aluminum case with epoxy finish, unbreakable acrylic lens, separable brass well, 9-inch scale and stainless steel or non-ferrous bulb. Scale shall rotate 180° and stem shall tilt 180° in 10° increments. Scale range as required. Style 30E by "Taylor" or approved equal.

15-B.29 AIR CHAMBERS

(a) GENERALLY Air compression chambers shall be installed on branch piping at each valve and

Information Handling Services, 1999
August 12, 1999 05:44:57

fixture where supply pipes terminate. Volume of air chambers shall be sufficient to prevent water hammer and shall have a length not less than 18 times diameter of pipe branch, of same diameter as branch pipe.

15-B.30 DISINFECTION OF WATER SYSTEMS

(a) GENERALLY After testing, water systems shall be flushed free of foreign matter and shall be thoroughly disinfected with a solution of not less than 50 ppm of chlorine. Solution shall remain in system for eight hours. Valves shall be opened intermittently to insure complete distribution of disinfectant. After eight hour retention period, flush systems until chlorine content is less than 0.2 ppm. Chemicals shall not be introduced into existing systems.

15-B.31 INSULATION

(a) MANUFACTURE As manufactured by "Certainteed", "Owens-Corning", "L.O.F.", "Johns-Manville", or approved equal.

(b) FIRE RATING All insulation shall have composite fire and smoke hazard ratings as tested by procedure ASTM E-84, NFPA 255 and UL 723 not exceeding Flame Spread = 25 and Smoke Developed = 50. Contractor shall certify in writing prior to installation that all products used will meet the criteria. Accessories such as adhesives, mastics, cements, tapes and cloth for fittings shall have the same component ratings as for insulation. All products or their shipping cartons shall bear a label indicating that flame and smoke ratings do not exceed above requirements. Any treatment of jackets or facings to impart flame and smoke safety shall be permanent. The use of water-soluble treatments is prohibited.

(c) APPLICATION Insulation shall be applied on clean dry surfaces after all tests are completed and shall be continuous through wall and ceiling openings and sleeves. Insulation on all cold surfaces where vapor barrier jackets are used shall be applied with a continuous, unbroken vapor seal.

Information Handling Services, 1999
August 12, 1999 05:44:57

Inserts shall be installed at all hangers or supports. Inserts shall consist of rigid pipe insulation of equal thickness to the adjoining insulation and shall be provided with vapor barrier where required. Metal shields shall be applied between hangers or supports and the pipe insulation. Shields shall be formed to fit insulation and shall extend up to the center line of the pipe.

(d) MATERIAL All cold water lines, condensation drains, hot water and hot water recirculating lines, and all branches, valves and fittings in these lines in building shall be insulated with 1/2" thickness preformed, sectional, glass fiber pipe insulation.

(1) All cold water and condensation drain line insulation shall be finished with glass cloth vapor barrier secured with "Benjamin Foster" 85-20 or approved equal adhesive.

(2) All exposed hot water and hot water circulating line insulation shall be finished with pre-sized glass cloth secured with "Benjamin Foster" 85-20 or approved equal adhesive.

(3) All concealed hot water and hot water circulating line insulation shall be finished with general purpose jacket secured with "Benjamin Foster" 85-20 or approved equal adhesive, and/or outward clinching staples spaced not less than 6" on centers.

(e) EXTERIOR WATER PIPING Makeup water piping to cooling tower shall be insulated above grade with 3/4" preformed, sectional glass fiber applied over electric heat tape and covered with vapor barrier as for other cold water lines, sealed water tight. Install 16 gauge aluminum jacket lapped to shed water and secured with sheet metal screws.

15-B.32 ACCESS DOORS

(a) GENERALLY Access doors shall be furnished and installed under this Section where required for access to valves, drains, and controls. Doors are not required where lift-out ceiling provides such access.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) CONSTRUCTION Access doors shall have steel frame not lighter than 16 gauge with 14 gauge steel panel, or 18 gauge steel reinforced panel, with continuous hinge on one side. Prime coat of white rust inhibitive paint shall be applied at factory. Doors shall have flush, screwdriver operated metal cam fastener. Masonry anchors and 1" wide exposed frame flange shall be furnished for all masonry construction. Casing beads or plaster ground shall be furnished for all plaster construction. A recessed door panel for application of tile on door shall be furnished for all ceiling tile construction.

(c) MANUFACTURE Access doors shall be Types A, K or M "Milcor", by "Inland Steel Products Co.", or approved equal.

15-B.33 SCHEDULE OF BRANCHES

(a) GENERALLY Size piping as shown on drawings and diagrams but not smaller than the following:

Fixture	Waste	Vent	Cold	Hot
Water Closets (Flush Valve)	4"	2"	1"	---
Urinals	2"	1-1/2"	3/4"	---
Lavatories	1-1/4"	1-1/4"	1/2"	1/2"
Service Receptors	3"	1-1/2"	1/2"	1/2"
Drinking Fountains	1-1/4"	1-1/4"	1/2"	---
Laboratory Sink	1-1/2"	1-1/4"	1/2"	1/2"
Wall Hydrants	---	---	3/4"	---
Hose Bibbs	---	---	1/2"	---

15-B.34 SCHEDULE AND DESCRIPTION OF FIXTURES

(a) GENERALLY Fixtures shall be best grade vitreous porcelain enameled ware with true outlines and without pit holes or blemishes. All fixtures of one type to be of one manufacture. All fixtures shall be connected to water, waste and vent lines and thoroughly cleaned. All fittings shall be chromium plated brass.

(b) QUALITY Except as noted, the following fixture catalog numbers are those of American-Standard. Fixtures of Crane, Eljer, Kohler or approved equal will be acceptable.

Information Handling Services, 1999
August 12, 1999 05:44:57

(c) SUPPLIES All supplies shall be rigid, I.P.S. brass.

(d) ESCUTCHEONS All escutcheons on supplies and wastes shall be heavy cast brass, set-screw type.

(e) DESIGNATIONS Letter and number designations of fixtures are those shown on the plans.

(f) SUPPORT The Contractor shall provide proper support for fixtures and piping. Wall-hung fixtures not provided with chair carriers shall be hung with 2" x 4" oak backup piece inside chase, with bolts extending through wall to fixture hangers.

(g) LAVATORY MOUNTING Lavatories shall be secured from the bottom in addition to standard hangers, either by toggle bolts through the wall and perpendicular to the wall, or by brackets secured to wall under lavatories.

(h) TYPE "P-1" TOILETS American-Standard F2222 new Madera vitreous china siphon jet action, floor mounted toilet, two No. 19 bolt caps; Sloan Royal 161YV flush valve and adjustable bar hinge open front elongated black ebony seat (seat operated valve).

(i) TYPE "P-2" LAVATORIES American-Standard F350 Lucerne vitreous china wall hung lavatory, size 20" x 18"; N-2101-8 supply fitting and pop-up drain; R2600 3/8" wall supplies; R7000-44 adjustable "P" trap. Top of rim set 31" above floor.

(j) TYPE "P-3" URINALS American-Standard F6400 Stallbrook vitreous china stall type urinal; Speakman K-9082 or Sloan Roal 186-11 flush valve. Install F6433 vitreous china seam covers where urinals are battery set.

(k) TYPE "P-4" SERVICE RECEPTOR "Williams Serviceptor", "Fiat", or approved equal, size 24" x 24" x 12", constructed of terrazzo with one piece 20 gauge 302 stainless steel cap cast integral on all four sides, flashing flanges on wall sides, 3" caulk

Information Handling Services, 1999
August 12, 1999 05:44:57

outlet; Speakman S-4815 spout with bucket hook, vacuum breaker, 3/4" hose thread on spout, top brace, and 4 foot hose with wall hook.

(l) TYPE "P-5" LAVATORIES American-Standard HF 92172 vitreous china wall hung lavatory complete with front overflow, anti-splash rim, cast in soap dish, basin off center to right hand side and wall hanger; HN 95006-A combination lavatory fitting with aquaseal compression valves, 4" wrist control handles, 3/8" gooseneck spout with aerator, outlet 5" above rim, escutcheons, drain plug with metal grid and 1-1/4" tailpiece, R2698 straight tailpieces with 1/4" pipe thread; HB 15588 3/8" wall supplies with loose key stops and cast escutcheons; HB 15603 1-1/4" cast brass "P" trap with cleanout; HB 15973 1-1/4" threaded pipe nipple with cast escutcheons; size 20" x 18"; top of rim set 31" above floor.

(m) TYPE "P-6" LABORATORY SINK "Hamilton" No. 52W4, or approved equal, soapstone laboratory sink, 1-1/4" thick, 25" long, 21" wide, 46" high, 4-1/2" splash back and ledge cap, standard table frame and leg supports with hot and cold water tray bibbs with hose adaptors, strainer, plug, overflow and lead trap.

(n) TYPE "EWC" ELECTRIC DRINKING FOUNTAIN "Halsey Taylor" WM14A or "Cordley" WHA-12 wall mounted unit with cooling capacity of 12 gph of 80° F water to 50° F with 90° F room temperature, tan or gray vinyl clad finish, wall mounting plate, "American-Standard" R7000-44 adjustable "P" trap and 3/8" R1700 straight stop. Mount rim 40" above floor.

15-B.35 PLUMBING SPECIALTY ITEMS

(a) DESIGNATIONS Letter designations are those shown on the plans.

(b) "W.H." WALL HYDRANTS Cast bronze, construction, non-freeze, key operated wall hydrants, "Josam" Series 1400-N, "Zurn" Z-1395-2, "Wade" W-8605 or approved equal. Finish shall be polished nickel-bronze. Set 18" above grade.

(c) "H.B." HOSE BIBBS 1/2" chromium plated brass,

Information Handling Services, 1999
August 12, 1999 05:44:57

female flanged faucets with lockshield, composition disc, loose key handles and hose end, "Prier" No. C-135SP, or approved equal.

(d) "A.D." AREA DRAIN Cast iron area drain with cast iron, flat cast iron loose set grate, deep seal "P" trap, inside caulk outlet and anchor flange, "Josam" series 110, "Zurn" Z-500, "Wade" W-1430 or approved equal. Install backwater valve, "Josam" Series 1000, or equal where shown.

(e) "F.D." FLOOR DRAINS

(1) Floor drains in floors on grade shall have cast iron body and flange, spigot outlet, integral trap, integral flush adjustable cleanout and nickel brass adjustable strainer. Clamping flange required where floor membrane is used. "Josam" series 250, "Zurn" Z-455, "Wade" W-1120-CO or approved equal. Install "Josam" series 1180-T backwater valve and extension fitting, or equal, where indicated.

(2) Floor drains in floors above grade shall be cast iron body and double drainage flange, adjustable nickel-brass strainer, threaded outlet and seepage holes. "Josam" series 300, "Zurn" Z-415, "Wade" W-1100 or approved equal. Install deep seal "P" trap with cleanout.

(f) "R.F.D." RECESSED FLOOR DRAINS Cast iron rectangular hopper drain with inside caulk bottom outlet, loose set internal perforated strainer and loose set grate. Provide clamping flange where membrane is penetrated. "Josam" series V-60, "Zurn" Z-566 with top grate. "Wade" W-2360-SQ, or approved equal. Install deep seal "P" trap with cleanout. Install "Josam"series 1180-T backwater valve and extension fitting, or equal, where indicated.

(g) STORM WATER BOOTS Cast iron boots extending 24" above finished grade and down to horizontal line. Inlet and outlet shall match connecting downspout and pipe sizes. Anchor boots to masonry or concrete construction. Boots shall be "Neenah Foundry", "Atchison Specialty Co.", or approved equal.

Information Handling Services, 1999
August 12, 1999 05:44:57

(h) "G." GAS OUTLET Hamilton No. 30L204 single outlet gas cock with wall flange, ground key type valve, serrated hose connector, 3/8" I.P.S. male thread inlet, blue button index marked "GAS". Locate as directed to suit laboratory equipment furnished and installed by others.

(i) ROUGH-IN-FOR AND CONNECT UP hot water, cold water, waste and vent to darkroom sink and water mixing valve furnished by others.

15-B.36 STANDPIPE SYSTEM

(a) GENERALLY Furnish and install a fire protection standpipe system, complete in all respects, conforming to all requirements of NFPA. All valves, equipment and special fittings shall be U.L. listed. System shall be connected to the existing fire protection system as shown on the plans and shall be extended to serve the roof washdown system specified hereinbefore.

(b) FIRE HOSE CABINETS Units shall be "Elkhart" as specified, "W.D. Allen", "Seco", or approved equal. Cabinets shall be surface mounted or semi-recessed as shown on the plans. Cabinets shall be "Elkhart" Series 1300, with duo-panel doors, aluminum construction, sized for 1-1/2" valve, No. RSSF hose rack consisting of 1-1/2" cast brass valve, red enameled steel rack, 100 feet of unlined linen hose, U.L. approved fog nozzle, escutcheon and coupling.

(c) FIRE DEPARTMENT VALVES shall be 2-1/2" cast brass, U.L. approved for 250 psig, with rough body and polished trim, hose cap and chain and threads to local Fire Department standard.

(d) FIRE HOSE RACKS shall be "Elkhart" No. RSSF, "W.D. Allen", "Seco", or approved equal, 1-1/2", with rack, hose, valve and nozzle as for fire hose cabinets.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 15 MECHANICAL

SECTION 15C

HEATING, VENTILATING, AND AIR CONDITIONING

15-C.1 GENERAL

(a) WORK INCLUDED This section includes all labor and materials required for the complete and finished installation of heating, ventilating, and air conditioning equipment, facilities, and systems.

(b) SYSTEMS AND EQUIPMENT Involved in the classifications of heating, ventilating, and air conditioning work above are the following:

(1) Hot water boiler, gas-oil fired

(2) Oil storage and piping system

(3) Steam and condensate return piping systems

(4) Hot water pumps and piping system

(5) Water chiller

(6) Chilled water pumps and piping system

(7) Cooling tower

(8) Condenser water pumps and piping system

(9) Single and multi-zone air handling units with hot water and chilled water coils

(10) Systems of supply and return air ductwork

(11) Exhaust ventilating systems

(12) Emergency ventilation system

(13) Temperature control and emergency ventilation control

15-C.2 REFERENCE

(a) ADDITIONAL REQUIREMENTS Attention is called to the GENERAL REQUIREMENTS FOR MECHANICAL AND ELECTRICAL

Information Handling Services, 1999
August 12, 1999 05:44:57

WORK preceding this Section which covers certain important procedures, materials and labor applying directly to the Heating, Ventilating, and Air Conditioning Section.

15-C.3 ELECTRIC MOTORS

(a) GENERALLY All motors, motor starters, and control equipment, unless otherwise specifically noted elsewhere in these specifications or shown on the plans, shall conform to the requirements set forth in the GENERAL REQUIREMENTS FOR MECHANICAL AND ELECTRICAL WORK, and to the following:

(1) Over 1/2 Horsepower:

460 Volt
Three Phase
60 Cycle

(2) 1/2 Horsepower and Smaller:

120 Volt
Single Phase
60 Cycle

(b) WIRING AND INTERLOCK DIAGRAMS All wiring and interlock diagrams shall be furnished under this Section and shall be submitted to the Resident Engineer for approval. Installation of starting and control equipment and final electrical connections in accordance with the approved diagrams will be furnished under the Electrical Section.

15-C.4 PIPING MATERIALS

(a) GENERAL Pipe and fittings shall be of nominal diameter as designated, with inner and outer surfaces concentric, smooth inside, straight, free from weld flaws, blisters or other defects. Each length of pipe and each fitting shall have cast, stamped or indelibly marked on it the maker's mark or name and the weight and quality of the product where such marking is required by the approved standard that applies.

(b) PIPE

(1) All steam, hot water, chilled water, condenser water, blowoff, vent piping and oil piping above

Information Handling Services, 1999
August 12, 1999 05:44:57

ground shall be Schedule 40 black steel pipe conforming to ASTM Designation A120 or A53.

(2) All oil piping and oil gauge lines in ground shall be Type K soft temper copper tubing conforming to ASTM Designation B88, pulled inside rigid galvanized electrical conduit.

(3) All condenser water piping in ground shall be Schedule 40 black steel pipe conforming to ASTM Designation A120 and shall be coated with high density polyethylene in coating thickness of 25 to 60 mils. Adhesive shall be modified rubber blend in 10 mil thickness. Bending of pipe shall not break bond between pipe and coating. Coating shall be "X-Tru-Coat", or approved equal.

(4) All condensate return piping shall be Schedule 40 nickel copper alloy steel pipe, "Youngstown" Yoloy, or "Byers" genuine wrought iron.

(c) FITTINGS

(1) Fittings for screwed steel piping shall be steam pattern, standard weight, cast iron screwed. Install eccentric reducers where required to assure drainage.

(2) Fittings for welded 2" and larger steel piping shall be butt welding type of the same weight as piping conforming to ASTM A-234. Flanges shall be welding neck type, cast steel, USA 150 lb. standard. Welding fittings shall include all elbows, tees, laterals, reducers, etc., which shall be "Tube-Turn", "Ladish", or "Taylor-Forge" full radius type; except that tees may be formed for lines 4" and larger when connecting to lines 6" and larger, by saddling branch into side of main with "Weldolet" or equal saddles; and connection of lines 2" and smaller into lines 2-1/2" and larger may be made with "Threadolets".

(3) Fittings for copper piping shall be wrought copper, solder type conforming to USA Specification B16.22.

15-C.5 VALVES, STRAINERS, AND UNIONS

(a) MARKING AND MANUFACTURE All valves and strainers shall have the name or trademark of the manufacturer

Information Handling Services, 1999
August 12, 1999 05:44:57

and the guaranteed working pressure cast or stamped on the body, and all valves of any one type shall be of the same manufacture.

(b) TYPE Unless otherwise specified or shown on the drawings, all valves shall be 125 psig S.W.P., with sizes 2" and smaller screw end, bronze body, and sizes 2-1/2" and larger flange end, iron body, bronze trimmed.

(c) VALVES Manufacturers' references given in the following table are to indicate a minimum standard of quality and design only.

	BRASS BODY	IRON BODY
(1) Gate Valves, Rising Stem		
Crane	Fig. 428-UB	Fig. 465½
Walworth	Fig. 2	Fig. 726F
(2) Globe Valves		
Crane	Fig. 1	Fig. 351
Walworth	Fig. 58	Fig. 906F
(3) Swing Check Valves		
Crane	Fig. 34	Fig. 373
Walworth	Fig. 406	Fig. 920
(4) Butterfly Valves		
Crane	- - -	Fig. 22FBRB-S93
DeZurik	- - -	Fig. 632
(5) Balance Cocks (Adjustable)		
DeZurik	Fig. 1035	Fig. 101F

(6) Where indicated on the plans, furnish chain wheels for valves and complete with guides and continuous chain extending to six feet above floor.

(d) BUTTERFLY VALVES All stop valves on hot, chilled and condenser water lines 3" and larger shall be butterfly valves with enclosed gear handwheel operator, adjustable stops and position indicator. Valves shall have bubble-tight shutoff at 175 psig differential.

Information Handling Services, 1999
August 12, 1999 05:44:57

(e) BALANCING AND FLOW CONTROL VALVES Chilled and hot water balancing valves for single zone air handling units Nos. 2 and 3 shall be of the adjustable type specified above. All other water balancing valves shall be flow control valves, constant flow type, non-adjustable, "Griswold" Series 3200 for 2" and smaller pipe and Series 3300 for 2-1/2" and larger pipe, or approved equal. Flow control valves shall be set for flow quantities scheduled on the plans for respective equipment.

(f) STRAINERS Strainers shall be iron body with 20 mesh monel screens for water service and 40 mesh monel screens for steam service. Strainers shall be wye pattern, similar and equal to "Crane" #988½ with screw ends for 2" size and smaller, and "Crane" 989½ with flanged ends for sizes larger than 2". Each strainer 2" and larger shall be provided with blow-off valve pipes to a floor drain; 3/4" for up to 3" size, 1-1/4" for 4" to 6" size.

(g) UNIONS Unions 2" and smaller shall be 300 psig S.W.P. malleable iron screw end, with bronze seat ring, similar and equal to "Crane" Fig. 198E or "Walworth" Fig. 7716. Unions 2-1/2" and to 4" size shall be 300 psig S.W.P. and 5" and larger 200 psig S.W.P., three-part flanged unions, with self-seating bronze to iron ball joint, similar and equal to "Walworth" 8301. Install insulating type unions for connecting ferrous to non-ferrous metals.

15-C.6 JOINTS

(a) THREADED pipe joints shall have full clean cut threads conforming to USA Specification B-2, with ends of pipe reamed, filed and all burrs removed. Joints shall be made with Teflon tape or approved equal pipe base joint compound. Not more than three exposed threads will be permitted. Packing threads with lampwick or other material will not be permitted. Fittings and pipe shall be free from oil or grease.

(b) PLASTIC coated pipe joints and fittings shall be welded. Joints and fittings shall be covered with primer and then wrapped with 10 mil polyethylene tape as recommended by tape manufacturer. Primer and tape shall be "X-Tru-Tape", or approved equal.

(c) COPPER TUBING Joints under ground will not be permitted. Joints at terminations shall be brass compression type.

Information Handling Services, 1999
August 12, 1999 05:44:57

(d) WELDED Joints shall be made in accordance with the ASME Code for Pressure Piping and by welding procedures which have been qualified in conformance with Section IX of the ASME Boiler Construction Code. Welders shall be fully qualified and certificates shall be submitted to the Resident Engineer. Where required by the Resident Engineer, oxy-acetylene welding shall be used in lieu of the metal-arc process to avoid electrical interference with existing operating electronic equipment.

15-C.7 PIPING INSTALLATION

(a) GENERALLY Diagrammatic piping layouts are shown on the drawings. Piping shall be installed with regard to structural features, ductwork and other piping. It shall be this Contractor's responsibility to notify the Resident Engineer before proceeding with work if a conflict arises between the work under this Section and other work. Additional drops, risers, traps, air vents, drains, etc., shall be provided where necessary. Parallel lines shall be straight, truly parallel and regularly spaced. Piping shall be concealed in utility spaces, pipe shafts, ceiling voids, etc., in finished portions of building. Piping shall be exposed in mechanical equipment rooms and other unfinished areas.

(b) BRANCHES All branch takeoffs shall be made with 90° elbows and shall be run direct as practical to riser. Connections from risers to mains to assure unrestricted circulation, eliminate air pockets, permit complete drainage of system and not trap or force coils or elements.

(c) EXPANSION AND ANCHORAGE Install anchors, expansion joints, pipe braces and swing joints as shown on plans and as required to prevent damage to pipe and fittings from expansion.

(d) VENTS Manual air vents shall be installed at all high points, pockets and where shown on plans. Where an air vent is required in an inaccessible location, a 1/4" copper line shall be run from the top of the high point down concealed to a suitable accessible location where a manual air vent shall be installed.

(e) DRAINAGE Steam lines shall pitch not less than one inch in twenty feet where condensate in steam line flows in same direction as steam. Steam lines shall pitch not less than one inch in two feet where condensate in steam line flows in opposite direction to steam.

Information Handling Services, 1999
August 12, 1999 05:44:57

Return lines shall pitch not less than one inch in twenty feet. Chilled water, hot water and condenser water lines shall pitch not less than one inch in 100 feet.

15-C.8 FLEXIBLE PIPE CONNECTIONS

(a) PIPING 2" AND SMALLER Connections shall be as specified in Section 15A.

(b) PIPING 2-1/2" AND LARGER Connections shall be molded black teflon bellows with monel reinforcing rings, three control units and ductile iron flanges, dynamically rated with 4 to 1 safety factor for 110 psi working pressure at 220° F. Type R-6904 as manufactured by "Flexonics", or approved equal.

15-C.9 EXPANSION JOINTS

(a) GENERALLY Expansion joints (compensators) 3" and smaller shall be two ply monel or stainless bellows type with limit stops, internal guides, internal positive anti-torque device, maximum of 175 lb. working pressure and 750° F. operating temperature, installation clip or spacer to be removed after installation, male thread or welding ends and 1-1/2" traverse. Units shall be "Flexonics" Model H, "Kopperman" Type T, or approved equal. Expansion joints 4" and larger shall have Type 304 stainless steel hydraulically formed bellows, cast nickel iron control rings, 300 lb. design, 150 lb. flanged or welding ends and traverse as shown on plans or as required. Units shall be "Flexonics" Controlled-Flex, "Kopperman" Type J-109, or approved equal.

(b) ANCHORS Pipe anchors shall be constructed of steel plate or pipe sections welded as required and clamped or welded to pipes. Anchors shall be securely anchored to building structure with channels and angles as required. Install pipe anchors adjacent to one side of expansion joints or compensators and where shown on plans.

(c) GUIDES Expansion joint or compensator pipe alignment guides shall be bolted split spider and outer ring, as manufactured by "Flexonics", "Kopperman" or approved equal. Install first pipe alignment guide not more than 4 pipe diameters from expansion joint or compensator on opposite side of anchor and the second guide not more than 14 pipe diameters from the first guide. Remainder

Information Handling Services, 1999
August 12, 1999 05:44:57

of guides shall be spaced in accordance with Expansion Joint Manufacturer's Association Standards of "Flexonics" Pipe Alignment Guide Spacing Chart. Guides shall be securely anchored to building structure with channels and angles as required.

15-C.10 STEAM TRAPS

(a) THERMOSTATIC traps shall be angle or straight pattern with union inlet connections and removable seats, brass or bronze body, phosphor bronze or monel bellows, stainless steel valve head, and renewable stainless steel seat. Thermostatic traps shall not be used for equipment over 165 EDR capacity. Traps shall be "Sarco" Series 9, "Dunham" No. 1-3, or approved equal.

(b) FLOAT AND THERMOSTATIC traps shall have stainless steel removable valve seat, semi-steel body and cover, copper flats and brass mechanism. Traps shall be designed for working pressure of 15 psig with capacity based on 1 psi pressure drop. Traps shall be "Sarco" Type FTL, "Dunham", "Webster", or approved equal.

(c) CAPACITIES Trap capacities shall be based on the equipment condensate rate times a factor of 5 for modulating steam control and times a factor of 3 for equipment without modulating control.

(d) INSTALLATION Float and thermostatic traps shall be installed with scale pocket, gate valve and strainer upstream and gate valve downstream, in that order. Unions shall be installed on both sides of each trap.

15-C.11 OIL STORAGE TANK

(a) GENERALLY Underground cylindrical fuel oil storage tank shall be furnished and installed for operation in conjunction with the hot water boilers. The tank shall be provided with the tappings and fittings noted on the drawings, and with 20" manhole with bolted, gasketed cover. All pipe connections to tank shall be extra-heavy welded full couplings.

(b) CODES AND CAPACITY The oil storage tank shall be made of steel or wrought iron and shall comply with the "Standard for Design and Construction of Underground Storage Tanks of the Underwriters' Laboratories, National Board of Fire Underwriters" and shall be so labeled. Size of tank shall be as noted on drawings.

Information Handling Services, 1999
August 12, 1999 05:44:57

(c) CORROSION PROTECTION The tank shall be painted two coats of red lead at the factory and two coats of black asphaltum at time of installation. The tank shall be electrically grounded in an approved manner.

(d) INSTALLATION The tank shall be securely anchored to reinforced concrete pad as detailed on drawings. All anchor bolts, hold-down straps, tie rods, and mat inserts shall be furnished as required. A sand cushion shall be provided and backfill over tank shall be compacted as specified in Section 2B.

(e) OIL At the time directed by the Resident Engineer the fuel oil storage tank shall be filled by and at the expense of the Contractor with commercial grade (No. CS-12-48) or diesel 28-40API.

(f) FITTINGS The tank shall be equipped with locking watertight fillcap "Clay & Bailey" No. 94, or approved equal. Suction pipe strainer shall be "Clay & Bailey" No. 306 or approved equal. Foot valve and strainer shall be "Clay & Bailey" No. 304 or approved equal.

15-C.12 OIL TANK GAUGE

(a) GENERALLY Furnish "King" gauge system C (compressed air not available), or system A (compressed air available), or approved equal gauge system complete with 3/8" copper transmission tubing, tank top fitting and gauge indicator with liquid as required.

15-C.13 BREECHING

(a) CONSTRUCTION #14 gauge black steel breeching with welded seams, connecting boiler to stack. Support from structure with 3/8" rods 5'-0" on centers.

(b) ACCESSORIES Install a hinged asbestos gasketed cleanout door at each bend. Where required by the boiler manufacturer for proper operation, install double-acting barometric damper, "Field" or approved equal, of required size for boiler capacity.

15-C.14 BOILER CHIMNEY

(a) GENERALLY The boiler chimney shall be the prefabricated refractory type listed by Underwriters' Laboratories, Inc. for use with medium heat appliances. Chimney shall be "Van-Packer" Model H.T., "Zurn Power-Pac" Model PH-11, or approved equal.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) ARRANGEMENT The chimney shall be supported on the Lower Level Floor, with tee or wye connection for breeching, shall extend through First and Second Floors and through Roof, terminating three feet above Roof level with rain cap.

(c) CONSTRUCTION Each chimney section shall be up to 4 ft. in length with an insulating refractory wall encased in 12 gauge galvanized steel jacket. Insulating refractory shall be flush and square with ends of jackets to insure 100% bearing surface between sections after erection. Insulating refractory shall be suitable for continuous operation at 1800° F. and intermittent operation at 2000° F. and shall be centrifugally cast into the metal jacket. Slumped or poured mix is not acceptable. Chimney sections shall be circular with inside diameter as shown on plans. Assembly shall be made by joining chimney sections with high temperature acid-resistant joint cement and covering joint with aluminized steel draw band. All materials shall be as supplied by, or recommended by, the chimney manufacturer. Chimney shall be supported floor to floor utilizing the manufacturer's standard floor supports and companion sections. The vertical expansion joint shall have a 1-1/2" overlap and shall be filled with non-setting, low-shear grout. The external joint shall consist of a metal band and refractory felt, the band to be secured to the floor support section. Field fabricated floor supports are not acceptable on this specification. Intermediate supports shall be designed according to the manufacturer's recommendations and shall be of sufficient strength to carry the assigned load.

(d) INSTALLATION The chimney shall be installed in accordance with specifications of Underwriters' Laboratories and the manufacturer. Breeching connection shall be welded.

15-C.15 CONDENSATE PUMP

(a) GENERALLY The unit shall be an automatic, electric, duplex, condensate pump with bronze fitted enclosed impeller, mechanical seals, cast iron underground tank in floor with gas-tight cover plate, motors, float switches, disconnect switches and automatic alternator mounted as a unit and wired for operation, "Weil" Type NRG, "Nash", "Ingersall-Rand", or approved equal.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) MOTORS 1750 rpm, 460 volt, three phase, 60 cycle A.C., with overload protection and magnetic starters.

(c) CAPACITY shall be as shown on plans based on 20 lb. discharge pressure and minimum single pump capacity of 1.5 gpm of 210° water per 1000 EDR.

15-C.16 HUMIDIFIERS

(a) GENERALLY Humidifiers shall be of a type which discharge clean dry steam without objectionable noise or drip into ductwork of air handling systems. Design shall utilize steam jacketed separating chamber, asbestos wick muffler and stainless steel steam jacketed distribution manifold. Units shall be complete with full modulating, direct acting, pneumatic motor operated steam valve, fine mesh strainer and suitably sized discharge manifold. Capacity shall be as shown on plans. Refer to "Automatic Control Equipment", herein for control. Units shall be manufactured by "Armstrong" or approved equal.

15-C.17 COMPRESSION TANKS

(a) SIZES shall be as shown on the plans.

(b) CONSTRUCTION Tanks shall be welded steel, constructed for a working pressure of 125 psi per ASME Code and so stamped. Provide tappings for lines shown on plans.

(c) FITTINGS Tanks shall be fitted with full tank range gauge glass and tank fitting, "Bell and Gossett" Type AFT or ATFL, or approved equal.

(d) SUPPORT Provide saddle supports and suspend from structure with 1/2" rods.

15-C.18 GAUGE COCKS

(a) GENERALLY At the inlet and outlet of each water coil, the Contractor shall furnish and install a 1/4" "Weksler" or equal brass gauge cock, mounted on a steel pipe nipple of sufficient length to extend through the insulation.

15-C.19 THERMOMETERS

(a) GENERALLY Furnish and install where shown on the plans thermometers having aluminum case with epoxy finish, unbreakable acrylic lens, separable brass well, 9-inch

Information Handling Services, 1999
August 12, 1999 05:44:57

scale and stainless steel or non-ferrous bulb. Scale shall rotate 180° and stem shall tilt 180° in 10° increments. Scale range as required. Thermometers shall be "Taylor" Style 30E or approved equal.

15-C.20 WATER MAKEUP REDUCING VALVES

(a) GENERALLY Chilled water and hot water system valves shall have iron or brass body, 3/4" connections, with working parts of brass and with easily cleaned built-in strainer, factory adjusted for 20 lb. delivery pressure, "Bell and Gossett" No. 7 or approved equal.

15-C.21 AIR SEPARATORS

(a) GENERALLY Units shall be factory fabricated and shall be constructed in accordance with ASME Code and stamped for 125 lb. working pressure. Units shall be guaranteed to separate free and entrained air from systems and prevent compression tanks from waterlogging. Units shall have removable, galvanized steel, perforated sleeve strainer basket with 3/16 inch perforations with free area at least 5 times the area of the connecting pipe. Nominal size shall be that of connecting piping. Separator shall be "Bell & Gossett" Rolairtrol, or approved equal.

15-C.22 GAUGES

(a) GENERALLY Furnish and install where shown on the plans gauges with brass or stainless steel cases, gasketed cover glass, 4-1/2" dial, bronze or stainless steel movement with bushed bearings and of the rotary adjustment type. Bourdon tube shall be phosphor bronze with silver brazed joints. Accuracy shall be at least 1% over dial range. Gauges shall be "Ashcroft" No. 1020 or 1030 or approved equal.

(b) ACCESSORIES Each gauge shall be installed with 1/4" brass tee handle cock, "Ashcroft" 1092 or approved equal. Furnish 1/4" brass coil pipe siphon for all gauges on steam lines "Ashcroft" No. 1/4-1098B or approved equal.

15-C.23 WATER PUMPS

(a) GENERALLY Pumps shall have capacities and heads as shown on the plans. Submittal data shall include characteristic curves. Pump efficiencies at specified conditions shall be within 3% of maximum efficiency for the impeller furnished.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) CONSTRUCTION Pumps shall be centrifugal, end suction, vertically split case, flexible coupled, base mounted, bronze fitted construction, with bronze shaft sleeves where water contacts shaft or with stainless steel shaft, enclosed bronze impellers, replaceable casing wearing rings, and mechanical seals and ball bearings arranged for routing lubrication. Seals shall be suitable for continuous operation at 225° F.

(c) MOTORS shall be non-overloading, wound for 460 volt, three phase, 60 cycle A.C., 1750 rpm, standard NEMA open type, ball bearing construction.

(d) MOUNTING Each pump shall be set on an isolated inertia base as specified in Section 15A. Pump and motor shall be installed, accurately aligned and started in accordance with manufacturer's recommendations.

(e) MANUFACTURE Pumps shall be "Bell & Gossett" 1510, "Aurora" GGU, "Allis Chalmers" F-2L, "Fairbanks-Morse" Fig. 5500, "Taco" LP, or approved equal.

15-C.24 CHEMICAL FEEDERS FOR CHILLED AND HOT WATER SYSTEMS

(a) GENERALLY Construct and install pot-type chemical feeders as shown on the plans. Vessels shall be constructed of schedule 80 steel pipe with welding caps or end closures and 2000 pound forged steel coupling connections.

15-C.25 COOLING TOWER-CONDENSER WATER CHEMICAL FEED SYSTEM

(a) GENERALLY Furnish and install a complete chemical feed system, ready for operation as shown on the plans and as follows:

(1) "H.E. Anderson" or approved equal "Bleed-Trol" control unit complete with transistorized conductivity relay to sense chemical composition of water, electrode assembly, D.C. amplifier, rectifier, thermistor bias control, solenoid valve, three-way bypass, and necessary piping.

(2) "Precision" electric motor diaphragm pump Model 821 or approved equal, complete with P.V.C. head and fittings, oil emersed 120 volt, 60 cycle A.C. motor and 53 gallon polyethylene tank with lid. Pump capacity shall be 20 GPD at 100 lbs. pressure.

Information Handling Services, 1999
August 12, 1999 05:44:57

(3) Provide 3/8" plastic line to condenser water return line (to tower) and PVC injection fitting installed as recommended by manufacturer. Route plastic injection line in continuous steel channel for mechanical protection.

15-C.26 FLOW SWITCHES

(a) GENERALLY Flow switches shall be installed in the chilled and condenser water branches to the refrigeration machine, on the machine side of branch line stop valves. Switches shall be of the "sail" type suitable for 125 psig working pressure and arranged with 1-1/4" male pipe thread connection. Switch shall be U.L. listed, single pole, double throw, rated 7.4 amperes at 115 volts A.C. Switches shall be "McDonnell Miller" No. FS7, or approved equal, installed in strict accordance with manufacturer's instructions.

15-C.27 LOW PRESSURE HOT WATER BOILER

(a) GENERALLY The low pressure hot water boiler unit shall consist of a steel multi-pass firetube boiler, boiler fittings, burner equipment and automatic controls. The boiler (with all piping and wiring) shall be completely factory assembled on a structural steel base as a self-contained unit. Both boiler and burner must be the product of the same manufacturer, or regularly catalogued as a jointly rated assembly.

(b) LABELS AND APPROVALS Boiler design and construction shall be in accordance with the ASME Code for 30 psig water pressure. The complete unit shall bear Underwriters' Laboratories Label "B", and shall be Factory Mutual approved. Unit shall also meet requirements of all state and local code regulations.

(c) CONSTRUCTION Boiler shall be horizontal firetube "Scotch marine" type with a centrally located furnace, with return tubes evenly spaced and arranged for free circulation on the water side and equalized flow of combustion gases at the rear tube sheet and return tubes. Adequate handholes shall be provided for access to the water side of the boiler. A handhole or clean out opening shall be provided at the lower part of one tube sheet so that the entire bottom of the boiler may be cleaned. Hinged or davited doors shall be provided at both front and rear of boiler to provide access to furnace and all

Information Handling Services, 1999
August 12, 1999 05:44:57

first critical speed. Bearings shall be sealed, self-aligning, lubricated type, with proper lubrication fitting (and extended lubrication lines where bearings are not fully accessible), and furnished with initial factory lubrication.

(g) BLOWERS Centrifugal blowers shall be backward curved or airfoil type, and shall be double inlet style. Wheels shall be statically and dynamically balanced, and shall have the proper number of blades to insure quiet and efficient operation. Construction classification shall be not less than that recommended by AMCA for the duty involved.

(h) CASINGS Casings shall be fully braced and rated for the total static pressures imposed, and so arranged that all internal parts are fully accessible by convenient removal of panels, access doors, etc. Casings shall be bonderized or phosphatized and finished prime coat, or may be mill galvanized.

(i) INSULATION Casings insulation shall be waterproof, not less than 1" thick, and with a "K" factor not higher than .25. Drain pan insulation shall be similar to casing insulation in thickness and "K" value, and shall be protected by a complete sheet steel inner pan to which the drain connections attach; or may be a homogeneous, waterproof sheet of expanded plastic material of equivalent thermal insulating capability, without the inner pan liner; or may be rigid heavy density fiber glass board insulation fully protected with heavy, homogeneous coating of bitumatic waterproofing material to points well above maximum water line. Inner steel pan liner shall be galvanized or otherwise suitably protected against corrosion.

(j) CAPACITIES AND ARRANGEMENTS Capacities and operating limitations shall conform to the schedule on the plans, and unit arrangements shall be as indicated.

(k) SPACE LIMITATIONS Contractor's attention is called specifically to the space limitations involved. Otherwise acceptable units with physical dimensions requiring more space than those shown on the plans, or which would otherwise hinder proper maintenance procedures, will not be considered.

Information Handling Services, 1999
August 12, 1999 05:44:57

to the other may be immediate and without burner change. Electric gas valves, gas electric ignition system, gas flow regulating valve, gas shutoff cock, electric oil valve, fuel oil pump unit complete with strainer and pressure regulating valve are to be piped to the burner ready to operate. An air interlock switch shall prevent burner operation until draft is established. A fuel selector switch shall be provided for changeover of control from one fuel to the other. Burner location and firing method to be such that combustion takes place within the water-backed furnace of the boiler. Vital burner parts such as fuel nozzles, flame scanner and ignition assembly shall be enclosed in a protective steel housing.

(k) CONTROLS Burner controls shall provide "off-on" firing sequence, with low fire start, and shall include the following:

(1) Limit control for automatic start and stop of burner operation and safety high limit control.

(2) Dual low water cut-off control to cause shut-down of unit when water level drops to minimum safe level.

(3) Air safety switch to prevent operation until sufficient combustion air is assured.

(4) An electronic type combustion flame safeguard and programming unit providing prepurge and post purge cycles with full protection against flame failure. Safety shutdowns shall require manual reset.

(5) Burner motor controller with thermal overload and undervoltage protection, and control transformer.

(6) Control circuit fuses.

(7) Indicator lights for low water and flame failure.

(l) CONTROL INSTALLATION All controls shall be panel mounted and so located on the boiler as to provide ease of servicing the burner and boiler without disturbing the controls; and also to prevent possible damage by water, fuel, or heat of combustion gases. Controls connected to water or fuel shall be installed outside the main boiler control panel. All controls

Information Handling Services, 1999
August 12, 1999 05:44:57

shall be mounted and wired according to Underwriters' Laboratories and National Electrical Code requirements.

(m) INSPECTIONS Factory boiler inspection shall include a hydrostatic test in the presence of an inspector having a National Board Commission. He shall certify a Data Report which shall be delivered with the boiler as evidence of ASME Code compliance. In addition to ASME symbol, the boiler shall bear a National Board Registration number.

(n) TESTS Performance test shall be rendered on the complete units with the specified fuels prior to shipment from factory, with operational adjustment of controls, check of all safety devices, recording of stack temperature and analysis of flue gases. Certificates of this test shall be furnished with the units.

(o) INSTRUCTIONS Instructions for installation, operation, and maintenance of the boiler shall be contained in a manual provided with each unit. Record of fire tests shall be included in this manual.

(p) SUPERVISION Supervision of startup and instruction of operating personnel shall be provided by a factory trained engineer. Instruction shall consist of not less than one (1) normal 8 hour day, and shall include control system operation, flame analysis and adjustment, maintenance procedures, and trouble shooting techniques. The instruction period shall be scheduled by the Contracting Officer.

(q) QUALITY AND CAPACITY Boiler unit shall be "Cleaver Brooks", "Kewanee", or "Continental". Capacity shall be as scheduled on the plans, and shall be for job-site altitude.

15-C.28 WATER CHILLER

(a) GENERALLY Furnish and install one electric motor driven, centrifugal water chiller, located and arranged, and with capacities as shown on the plans. Unit shall suit the space available without limiting access.

(b) DRIVE The unit shall be of the hermetically sealed type and shall be driven by a water or refrigerant cooled motor. Motor shall be of the squirrel cage type designed for operation at 460 volts, 60 cycle, 3 phase, 3600 rpm. The hermetic motor shall drive directly a centrifugal

Information Handling Services, 1999
August 12, 1999 05:44:57

compressor at 3600 rpm. The motor shall be supplied with a separate force feed lubricating system consisting of an oil sump, hermetically sealed motor driven pump to provide proper lubrication, and filter for delivering clean oil to the motor bearing. The oil shall be thermostatically controlled to maintain proper oil temperature for lubrication and to prevent dilution of oil by refrigerant. If motor is water cooled, water regulating valve shall be furnished and cooling water piping shall be field installed in accordance with manufacturer's recommendations.

(c) EVAPORATOR AND CONDENSER The unit shall be complete with shell and tube type water cooled condenser and evaporator of copper integral finned-tube construction. Each tube shall be individually replaceable with the tube ends rolled into tube sheets. Both ends of the evaporator and condenser shall be provided with flanged water connections suitable for 150 psi working pressure. Evaporator shall be provided with a diaphragm type safety blow-off valve, the discharge of which shall be piped to the outside of the building as shown on the plans. Capacity shall be based on a fouling factor of .0005 on both the evaporator and condenser.

(d) CAPACITY CONTROL Unit shall be provided with a capacity control system consisting of automatically controlled variable inlet vanes at the entrance of each impeller and shall provide continuously variable capacity from 10 to 100% output. This control system shall include automatic stopping when load falls below 10 percent and automatic restarting. The temperature controller shall be provided for remote mounting with its bulb mounted in the chilled water supply line leaving the chiller. Where the Automatic Control system is pneumatically operated, pneumatic-electric switch shall be furnished to activate the cooling circuit. 20 psi of dry and filtered air will be supplied to the controller as specified under Automatic Control System, hereinafter.

(e) INSTRUMENTATION AND CONTROL The unit shall be equipped with an instrument and gage panel on which shall be located gages indicating the condenser pressure, evaporator pressure, lubricating oil pressure and purge drum pressure. This panel shall contain switches permitting manual or automatic operation of the oil pump and the purge pump. A switch shall be furnished for the purge oil separator heater and pilot lights shall be furnished to indicate operation of these devices. The additional following controls shall be included in the control panel:

Information Handling Services, 1999
August 12, 1999 05:44:57

(1) Evaporator low temperature cutout.

(2) Condenser high pressure cutout.

(3) Motor high temperature cutout.

(4) Differential oil pressure controller so interlocked that the compressor will only operate if adequate oil pressure is maintained to the bearings.

(5) Current limiting device shall operate the capacity control machine mechanism to limit the load on the compressor motor to a safe maximum.

(6) Current demand limiter with manual control switch and capacity indicator to limit electrical current to the machine for less than full load requirements.

(7) Contacts in the starting circuit for remote chilled and condenser water flow switches.

(8) Items (1), (2), (3), above shall be arranged in a lockout circuit provided with a reset pushbutton and individual pilot lights on the face of the panel.

(f) PURGE UNIT shall be furnished, consisting of a motor driven purge compressor provided with an automatically heated oil separator and a sectionalized separator drum permitting separation of the non-condensable gases and water from the discharge of the purge compressor. Means shall be provided for returning only refrigerant to the evaporator. The purge system shall contain a solenoid valve that will automatically isolate the purge system from the machine when the purge compressor is not in operation. Motor shall be 1/4 HP suitable for 120 volts, 60 cycle, single phase operation.

(g) INSTALLATION Contractor shall set the unit on isolation pads specified hereinbefore. The evaporator shell and water boxes and certain other parts of the machine shall be insulated as specified hereinafter. Manual vent valves shall be installed to completely vent the condenser and evaporator water boxes and hose end valves shall be connected to condenser and evaporator drain connections. All drain and vent valves shall be mounted in an accessible location.

Information Handling Services, 1999
August 12, 1999 05:44:57

(h) ELECTRICAL EQUIPMENT This Contractor shall provide to the electrical subcontractor one compressor motor starter, star-delta closed transition type with manual reset type overloads. The starter shall be designed for 460 volts, 60 cycle, 3 phase and shall provide 2 steps of acceleration. The Contractor shall also furnish one across-the-line starter 1/4 HP, 60 cycle, 3 phase for the lubrication oil system. Both starters shall be suitable for 120 volt separate control. A 2 KVA control transformer, line voltage to 120 volts, shall be provided for operation of the control and interlocking system. All electrical and control wiring shall be done by the electrical subcontractor. A wiring diagram tailored to the specified job requirements shall be furnished by the manufacturer showing interconnection of the chiller with its oil pump, the chilled and condenser water flow switches, and all interlocking control devices specified above, and in the automatic control and electrical portions of the specifications.

(i) MANUFACTURE Water chiller shall be "Trane", "Carrier", or approved equal.

(j) INSTRUCTIONS for installation, operation and maintenance shall be contained in a manual furnished with the unit.

(k) START-UP The Contractor shall completely charge and lubricate the unit and shall furnish to the Resident Engineer, additional refrigerant, in standard containers, equal to the full charge of the machine. Supervision of charging, lubrication and start-up and instruction of operating personnel shall be provided by a factory trained engineer. Instruction shall be not less than one normal 8 hour day in addition to start-up time and shall include control system operation, and maintenance procedures. Instruction period shall be as scheduled by the Contracting Officer.

15-C.29 COOLING TOWER

(a) GENERALLY Furnish and install an induced draft, vertical discharge, packaged, crossflow-type cooling tower. Total horsepower requirements shall not exceed 10 HP. Capacity, location and arrangement shall be as shown on a reinforced concrete slab not less than 6 inches thick, sized for the cooling tower actually furnished.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) CASING AND LOUVERS Casing shall be 3/8" corrugated asbestos cement board with lapped joints. Louvers shall be corrugated asbestos cement board of sufficient thickness to prevent sagging and shall be slipfit.

(c) HARDWARE AND FINISH All bolts, nuts and washers shall be galvanized steel. All steel used in the construction of the cooling tower shall be galvanized. Standard coating shall be 2-1/4 oz. per square foot.

(d) DISTRIBUTION BASIN Open gravity type distribution basin using plastic diffusing type metering orifices shall be provided. Flanged connections and flow control valves shall be provided for condenser water return.

(e) MECHANICAL EQUIPMENT The fan shall have four or six cast aluminum blades and cast iron or cast aluminum hub. Each blade shall be individually adjustable and attached. Fan drive shall be thru parallel shaft, helical gear reduction unit with external oil fill line and oil sight gauge. Motor shall be flange mounted and shall be 1800 RPM, 3 phase, 60 cycle, 460 volts, totally enclosed, air over or fan cooled type. The fan cylinder shall be designed with eased inlet for efficient fan operation. V-belt drive shall not be provided.

(f) COLLECTION BASIN The cold water collection basin shall be minimum 12 gauge steel bottom with 12 gauge steel sides, self cleaning, with depressed center section; basin shall be complete with cleanout and drain, steel side suction connection with suction screen and anti-cavitation device and mechanically operated automatic make-up water valve.

(g) SOUND Sound levels in occupied spaces 50 feet from the cooling tower shall not exceed NC 60.

(h) FILL AND DRIFT ELIMINATORS Fill shall be light weight, non-corrosive polyvinyl chloride. Drift eliminators shall be two-pass non-corrosive honeycomb supported in steel frames. Maximum allowable drift loss 0.2 of 1% of the water circulated. Air inlets shall be covered with No. 2 mesh, .063" galvanized wire screens.

(i) ACCESS AND SAFETY Access panels shall be provided on both endwalls for access to the eliminator and plenum section. A heavy gauge, galvanized wire, grille type fan guard shall be provided over each fan cylinder.

Information Handling Services, 1999
August 12, 1999 05:44:57

(j) RAILING AND LADDER Steel angle handrail and posts shall be furnished to extend 3'-6" above fan deck. Steel angle rail ladder or ladders shall be furnished to afford access to all parts of the tower.

(k) HEATER FLANGE Furnish standard 3"-150 lb. standard flanged connection in side of hot water basin for electric heating element.

(l) MANUFACTURE Cooling tower shall be "Marley" series NC, or approved equal.

15-C.30 AIR HANDLING UNITS NOS. 1, 2, 3 AND 8

(a) GENERALLY Air handling units shall be "Carrier", "McQuay", "Buffalo", "Worthington", "Trane", or "American Standard", factory assembled fan and coil units.

(b) SINGLE ZONE UNITS NOS. 2 AND 3 Single zone air handling units shall be draw-through type, complete with centrifugal blower(s); motor with base and drive; chilled water cooling coil and hot water heating coil (or separately mounted reheat hot water coil as shown on the plans); face and by-pass dampers; filter section; drain pan; drain connections; and internally insulated heavy gauge steel casing. Motors shall be of the two-speed, two winding type. Units shall be arranged for top removal of coils.

(c) MULTI-ZONE UNITS NOS. 1 AND 8 shall be blow-through type, complete with centrifugal blower(s), motor with base and drive; chilled water cooling coil and hot water heating coil; zone mixing dampers; drain pan; drain connection and internally insulated heavy gauge steel casing.

(d) COILS Cooling and heating coils shall be of copper tube and mechanically bonded aluminum finned construction, rated 200 psig working pressure for water.

(e) MOTORS AND DRIVES Drive motors shall be ball bearing type, open frame, 1750 rpm, and mounted externally. Each motor shall be provided with an adjustable motor base, and adjustable pitch V-belt drive with guard. Motors shall be wound for 460 volt, 3 phase, 60 cycle A.C.

(f) SHAFTS AND BEARINGS Fan shafts shall be dynamically balanced, and sized so that maximum rpm is well below

Information Handling Services, 1999
August 12, 1999 05:44:57

first critical speed. Bearings shall be sealed, self-aligning, lubricated type, with proper lubrication fitting (and extended lubrication lines where bearings are not fully accessible), and furnished with initial factory lubrication.

(g) BLOWERS Centrifugal blowers shall be backward curved or airfoil type, and shall be double inlet style. Wheels shall be statically and dynamically balanced, and shall have the proper number of blades to insure quiet and efficient operation. Construction classification shall be not less than that recommended by AMCA for the duty involved.

(h) CASINGS Casings shall be fully braced and rated for the total static pressures imposed, and so arranged that all internal parts are fully accessible by convenient removal of panels, access doors, etc. Casings shall be bonderized or phosphatized and finished prime coat, or may be mill galvanized.

(i) INSULATION Casings insulation shall be waterproof, not less than 1" thick, and with a "K" factor not higher than .25. Drain pan insulation shall be similar to casing insulation in thickness and "K" value, and shall be protected by a complete sheet steel inner pan to which the drain connections attach; or may be a homogeneous, waterproof sheet of expanded plastic material of equivalent thermal insulating capability, without the inner pan liner; or may be rigid heavy density fiber glass board insulation fully protected with heavy, homogeneous coating of bitumatic waterproofing material to points well above maximum water line. Inner steel pan liner shall be galvanized or otherwise suitably protected against corrosion.

(j) CAPACITIES AND ARRANGEMENTS Capacities and operating limitations shall conform to the schedule on the plans, and unit arrangements shall be as indicated.

(k) SPACE LIMITATIONS Contractor's attention is called specifically to the space limitations involved. Otherwise acceptable units with physical dimensions requiring more space than those shown on the plans, or which would otherwise hinder proper maintenance procedures, will not be considered.

Information Handling Services, 1999
August 12, 1999 05:44:57

15-C.31 AIR HANDLING UNITS NOS. 4, 5, 6 AND 7

(a) GENERALLY Air handling units shall be "Liebert Corporation", "Weber Showcase and Fixture Company", "Blazer Company", or approved equal single zone, factory-assembled, down-discharge units specifically designed for discharging to a raised floor plenum. Capacities shall be as scheduled on the plans.

(b) TYPE AND COMPONENTS Units shall consist of enclosing cabinet, top return air grille, filter section, chilled water coil, hot water reheat coil, steam humidifier, draw-through blower section and bottom discharge.

(c) SIZE Units shall be approximately 72" wide, 31" deep and 72" high and shall suit the limited space available, with adequate space for operation, maintenance, coil removal, filter removal and access panel swings.

(d) CABINETS shall be completely enclosed, constructed of 16 gauge steel with welded steel frame, easily removable 16 gauge panels, 1" thick inside insulation, painted and baked enamel finish to match CDC equipment.

(e) FILTERS shall consist of 1" thick glass fiber throwaway pre-filters and 24" x 24" x 12" replaceable media secondary filters, each rated 2,000 cubic feet of air per minute, "American Air Filter Vericell" with No. 9 media, "Cambridge", or approved equal. Filters shall be removable from either side of unit through hinged doors.

(f) COILS Chilled water and hot water reheat coils shall be constructed of copper tubes with aluminum fins, rated for 200 psig working pressure and of sizes and ratings scheduled on the plans. Coils shall be arranged for uniform air flow over entire face area.

(g) DRAIN PAN shall be constructed of stainless steel and shall be piped to bottom of unit for external connection.

(h) HUMIDIFIERS shall be of the "Armstrong", or approved equal type, as specified hereinbefore, sized as scheduled on the plans and arranged for motor operation of the pneumatic or electric type to match the Automatic Control system furnished.

(i) BLOWERS shall be of the multiple type on single shaft, double inlet, low speed, quiet design, with rubber mounted bearings, lifetime lubrication, adjustable mounting

Information Handling Services, 1999
August 12, 1999 05:44:57

frame, and variable pitch 2-belt pulley. Blowers shall be dynamically balanced.

(j) UNITS shall be completely pre-wired to terminal strips ready for field connections. Electrical source shall be 460 volts, 3 phase, 60 cycle A.C., and blower motors shall be wound for these characteristics.

(k) CONTROLS shall be of the pneumatic or electric type as specified under "Automatic Control Systems", hereinafter, and shall be of the same manufacture as for other new control systems. At the Contractor's option, controls and control valves inside unit cabinets may be installed and pre-piped or wired at the factory, or may be field installed. All other piping shall be factory installed.

(l) MOTOR STARTERS for blowers shall be factory installed within units and shall be furnished for starting from the central control panel. Lights shall be installed on exterior of cabinets to indicate blower operation. Starters shall have auxiliary contacts for manual tripping as shown on the plans.

(m) FLOOR STAND Each unit shall be furnished with a vibration isolation floor stand extending from the structural slab to the top of the raised floor. The stand shall effectively isolate units from the raised floor system and shall provide vibration isolation between units and the structural slab. This Contractor shall direct the raised floor Contractor in construction of the floor system around units for proper fit and air seal.

(n) START-UP SERVICE When directed by the Resident Engineer, the Contractor shall provide the services of an engineer from the unit manufacturer's factory to place the units in successful operation and to instruct Government employees in proper operation and maintenance of the equipment.

15-C.32 CABINET UNIT HEATERS

(a) CONSTRUCTION Centrifugal blowers shall be isolated from cabinet to prevent transmission of vibration. Hot water coil tubes and headers shall be of copper or copper alloy construction. The composite coil and header system shall be welded or brazed together. Casings shall be die formed furniture steel, bonderized with baked on enamel finish. Provide access opening in casings to

Information Handling Services, 1999
August 12, 1999 05:44:57

motors, fans, coils, etc. Discharge grilles shall be adjustable, double deflection type.

(b) MOTORS shall be split phase or capacitor, single speed, 120 volts, 1 phase, 60 cycle, resiliently mounted to unit and with overload protection. Provide manual on-off switch located behind flush hinged door in front of cabinet. Switch shall be factory mounted and factory wired to motor.

(c) CAPACITIES shall be as shown on the plans. All ratings shall be based on Standard Test Code of ASHRAE with 220° F. inlet water, 20° F. drop and 60° F. entering air.

(d) TYPES AND MANUFACTURE Floor mounted surface units shall have plenum bases furnished with unit similar to "Modine" Model C, arrangement 08. Ceiling surface mounted units shall be similar to Modine Model CW, arrangement 50. Units shall be "Modine", "Herman-Nelson", "American-Standard", "Nesbitt", "Trane", or approved equal.

15-C.33 ELECTRIC IMMERSION HEATER

(a) GENERALLY Furnish and install electric heaters in cooling tower warm water basin as shown on the plans.

(b) CONSTRUCTION Heater shall be copper sheathed electric elements with tinned 3" - 150 lb. standard steel flange. Heater shall be of the 3-element type of capacity shown on the plans, having a heating rating of 40 watts per sq. in. Heater shall be designed and constructed for outdoor installation, with gasketed, moistureproof, head assembly. Heater shall be "Chromalox" Type TM-3, "Indeeco" or approved equal.

15-C.34 EMERGENCY AIR HANDLING UNIT

(a) GENERALLY The emergency air handling unit shall consist of blower cabinet, with field assembled filter section, inlet damper section and future filter section, arranged as shown on the plans. Filters, dampers and sheet metal work shall be as specified hereinafter.

(b) BLOWER CABINET The unit shall be as specified for Air Handling Units, hereinbefore, except as follows:

(1) Blower shall be Class II construction with backwardly inclined, airfoil section blades.

Information Handling Services, 1999
August 12, 1999 05:44:57

(2) Unit shall be designed and constructed for roof-top, outdoor mounting and shall be water and air-tight. All joints and seams shall be continuously welded. All access doors shall be of heavy construction with positive seating, airtight gaskets. Hinged doors with locking type operating handles shall be provided for full access to blower compartment.

(3) Drive motor, sheaves, belts and rails shall be located within the cabinet. Motor shall be wound for 460 volts, 3 phase, 60 cycle A.C.

(c) MANUFACTURE Unit may be factory fabricated, as specified for Air Handling Units, or may be field fabricated of equal construction, subject to approval of detailed fabrication drawings.

(d) CAUTION The emergency air unit is designed for operation under radiological fallout conditions and will be tested for water and air tightness, and specified capacities for that service.

15-C.35 SHEET METAL WORK

(a) GENERALLY The Contractor shall furnish and erect all supply, return, and exhaust air ventilating casings, ducts, risers, branches, elbows, dampers, etc., necessary to make the complete systems, in accordance with recommendations of the latest "Duct Manual and Sheet Metal Construction for Ventilating and Air Conditioning Systems, Section I - Low Velocity Systems", published by SMACNA, and as indicated on the drawings. All ductwork shall be constructed of mill-bonderized galvanized steel sheets. Such ductwork as is hereinafter specified to be painted, shall be constructed of steel sheets equal to "Zincgrip-Paintgrip".

(b) SUPPORTS All horizontal ducts shall be rigidly supported by means of 18 gauge strap hangers spaced not more than 6'-0" on centers, securely fastened into the construction above. All vertical ducts shall be supported with angles riveted to the duct and fastened to wall or partition on not over 6'-0" centers. All ductwork shall be left clean inside.

(c) CROSS-BRAKING All rectangular duct panels 12" or larger, not internally lined or externally insulated, shall be cross-broken.

Information Handling Services, 1999
August 12, 1999 05:44:57

(d) TURNING VANES Where square elbows are indicated on the plans, or are otherwise necessary, turning vanes equal to "Tuttle & Bailey Ducturns" shall be installed. Shop built double-vane turning vanes, constructed to SMACNA Duct Manual Standards, will be acceptable.

(e) TAKE-OFFS At each branch from a main duct, and at each sweeping take-off to an air outlet, there shall be provided a splitter damper with an adjustable device. At all other take-off boots to air outlets of any type there shall be provided "Santrols", "Deflectrols", or equal air straightening devices.

(f) DAMPERS Splitter dampers shall be shop constructed of same materials as ductwork. Damper rods shall be square steel rods with "U" bolts, and with marked adjustment settings, "Young" Type CRS No. 660 or equal. End bearings shall be equal to "Young" No. 654, 5, 6, or 9.

(g) DAMPER REGULATORS Damper regulators in concealed areas or above accessible ceilings shall be equal to "Young", "Valcolox" key-locking lever handle regulators, fitted to the duct. Regulators in exposed areas shall be equal to "Young" flush mounted, adjustable cover, C.P. concealed type, No. 315, 6, 7, or 8. All units shall have marked adjustment settings.

(h) INSTALLATION Ducts shall be installed to leave sufficient head room in all cases, and where it becomes necessary to change the size or shape of a duct to conform to structural or architectural conditions, the Resident Engineer shall be consulted for resizing or rerouting.

(i) ROOF PENETRATIONS Where ducts pierce roof to terminate in fans, adequate flashing and counterflashing shall be provided to exclude any rainwater from entering building through duct roof penetrations.

(j) SCREENS All forced air inlets or outlets from the building shall be provided with 18 gauge galvanized steel wire bird screens, in suitable removable frames of same material as the outlet or inlet.

(k) ACCESS DOORS IN SHEET METAL WORK

(1) Locations. Wherever necessary in ductwork, there shall be provided suitable access doors and frames to permit inspection, operation and maintenance of

Information Handling Services, 1999
August 12, 1999 05:44:57

all valves, controls, filters, fire dampers, bearings, or other apparatus concealed behind the sheet metal work. All such doors shall be of double construction of not less than No. 20 gauge sheet metal and shall have sponge rubber gaskets around their entire perimeter.

(2) Insulted Doors. Doors in insulated ducts shall have rigid fiberglass insulation between the metal panels.

(3) Construction. In no case shall access to any items of equipment requiring inspection, adjustment, or servicing require the removal of nuts, bolts, screws, wing nuts, wedges, or any other screwed or loose device. It is the intention of this specification that all access doors be hinged with heavy brass flat hinges and latched with clinching type brass latches.

(1) ACOUSTICAL LINING Ductwork noted or specified to have acoustical lining is sized on the plans for air flow dimensions. Ducts shall be constructed to allow for full acoustical lining thickness.

15-C.36 FLEXIBLE CONNECTIONS

(a) GENERALLY Flexible connections shall be furnished and installed between all fan units and connecting ductwork.

(b) CONSTRUCTION Flexible connections shall consist of a clean 2" break between metal ducts, jointed by a waterproof and fire-resistant glass fabric double coated with neoprene, equal to "Ventglas". Fabric shall be fastened to ductwork with sheet metal binding strips and sheet metal screws or rivets.

15-C.37 AIR INTAKES AND DISCHARGES

(a) LOUVERS Air intake and discharge louvers will be furnished and installed under another Section.

15-C.38 MANUAL DAMPERS

(a) CONSTRUCTION Manual dampers for multi-zone balancing shall be opposed blade type with positive locking quadrant which shall hold damper blades securely in the desired position and shall indicate the relative position

Information Handling Services, 1999
August 12, 1999 05:44:57

of the damper blades. Quadrants shall be mounted in accessible locations. Quadrants shall be as manufactured by "Ventfabrics, Inc.,", "Elgen" or approved equal.

15-C.39 MANOMETERS

(a) GENERALLY Furnish and install a manometer at the filter section of each of the air handling units. Manometers shall be mounted where they can be easily read and shall have a range of 0 to 3.0" w.g., "Dwyer" Model 25, "Ellison" 3000 Series or approved equal.

15-C.40 GRILLES, DIFFUSERS, REGISTERS, AND OUTLETS

(a) GENERALLY Each supply, return, exhaust, or other duct terminal shall be provided with a grille, register, or outlet as noted on the plans and/or specified herein.

(b) CEILING DIFFUSERS shall have adjustable flaring members or cones, equalizing grid, key operated damper and baked aluminum enamel finish. Square Diffusers: "Anemostat" EA-1 with Combo Unit, "Barber-Colman" SFSJ, or approved equal. Mounting styles shall suit ceiling construction.

(c) SUPPLY AIR GRILLES IN FLOORS shall be heavy aluminum construction with natural anodized finish, 1/4" wide zero degree deflection louvers spaced 1/2" on centers with key operated opposed blade dampers; "Barber-Colman" TBAV, "Waterloo" AL 10, "Titus" C-2535 or approved equal.

(d) RETURN AIR GRILLES in First Floor lay-in ceilings shall be 9/16" x 9/16" virgin acrylic "egg-crate" louver providing 45° viewing cutoff, milk white in color.

(e) WALL AND CEILING RETURN REGISTERS Return registers shall be "Barber-Colman" Type GER, "Titus" Type RL-230, "Waterloo" Type 3HD, or equal with loose-key face-operated opposed blade register. Blades shall be fixed, 45° type spaced to be sight-proof when viewed perpendicular to face.

(f) EXHAUST GRILLES AND REGISTERS Exhaust grilles and registers shall be the same as return registers, except opposed blade damper will not be required when one grille only is connected to the exhaust system.

Information Handling Services, 1999
August 12, 1999 05:44:57

(g) GRILLE, REGISTER, AND DIFFUSER FINISH All steel wall and ceiling units or grille cores shall have baked enamel finish; aluminum for walls and off-white for ceilings. Units shall not be installed until building painting is complete.

(h) DOOR GRILLES Door grilles will be furnished and installed under another Section.

15-C.41 IN-LINE CENTRIFUGAL FAN

(a) GENERALLY Fan shall have steel housing, backward inclined non-overloading wheel, direct drive with gasketed access panel, internal vibration isolation, self-acting backdraft damper, angle supports for horizontal mounting and rod suspension. Motor shall be wound for 460 volts, 3 phase, 60 cycle A.C. Fan shall be "Penn Centrex," or approved equal, of capacity shown on the plans.

15-C.42 FACTORY FABRICATED SOUND ABSORBERS

(a) GENERALLY Factory fabricated sound absorbers shall be installed in return air opening to CCC mechanical equipment room as shown on the plans. The units shall be complete with sound absorbing material, protective facing and outer zinc-coated steel casing which shall be internally baffled and supported so that, under an internal pressure of 10-inches water gage, the casing will not leak or deflect more than 1/2-inch. Lining materials shall be held in place with compression to prevent settling. Protective facing over lining shall be zinc-coated steel, metal mesh-glass cloth facing, or formed rigid lining material with bonded woven glass cloth facing. Perforations shall be small enough to prevent erosion of the absorbing material or shall be backed by a second material that will prevent such erosion. Manufacturer shall be Koppers, IAC, Korfund, or approved equal.

(b) ATTENUATION The sound attenuations of factory fabricated sound absorbers shall be not less than the values given in the following table when tested in a duct, without air flow, by a method which measures upstream and downstream sound levels without the effects of end reflections, bypassing or room absorption:

Information Handling Services, 1999
August 12, 1999 05:44:57

Duct Service	Octave Bands, Cycles Per Second			
	150 300	300 600	600 1200	1200 2400
Main Low Press Supply	13	24	30	33

Published catalog data or a certified laboratory test report showing sound attenuation characteristics of each sound absorber shall be submitted for approval.

15-C.43 UTILITY SET EXHAUST FANS

(a) GENERALLY Utility sets shall be installed at locations and of capacities shown on the plans and shall be suspended or base mounted as indicated. Ratings shall be in accordance with AMCA Standards and Methods of Ratings.

(b) CONSTRUCTION Units shall have centrifugal fans mounted on rigid steel base with motor. Fans shall be "V" belt driven with drives sized for 150% of motor horsepower.

(c) MOTORS shall be 1750 RPM, NEMA standard open type and shall be furnished with overload protection and magnetic starter with pushbuttons in cover for remote surface mounting. Refer to plans for voltage and phase.

(d) MANUFACTURER shall be "American Standard", "Peerless", "Trane", or approved equal.

(e) DAMPERS Furnish and install aluminum gravity-acting damper with felted edges in the discharge of each exhaust fan.

15-C.44 FIRE DAMPERS

(a) GENERALLY Fire dampers shall be of the stacked or interlocking blade design. In the closed position each blade shall fully interlock with its adjacent blade. Blades shall be fabricated of 18 gauge steel. Entire assembly shall be given a rustproof protective coating. Units shall meet all NFPA requirements and shall have U.L. label. Dampers shall be "Airstream Products", "M & T", or approved equal.

15-C.45 AIR FILTERS

(a) LOCATIONS Air filters shall be provided for all air

Information Handling Services, 1999
August 12, 1999 05:44:57

handling units and/or other locations as indicated on the plans.

(b) MULTI-ZONE UNIT FILTERS shall be high velocity flat type, "Continental" Type HA and JA, "Farr" Type 44, "American Air Filter" Type HV, or approved equal, permanent, cleanable, all metal impingement type, not less than 2" thick. Media shall be encased in galvanized steel frames, not lighter than 16 gauge. Pressure drop of clean filters shall not exceed .12" W.G. at 500 feet per minute face velocity. All filters shall be provided with galvanized steel holding frames, not lighter than 16 gauge, arranged for easy removal.

(c) SINGLE ZONE UNIT NOS. 2 AND 3 FILTERS shall be of the sectional type, 24" x 24" x 8-3/4", having a rating of 1000 CFM per section and an average arrestance of 87.5% by the A.F.I. Code test method. Unit frames shall be assembled with No. 7 rivets, calking between frames to prevent air leakage and frames securely fastened to casings and caulked airtight. Number and arrangement of filter sections shall be as shown on plans. Filters shall be "American Air Filter" PL-24, with 5-ply airmat media, "Cambridge", or approved equal. Furnish an extra set of filter frames for each unit and a supply of media equal to one complete refilling of all units furnished.

(d) SINGLE ZONE UNIT NOS. 4, 5, 6 AND 7 FILTERS shall be as specified hereinbefore with the units.

(e) EMERGENCY AIR FILTERS shall be radiological, 99.97% efficient, particulate, replaceable type conforming to U.S. Army Chemical Corps Specification MIL-F-50052. Sections shall be 24" x 24" x 11-1/2" deep, rated 1200 CFM. Initial resistance shall not exceed 1.1" W.G. Each section shall be equipped with neoprene and cork gasket and shall be retained by 6 transit case latches, Signal Corps style SM-B-1 43130, cadmium plated. Special airtight holding frames shall be furnished by the filter manufacturer to insure filtering integrity. Each filter shall be tested in accordance with MIL-STD. 282 (DOP Test Method). Filters shall be "American Air Filter" astrocel absolute filter, "Cambridge", or approved equal.

(f) FRESH AIR FILTERS for CCC and CDC ventilation air shall be 1" thick, glass fiber, throwaway type in galvanized steel holding frame, not lighter than 16 gauge, arranged for easy removal.

Information Handling Services, 1999
August 12, 1999 05:44:57

15-C.46 INSULATION

(a) GENERALLY Insulation shall be as manufactured by "Certaineed", "Owens Corning", "L.O.F.", "Johns-Manville, or approved equal. Glass fiber insulation shall have "K" value not exceeding 0.22 Btu/sq.ft./°F/hr. at a mean temperature of 75° F.

(b) FIRE RATINGS All insulation shall have composite fire and smoke hazard ratings as tested by procedure ASTM E-84, NFPA 255 and UL 723 not exceeding Flame Spread = 25 and Smoke Developed = 50. Contractor shall certify in writing prior to installation that all products used will meet the criteria.

(1) Except for canvas jackets, accessories such as adhesives, mastics, cements, tapes and cloth for fittings shall have the same component ratings as listed above.

(2) All products or their shipping cartons shall bear a label indicating that flame and smoke ratings do not exceed above requirements.

(3) Any treatment of jackets or facings to impart flame and smoke safety shall be permanent. The use of water-soluble treatments is prohibited.

(c) APPLICATION Insulation shall be applied on clean dry surfaces after all tests are completed and shall be continuous through wall and ceiling openings and sleeves. Insulation on all cold surfaces where vapor barrier jackets are used shall be applied with a continuous, unbroken vapor seal. Inserts shall be installed at all hangers or supports and shall consist of rigid pipe insulation of equal thickness to the adjoining insulation and shall be provided with vapor barrier where required. Heavy gauge metal shields shall be applied between hangers or supports and the pipe insulation. Shields shall be formed to fit insulation and shall extend up to the center line of the pipe.

(d) STEAM, CONDENSATE AND HOT WATER PIPING All steam, condensate return and hot water piping and all valves and fittings in these lines shall be insulated with preformed, sectional insulation. Piping 3" and smaller shall be insulated with 3/4" thick glass fiber or 1" thick magnesia. Piping 4" to 6" inclusive shall be insulated with 1" thick glass fiber or 1-1/2" thick magnesia. All exposed insulation shall be finished with presized glass cloth secured with "Benjamin Foster"

Information Handling Services, 1999
August 12, 1999 05:44:57

85-20 adhesive or approved equal. All concealed insulation shall be finished with general purpose jacket secured with "Benjamin Foster" 85-20 adhesive or approved equal, and/or outward clinching staples a maximum of 6" on centers.

(e) CHILLED WATER PIPING All chilled water piping, valves and fittings shall be insulated with 1-1/2" thick, pre-formed glass fiber insulation with vapor barrier. All exposed insulation shall be finished with pre-sized glass cloth vapor barrier smoothly secured with "Benjamin Foster" 85-20 or approved equal adhesive. All concealed insulation shall be finished with concealed vapor barrier smoothly secured with "Benjamin Foster" 85-20 or approved equal adhesive and/or outward clinching staples where required. Apply a brush coat of "Banjamin Foster" 85-20 or approved equal over the staples. All fittings shall be insulated with fiberglass fitting covers. Valves and flanges shall be insulated with pre-molded pipe covering. The insulation shall be equal thickness to the acjacent pipe insulation. All fittings shall be vapor sealed with a layer of glass fabric embedded between two 1/16" thick coats of "Benjamin Foster" 30-35 or approved equal. Lap seal glass fabric at least 1" on itself and adjoining insulation.

(f) CHILLED WATER EQUIPMENT

(1) Chilled water pumps and removable heads on chiller evaporator shall be insulated with sectional, removable, galvanized steel housings containing not less than 2" thickness of granular cork or loose fill mineral wool.

(2) Chiller evaporator and chilled water air separator shall be insulated with 1-1/2" thick glass fiber or 2" thick 85% magnesia blocks. Blocks shall be tightly butted with joints staggered and shall be secured with No. 16 gage galvanized annealed steel wire for small areas and No. 14 gage wire or 1/2" x .015" galvanized steel bands on 12" centers for large areas. Where required, provide welded studs, clips or angles as anchors for wires and bands. 1" hexagonal mesh wire shall be tightly stretched in place over insulating blocks and secured by wiring to anchors with edges tied together. Apply 1/4" thick coat of insulating and finishing cement trowelled to a smooth finish. All corners are to

Information Handling Services, 1999
August 12, 1999 05:44:57

be reinforced with corner bead. Insulation shall be finished with presized glass cloth secured with "Benjamin Foster" 85-20 adhesive.

(3) Chiller suction piping to the first stage compressor, and all other chiller surfaces subject to sweating, as determined from operating test, shall be insulated either as specified for chilled water piping or for evaporator, hereinbefore.

(g) BREECHING shall be insulated as specified for chiller evaporator, except that 2" thick, high temperature (1200°) blocks shall be used.

(h) DUCT INSULATION - LINER The following ducts shall be lined with 1" thick, 2 lb./cubic foot density glass fiber liner conforming to the standards of NFPA 90A.

(1) All outside air ducts

(2) Air handling unit supply ducts

(3) Emergency air supply ducts

(4) Air handling unit return air ducts

(5) Exhaust ducts where noted on the drawings

The duct liner shall be cut to assure snug corner joints and installed so the black surface of the liner faces the air stream. Duct liner shall be applied to the flat sheet with a 100% coverage of "Benjamin Foster" 85-20 or approved equal adhesive. On horizontal runs, tops of ducts over 12" in width and/or sizes over 16" in height shall be additionally secured with Gripnail or welded pins and speed clips on a maximum of 15" centers. On vertical runs, Gripnail or welded pins and speed clips shall be spaced on a maximum of 15" centers on all width dimensions over 12". Mechanical fasteners shall start within 2" of leading edge of each section, and within 3" of the leading edge of all cross joints within the duct sections. Mechanical fasteners shall be flush with the liner surface.

15-C.47 PAINTING

(a) EXPOSED CANVAS WORK All exposed canvas covered work shall be painted one coat of approved size in preparation for finish painting.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) CONCEALED WORK All work in concealed spaces such as pipe chases or attics above ceilings, shall not be painted, except that bare ferrous metal shall be painted one coat of red lead primer.

(c) ALL OTHER WORK All other painting or preparation therfor shall be as called for in the GENERAL REQUIREMENTS FOR MECHANICAL AND ELECTRICAL WORK.

15-C.48 AUTOMATIC CONTROL EQUIPMENT

(a) GENERALLY Complete systems of pneumatic, electronic or electric control shall be furnished as shown on the plans or specified herein. Systems shall be complete with all controlling elements, tubing, control valves, dampers, damper motors, relays, incidental to a finished job. Systems shall be "Johnson Service Company", "Powers Regulator Company", "Honeywell" or "Barber-Colman".

(b) ELECTRICAL If an electric or electronic control system is furnished, all conduit, wire, boxes, relays, etc., and installation shall be by the Control Subcontractor unless specifically shown otherwise on the electrical plans. Refer to electrical specifications for type of conduit, wire, etc., required. All power and interlock wiring for the control system shall be furnished and installed as a part of and in accordance with the requirements of the Electrical Section. Any electronic or low voltage wiring required for control equipment shall be furnished and installed in conduit as a part of the control system. Control panels shall be internally factory prewired to properly identified terminal blocks.

(c) COMPRESSED AIR PIPING

(1) Generally. All compressed air piping throughout the building shall be seamless, hard drawn copper tubing, either single tube or multiple tube bundles, with sweat type fittings, except that final connections within panels or to control devices (up to two feet in length) may be soft drawn copper or virgin polyethylene plastic tubing; or compressed air piping may be virgin polyethylene plastic tubing in its entirety. Number of tubes per bundle shall depend upon job requirements.

(2) Polyethylene Tubing. Polyethylene tubing shall be single or multi-tube bundles, shall have an ambient

Information Handling Services, 1999
August 12, 1999 05:44:57

temperature range of not less than -100° F. to +175° F. and an operating temperature capability of not less than +120° F. for continuous operation. Pressure ratings shall be not less than 600 p.s.i. burst pressure and 160 p.s.i. working pressure at 72° F. operating temperature. Tubing shall be capable of meeting the requirements of ASTM D1693 test (modified) for thermal and environmental characteristics. Testing reports of batch samples shall be submitted to the Contracting Officer if so requested before or during job progress. Bundled tubing shall consist of multiple tubes, wrapped together with "mylar" tape, and covered with not less than a .062 inch jacket of polyvinyl chloride to provide further mechanical protection.

(3) Installation and Testing. All compressed air piping shall be run concealed in the building construction wherever possible, but whether concealed or not shall be run parallel to the building construction in a neat, careful, and workmanlike manner, subject to the approval of the Resident Engineer. Piping system shall be tested at 30 p.s.i.g. for a period of 24 hours, during which the pressure drop (ambient temperature compensated) shall not exceed 2 pounds.

(4) Supports. Compressed air piping shall be supported at not more than eight feet on centers, and at each loop and offset. Concealed piping shall be supported by wall clips, and an approved type of power driven concrete nails and fasteners. Exposed piping shall be supported by standard pipe straps and approved screw type fasteners, and where multiple pipes are run across open areas between control devices, same shall be strapped and/or banded together to give a presentable appearance. Proper precautions shall be taken to prevent damage to piping during or after completion of construction. In piping around building obstructions and/or other pipes, ducts, or conduits, no loose sags or bends in the air piping will be permitted.

(d) CONTROL SYSTEM AIR SUPPLY Control air shall be taken from the existing system. All air supplied to controls in the new building addition shall be dehydrated, using the manufacturer's standard self-contained, refrigeration unit.

Information Handling Services, 1999
August 12, 1999 05:44:57

(e) VALVES AND DAMPERS All automatic control valves and all automatic control dampers other than air handling unit mixing, zone and dampers and face and by-pass dampers shall be furnished by the Automatic Control Manufacturer and installed under his supervision by the Contractor. Dampers shall be of the opposed blade type. Outside air dampers shall have gasketed edges and angle wind stops.

(f) FREEZE PROTECTION Coil freeze protection shall be provided for multi-zone Air Handling Units Nos. 1 and 8 duct thermostat with an extended averaging sensing element, installed in each air unit inlet plenum, preventing opening of the respective ouside air damper if air temperature there is below 38° F.

(g) CONTROL CENTER The automatic control Subcontractor shall furnish and install a walk-in type control center for the new building addition located as shown on the plans.

(1) The control center frame shall be fabricated from No. 6063-T5 aluminum alloy extrusions or 1-1/2" x 1-1/2" x 3/16" angle iron. The front, sides, back and top shall be completely enclosed with plastic laminated (Graphmite) panels constructed from 1/2" thick mica flakeboard laminated on both sides with 1/16" Formica or equivalent material (plexiglass and steel are not acceptable). The plastic laminate material must be impervious to water, acids, alkalines and shall be resistant to scratches. The Graphmite panels shall be supported firmly and securely within the enclosure frame. No screws or bolts shall penetrate the panels. Furnish with one hinged access door on the side of the control center. The side requiring the access door will be determined by location of control center on the job site.

(2) The interior of the control center shall be non-reflective white throughout. Provide 110 volt duplex receptacle for the interior of the enclosure. Furnish two (2) 110 volt rapid starting fluorescent fixtures, minimum 20" length, with a self-actuating door switch interlocked to the access door.

(3) Furnish and install a work shelf on the face of the control center. Shelf shall be 14" wide, mounted

Information Handling Services, 1999
August 12, 1999 05:44:57

on face of enclosure with top surface of shelf 30" from the floor. Shelf shall be covered on top, sides and bottom with Formica plastic laminate material same as enclosure panels.

(4) Furnish control center with an aluminum canopy light, securely attached to the top of the enclosure frame. The canopy shall be extruded aluminum with provision made for inserting plastic laminate strips on the fascia and ends, of a color to match the rest of the enclosure. The canopy shall permit the light to be reflected completely and evenly over the face panel. The canopy shall be equipped with rapid start fluorescent fixtures, extending the full width of the enclosure. A toggle switch to control the canopy light shall be mounted on the right corner post of the enclosure.

(5) All temperature indication shall be continuous reading type. Indicating receivers shall have 3-1/2" face dials or tray gauge type. Transmitters shall be room type and remote bulb type with sensing elements of the type as indicated on the drawings. Accuracy of temperature indication shall be within plus or minus 1% of scale range.

(6) The face panels for the control center shall contain the instrumentation and graphic representation as specified hereinafter. Color of face panel shall match the console. Face panel material shall be plastic laminate 5/8" thick and capable of supporting instrumentation without bending and warping. Graphic representations for unit fans, refrigeration system, heating system, pumps, etc., shall be front engraved on face panels.

(7) Color fill applied to face panels showing symbols and schematics shall be durable and hard, resistant to repeated washing and impervious to acids and alkalines. Colors used for schematics and flow lines, etc., shall be standard coded colors. Schematic symbols, indicator-gauges, pushbuttons, pilot lights, air handling units, etc., shall be properly identified by means of engraved lettering on face panel or on lens of pushbutton and pilot lights.

Information Handling Services, 1999
August 12, 1999 05:44:57

(8) Electrical switches including "on-off", "high-low-off", and "off" operations shall be miniature type, back lighted for "on", "high", or "low" indication of operation. Lamps shall be low voltage and shall be arranged for front relamping. Furnish transformers for 24 volt pilot lights prewired to terminal points inside control center console.

(9) All wiring inside control center console shall be furnished and wired by the control center manufacturer. The control center wiring shall be laced and terminated at properly identified terminal blocks ready for field connections. Control center manufacturer shall furnish wiring diagram of the panel showing method of making connections at the panel and at all remote switches and devices connected to the panel. Wiring diagrams shall be submitted for approval.

(10) Scale drawings of control center console and face panels showing instrument layout, system schematics, fan systems, lettering, etc., shall be furnished for approval prior to commencing fabrication.

(11) The following items shall be included in the face panel instrumentation:

Multi-Zone Units #1 and #8

One (1) graphic schematic.
Hand-Off-Auto switches for fan control with pilot light for each unit to indicate fan operation.
Temperature indication for each unit:
a. Mixed air
b. Hot deck
c. Cold deck
Low mixed air alarm (audible and visual) for each unit.

Air Handling Units #2 and #3

One (1) graphic schematic.
Pushbutton switches, 2-speed, for fan control with pilot lights to indicate fan operation (high and low) for each unit.
Temperature indication:
a. Conditioned space (one only).

Information Handling Services, 1999
August 12, 1999 05:44:57

b. Supply air for each unit.
c. Return air (one only).
d. Mixed air (one only).

Humidity indication:
a. Conditioned space (one only).

Air Handling Units #4, #5, #6 and #7

One (1) graphic schematic.
Pushbutton switches for fan control with pilot lights to indicate fan operation.
Temperature indication:
a. Conditioned space (one only).
b. Supply air for each unit.
Humidity indication:
a. Conditioned space (one only).

(12) The following are required, including transmitters and indicators, whether shown on control drawing or not:

Refrigeration and heating equipment and piping system.

Color filled equipment symbols and color coded chilled water and steam flow lines illustrating the following:

Refrigeration machine.
Chilled water pumps (2).
Condenser water pumps (2).
Cooling tower and fan.
Boiler (hot water).
Hot water pumps (2).
Schematics showing relationship of all equipment and associated piping.
Temperature indication:
a. Chilled water supply header
b. Condenser water supply header
c. Hot water supply
Provide pilot lights for indication of above motors operation (8 required).
Miscellaneous indication:
a. Outside air temperature
b. Control main air pressure
c. Control heating-cooling supply air pressure
d. Steam header pressure
e. Taylor 90-J, 1-pen, strip chart recorder with seven day chart to record chilled water supply temperature

Information Handling Services, 1999
August 12, 1999 05:44:57

(13) Air handling system schematics shall consist of permanent color filled Graphic representations illustrating the arrangement of the air handling systems. The control dampers (fresh air, return air, and face and bypass as applicable), damper operators, filters, coils, and respective valves, humidifiers and respective valves, fans, locations of temperature sensors, shall be color filled in control center manufacturer's standard color scheme.

(14) The Mechanical Contractor shall provide all pipe taps for separable wells, and steam header tap for sensing tip in the above locations.

(h) UNIT CONTROL PANELS The Automatic Control Subcontractor shall furnish and install unit control panels for all air handling units, wall or floor mounted, to match existing unit control panels with regard to appearance, function and arrangement.

(i) FIRESTATS A firestat shall be furnished and installed at each air handling unit, ventilating fan and exhaust fan. Firestats shall be adjustable, with manual reset, and shall stop respective fans when return or exhaust air temperature exceeds 120° F.

(j) BOILER RESET CONTROLLER Furnish and install on the wall adjacent to the boiler, a boiler water temperature reset controller to vary water temperature in a 1 to 1 ratio from 210° F. at an outside temperature of 0° F. to 140° F. at an outside temperature of 70° F. Reset range shall be adjustable. Control panel shall provide a manual switch for maximum or minimum heat and shall have enclosing cabinet with door, lock and keys.

(k) CONTROL SEQUENCES

(1) Multi-zone Units No. 1 and 8: When the supply fan is off the outside and return dampers shall be in their normal positions. The outside damper shall be closed and the return damper opened. With the fan running, the outside air damper shall open to a predetermined minimum position. The extended element freeze stat shall stop the supply fan anytime freezing conditions are sensed over any one-foot portion of its sensing element. The firestat

Information Handling Services, 1999
August 12, 1999 05:44:57

shall stop the fan anytime the return exceeds 120° F. Individual zone control shall be accomplished by modulation of the zone mixing dampers by room thermostats. Hot deck control shall be inversely reset by the zone thermostat requiring the most heat. As this zone temperature begins to drop, the hot deck temperature shall be reset to a higher temperature to provide the necessary heat to maintain desired zone temperature. The reverse shall occur on a rise in zone temperature. One room humidistat located as shown on the plans shall modulate the steam humidifier to maintain humidity at setting. A high limit humidistat shall be provided in the largest duct leaving the humidifier to prevent saturated conditions in the air ducts. Interlock humidifier to close when supply fan is not running.

(2) Single-zone Units Nos. 2 and 3: Chilled water coil face and bypass dampers shall be modulated from the space dry bulb temperature or humidity, whichever has the greatest demand. The humidifier and the chilled coil shall be operated in sequence from the humidity controller when the dry bulb temperature is satisfied. The high limit humidistat shall override the space controller to prevent saturated conditions. The space dry bulb controller shall modulate the chilled coil damper first to a bypass condition and then reset the submaster controller to modulate the hot water coil 3-way valves for heat on a drop in space temperature. The reverse sequence to apply on rising space temperature. Interlock humidifiers to shut-off on fan shut-down. Firestat located in return shall stop fan if 120° F. is exceeded.

(3) Single-zone Units Nos. 4, 5, 6 and 7: The space dry bulb temperature shall be maintained by a temperature controller (one required) and discharge submaster at each unit. As the space temperature drops below the temperature controller setting, the submasters shall reset to modulate the 3-way hot water valves open to the coils and the chilled water 3-way valves to bypass the coils. On a rise in space temperature, the temperature controller shall reset the discharge submasters to modulate 3-way hot water valves closed to the coils and chilled water 3-way valves open to the coils. The space humidity shall be maintained by a humidity

Information Handling Services, 1999
August 12, 1999 05:44:57

controller (one required). As space humidity rises above set point, the chilled water 3-way valves shall be modulated open to the coils to dehumidify. The temperature controller, through the discharge submasters shall modulate 3-way hot water valves open to the coils to maintain space dry bulb temperature. High limit humidistats in each unit discharge shall override humidistat operation to shut off steam to humidifiers to prevent saturated condition in discharge air.

(4) Condenser Water: Condenser water shall be controlled by cycling tower fan in sequence with modulating butterfly valve. As condenser water temperature begins to rise above set point, the butterfly valve shall position flow of water to the top of the cooling tower. The thermostat located in tower sump shall cycle tower fan to maintain desired temperature. As the condenser water temperature drops below set point, the butterfly valve shall divert flow and bypass cooling tower. Below 40° F. outside air temperature, flow to the tower shall be diverted from top of tower directly to tower sump by 3-way butterfly valve. Should sump water temperature exceed 75° F., flow shall be directed over top of tower in a 2-position manner to prevent icing of louvers. Above 40° F. outside air temperature, flow shall be over top of tower in normal fashion. Tower heater thermostat shall cycle electric heater to prevent icing conditions in sump.

(5) Volume Dampers: On a drop in space temperature, volume dampers shall be modulated closed, to a minimum of 50%. On a further drop in temperature, electric reheat shall be cycled on to maintain space temperature.

(1) RECORDER-ALARM STATIONS Furnish and install for the CDC and CCC Area recorder-alarm stations, each complete with aspirating cabinet, temperature and humidity recorder (two-pen chart), 24 hour eight inch chart, high and low alarm lights for temperature and humidity and manual reset alarm buzzer. All equipment shall be installed on or in an enclosing cabinet with baked enamel finish of the manufacturer's standard color. The units shall be portable and shall have wheels or casters with locking device. Provide twenty-foot long

Information Handling Services, 1999
August 12, 1999 05:44:57

portable cord (Type SO) with male plug to suit parallel slot, grounding type convenience outlet. Provide twenty-foot long flexible tubing with .062 inch thick PVC jacket and quick disconnect air coupling, and four fixed control air outlets with quick disconnect couplings rigidly piped under each of the CDC and CCC raised floors, spaced to serve all areas by use of the flexible tubing. Submit arrangement and construction details of the portable cabinet for approval prior to fabrication.

(m) EMERGENCY VENTILATION SYSTEM

(1) Existing System. An emergency ventilation system is presently in operation. The system consists of positive closing dampers on exterior wall louvers, emergency supply air fans with fallout filters, emergency control panel and associated controls for dampers, air handling units and exhaust fans.

(2) Extension of Existing System. Positive closing, motor operated dampers shall be furnished and installed by the Automatic Control Subcontractor at locations shown on the drawings. Construction of dampers shall be as detailed and as required to match existing dampers in performance. Soft rubber receiving gaskets shall be installed to provide an airtight seal when the damper is closed. Damper shall be equipped with SPDT switch for remote indication of damper position. Existing emergency control panel shall be modified to control new units in the same manner as for existing units and as follows:

(aa) Operation of the existing master control switch shall close all positive closing dampers, close fresh air dampers on all air handling units, shut off all exhaust fans, and start emergency air fans.

(bb) Panel lights shall be furnished for all positive closing dampers, air handling units and exhaust fans. Green lights shall indicate a functional emergency condition. Red lights shall indicate an inadequacy in the emergency system.

(cc) Pushbutton "Start-Stop" stations shall be installed on the panel for all air handling units.

Information Handling Services, 1999
August 12, 1999 05:44:57

(3) After completion of the work, the Contractor shall demonstrate the proper operation of the emergency ventilation system. The maintained positive pressure shall not be less than 0.25 inches water gauge. The existing building emergency ventilation system may be operated in support of this test. In addition, access to the existing building may be closed off. If the minimum positive pressure of 0.25 inches W.G. is not maintained, smoke tests shall be made to test the possible leakage of the positive closure dampers. Positive closure seals and operation shall be corrected to prohibit smoke discharge. Smoke tests shall be made until positive closures pass the test. In addition, emergency air handling capacity shall be measured and checked. If the minimum required positive pressure is not maintained after corrective action on the positive closure dampers or the emergency air handling unit, building leakage shall be corrected until positive pressure of 0.25 inches W.G. is obtained.

15-C.49 ELECTRIC DUCT HEATERS

(a) GENERALLY Furnish and install in accordance with the plans, "Chromalox" Type FFF, "Indeeco" or approved equal duct heaters of the heating capacity shown. Heater shall be listed by Underwriters' Laboratories, Inc., and shall bear the appropriate U.L. label.

(b) CONSTRUCTION All frame-members, terminal-box, terminal-box cover, and similar associated sheet metal parts shall be of heavy gauge, die-formed aluminized corrosion-resisting steel. Heater shall be U.L. labeled for "Zero Clearance" to combustible materials. Heating banks shall consist of individually flange-mounted Fintube heating elements having highest quality alloy coiled resistors centered within the tubes and embedded in compacted insulating refractory material. Flanges and fins shall be permanently furnace brazed to elements for rigid support and rapid heat transfer. Each element and fins shall be continuously coated with a heavy layer of ceramic material, fired at not less than 1500° F. and capable of continuously resisting corrosion from high humidity without cracking, checking or spalling under all operating conditions. Heating-banks shall be connected for 3-phase operation and leads from each element or bank shall be brought to clearly marked terminal strips.

Information Handling Services, 1999
August 12, 1999 05:44:57

(c) CONTROLS Heater shall be equipped with a U.L. listed automatic reset, snap-action overheat limit control, plus similarily U.L. listed, snap-action, manual reset overheat control, each rated at 15 ampere, 480 volt, A.C., single phase. Heater shall be equipped with built-in line contactor, back-up safety contactor, step-down transformer and overcurrent-protective fuses as required. Line contactor shall be U.L. listed for 100,000 cycles and safety contactor U.L. listed for 6,000 cycles minimum. All control components shall be factory prewired with all leads brought to clearly marked terminal strips.

15-C.50 CLEANING, TESTING AND ADJUSTING

(a) GENERALLY It is the intent of this Section of the specification to provide for all necessary tests during and at completion of the job to insure tight piping and correctly balanced systems. The Contractor shall perform such tests, and shall do any and all work required to accomplish this end.

(b) STEAM, CONDENSATE RETURN, HOT WATER, CONDENSER WATER AND CHILLED WATER LINES Before installation of pipe covering or final connection of units, all piping shall be tested under a hydro-static pressure of 125 p.s.i.g. at the lowest points in the systems, with all air freed from the lines, which pressure shall be maintained without pumping for a period of one (1) hour. Control valve elements, instruments or other equipment that might be damaged by this pressure shall be removed from the system before testing. After completion of this test, the systems shall be drained and final connections made to the units.

(c) FUEL OIL LINES Prior to covering or backfilling, all fuel oil piping shall be subjected to an air pressure test of 100 p.s.i.g. for a period of 30 minutes and made tight at that pressure. All fuel oil suction lines shall also be tested under a vacuum of 20" mercury for a period of 20 minutes and made tight at that condition.

(d) DRAIN LINES All drain piping shall be subjected to a 125 p.s.i.g. hydrostatic test and made tight at this pressure.

(e) BOILER shall be cleaned and blown down in accordance with the boiler manufacturer's instructions. Boiler controls shall be adjusted and checked for proper

Information Handling Services, 1999
August 12, 1999 05:44:57

operation under flame failure, power failure, high pressure and low-water conditions. Breeching and/or inlet dampers shall be regulated for proper combustion and locked at proper settings.

(f) STEAM AND CONDENSATE RETURN SYSTEM Blowing down and cleaning out all portions of the steam and condensate return system under steam pressure shall be done in the following manner:

(1) Remove all thermal members from traps and provide same with blank caps.

(2) Wash out entire system with clean water, and waste water to sewer or outside of building.

(3) Disconnect condensate return line at reciver. Fire existing boiler to 5 p.s.i.g. and waste all condensate into sewer or outside of building for four (4) hours, adding water as required to make up for condensate wasted.

(4) Reconnect condensate return unit; then valve off and test system at 15 p.s.i.g.

(5) After system has been cleaned and proven tight, replace all thermal members in the traps, and operate the entire system at 15 p.s.i.g. supply pressure, to determine heating ability and quietness of operation.

(g) CHILLED WATER AND HOT WATER VENTING AND BALANCING After chilled and hot water systems have been completely connected they shall be filled with water, completely vented, and drained. Systems shall then be refilled, revented, and operated for 48 hours continuously with circulating pumps running. Systems shall then be drained, refilled, revented, and balanced to scheduled g.p.m. quantities.

(h) STRAINERS All strainers shall be cleaned after pressure testing and system cleaning operations, and prior to final filling of systems.

(i) LUBRICATION All motors, bearings, etc., on all equipment shall be correctly oiled and/or greased with the proper lubricant before the equipment is operated, and again at completion of the job.

Information Handling Services, 1999
August 12, 1999 05:44:57

(j) FANS The external static pressures specified in connection with the various fans and/or air handling units may vary somewhat with job conditions and the various types of air distribution which may be employed, and this may not be exactly correct for the installed systems. The Contractor shall test and adjust the completed systems as necessary to produce the specified air quantities, including the changing of fan speeds and the furnishing of new drives where required.

(k) AIR BALANCE Air distribution balance for specified CFM delivery at the various individual outlets shall be achieved by temperature testing and by use of anemometer or velometer. Such balancing shall be performed in conjunction with temperature regulation adjustments specified under AUTOMATIC CONTROL EQUIPMENT.

(1) Test Data. Provide to the Contracting Officer six (6) copies of air balance test data obtained for each balanced air handling system. Test data shall include the following:

System Number
Fan Number
Date of Test
Name of Individual Certifying Test
Design Air Quantities (CFM)
Actual Air Quantities (CFM)
Design S.P. (Inches W.G.)
Actual S.P. (Inches W.G.)
Motor H.P.
Fan Brake H.P.
Motor Amps (Nameplate)
Motor Amps (Measured)
Line Volts (Measured)
Motor RPM
Fan RPM
Air Filter Resistance (Inches W.G.)
Grille Air Quantities (CFM)
Grille Air Velocity (FPM)
Grille Air Temperatures (^{o}F)
Damper Settings
Exhaust Air Quantities (CFM)

(2) Tolerances. All systems shall be properly adjusted to achieve actual air quantities to within plus or minus five (5) percent of the values shown on the contract drawings.

Information Handling Services, 1999
August 12, 1999 05:44:57

(3) Instruments. In performing the air balance and adjusting work, the Contractor shall use carefully calibrated instruments as approved by the Resident Engineer.

(l) ACCEPTANCE Systems will not be considered completely adjusted and balanced until approved and accepted by the Resident Engineer.

(m) SEASONAL ADJUSTMENT On completion of the installation, the Contractor shall test and adjust the new systems for proper operation for the season (summer or winter) in effect at the time. At the beginning of the next ensuing season (winter or summer), the Contractor shall return to the job and readjust where necessary.

(n) TEST OPERATION AND INSTRUCTION The Contractor shall operate the entire plant for five (5) working days of eight (8) hours each, and shall leave the entire plant in perfect operating condition. During this period, he shall also instruct the Government's representatives in the proper operation and maintenance of all equipment and systems.

(o) OPERATING INSTRUCTIONS AND MAINTENANCE SCHEDULES The Contractor shall furnish the Contracting Officer four (4) typed sets of complete operating instructions and maintenance schedules. Operating instructions shall first be submitted to the Resident Engineer for approval. Maintenance schedules shall include, but not be limited to, complete lubricating instructions designating all oiling and greasing points for all equipment and designating type of lubricant to be used.

(p) CONTROL DIAGRAMS The Contractor shall furnish the Contracting Officer four (4) sets of as-built control diagrams complete with detailed narrative control sequences, physical descriptions and identifying numbers for components and set points. Diagrams shall show control air pressures for a range of outputs for all controllers. Diagrams shall first be submitted to the Resident Engineer for approval.

Information Handling Services, 1999
August 12, 1999 05:44:57

DIVISION 16 ELECTRICAL

SECTION 16A

ELECTRIC WIRING AND LIGHTING

16-A.1 GENERAL

(a) WORK INCLUDED This section includes all labor and material required for the complete and finished installation of the various electrical equipment, facilities, and systems.

(b) SYSTEMS Involved in the classifications of electrical work are the following systems:

(1) New electrical services and emergency transfer switch

(2) Distribution equipment and transformers

(3) Wiring in conduit for lighting and power

(4) Grounding systems

(5) Lightning protection system

(6) Lighting system, including fixtures and lamps

(7) Telephone raceway system and outlet boxes

(8) Extension of existing fire alarm system

(9) New fire detector systems and interconnection to existing system

(10) Control wiring for equipment furnished under other sections

16-A.2 REFERENCE

(a) ADDITIONAL REQUIREMENTS Particular attention is called to the GENERAL REQUIREMENTS FOR MECHANICAL AND ELECTRICAL WORK preceding this section which covers certain important procedures, materials, and labor applying directly to the Electrical section.

Information Handling Services, 1999
August 12, 1999 05:44:57

16-A.3 ELECTRIC SERVICE AND CHARACTERISTICS

(a) GENERALLY The service arrangement shall be as shown on the plans for temporary, single, 277/480 volt, 3-phase, 4-wire A.C.

(b) TEMPORARY SERVICE The Contractor shall extend conduits and service conductors, as shown on the plans, to a manual transfer switch and to the location of the temporary substation and shall terminate both conduits and conductors as required by the local Power Company. The transfer switch shall be installed with emergency power source lugs not connected. The Contractor shall furnish and install three service switches and shall connect the switches to the single temporary service. In addition, spare conduits for future service shall be stubbed out and capped as shown on the plans. Service switches and building wiring systems are designated as follows, with regard to future reliability:

(1) Critical

(2) Essential

(3) Non-Essential

16-A.4 PANELBOARDS

(a) TYPE AND STANDARD Panelboards shall be of the dead-front type and shall be in accordance with Underwriters' Laboratories, Inc., standard for panelboards and enclosing cabinets, and so labeled.

(b) GENERALLY Panelboards shall be designed for connection to the electric services specified above, and service connection made at the top or bottom as indicated on the plans. The neutral bar (solid neutral) shall be mounted at the opposite end of the structure from the mains and shall have numbered terminals for connection of neutral wires.

(c) BOXES Each panelboard shall be fabricated from galvanized sheet steel. A turned edge shall be provided around the front of the box for rigidity and attachment of the front. Wiring gutters shall be in accordance with the National Electrical Code.

(d) FRONTS Each panelboard front shall consist of a flat piece of sheet steel. Panelboard fronts shall

Information Handling Services, 1999
August 12, 1999 05:44:57

have an opening to which the panelboard door is attached by means of semi-concealed steel hinges. The door shall have a cylinder tumbler-type lock. On doors more than 48" high, a combination three-point catch and lock shall be provided. A circuit directory shall be provided on the inside of the door. Locks to all doors shall be keyed alike. Distribution panelboards shall have openings providing access to switch handles. Front shall be finished in gray enamel over a rust inhibitor, and shall be designed for flush or surface mounting as indicated on the plans.

(e) INTERIORS Interiors shall be of the unit type, mounted on a back plate, properly reinforced by flanging providing a rigid assembly to protect against damage during handling or installation. Structures shall be so designed that units may be easily removed without disturbing adjacent units, bus structure, or insulation. A removable dead-front shield shall be provided for easy access to the wiring. Panel busing shall be arranged to maintain sequence phasing throughout that is, adjacent poles shall be of unlike polarity and rotated in sequence.

(f) GROUNDING Where indicated on the plans panelboard shall be provided with full ground bus insulated from the panel as for other busses.

16-A.5 DISTRIBUTION PANELBOARDS

(a) GENERALLY Distribution panelboards shall each consist of automatic short-circuit and overcurrent protective devices of the circuit-breaker type, assembled into a single interior unit which shall be mounted in a sheet-steel enclosure, consisting of a box and front designed to be placed in or against a wall or partition. Shunt trip mechanisms shall be provided for circuit breakers as shown on the plans.

(b) MAINS The mains of each panelboard shall be provided with main lugs only, or main circuit breaker as indicated on the plans, and with solderless lugs.

(c) BRANCHES Branch circuit-protective devices shall be of the bolt-in, molded case, circuit-breaker type consisting of the number of poles and ampere ratings as listed on the drawings.

Information Handling Services, 1999
August 12, 1999 05:44:57

(d) CIRCUIT BREAKERS The breakers shall have quick-break toggle mechanism, inverse-time trip characteristics, and shall be trip-free on overload or short circuit. Automatic release is to be secured by a bimetallic thermal element releasing the mechanism latch. In addition a magnetic armature shall be provided to trip the breaker instantaneously for short-circuit currents above the overload range. Automatic tripping shall be indicated by handle position between the manual OFF and ON positions. The individual breakers shall be calibrated and sealed to eliminate tampering or unauthorized changes in calibration. Breakers shall be interchangeable and capable of being operated in any position.

(e) INTERRUPTING CAPACITIES

TRIP CURRENT NOMINAL

Range Amperes	Frame Size	Fed.Spec. W-C-375a Class	System Voltage	Asym. Amps.	I.C. Amperes Volts	Sym.Amps.
15-100	100	2d	208y/120	20,000	240	18,000
70-225	225	3b	208y/120	30,000	240	25,000
125-400*	400	4b	208y/120	50,000	240	42,000
125-800*	800	5a	208y/120	50,000	240	42,000
15-100	100	2f	460y/265	30,000	480	25,000
70-225	225	3d	460y/265	40,000	480	35,000
125-400*	400	4c	460y/265	40,000	480	35,000
125-800*	800	5b	460y/265	40,000	480	35,000

*Indicates circuit breakers shall be equipped with interchangeable trip units.

(f) MULTIPLE-POLE BREAKERS Multiple-pole circuit breakers shall be common-trip type.

(g) NAMEPLATES Each circuit breaker unit shall be identified with an engraved laminated plastic nameplate having white lettering on black background. Identification shall indicate circuit name of equipment served and not circuit number.

(h) TYPE AND QUALITY Distribution panelboards shall be "General Electric", "Square D", "Westinghouse", "Federal Pacific", or equal.

Information Handling Services, 1999
August 12, 1999 05:44:57

16-A.6 BRANCH CIRCUIT PANELBOARDS

(a) GENERALLY Branch circuit panelboards shall each consist of bolt-in automatic short-circuit and overcurrent protective devices of the circuit-breaker type; assembled into a single interior unit which shall be mounted in a sheet-steel enclosure, consisting of a box and front designed to be placed in or against a wall or partition.

(b) MAINS The mains of each panelboard shall be provided with main lugs only, or a main circuit breaker as indicated on the plans, and with solderless lugs.

(c) BRANCHES Branch circuit-protective devices shall be of the molded case circuit-breaker type consisting of the number of poles, and ampere ratings, as listed on the drawings. "Plug-in" or "twin" breaker units will not be acceptable.

(d) CIRCUIT BREAKERS The breakers shall have quick-make and quick-break toggle mechanism inverse-time trip characteristics, and shall be trip-free on overload or short circuit. Automatic release is to be secured by a bimetallic thermal element releasing the mechanism latch. In addition, a magnetic armature shall be provided to trip the breaker instantaneously for short-circuit currents above the overload range. Automatic tripping shall be indicated by handle position between the manual OFF and ON positions.

(e) MULTIPLE-POLE CIRCUIT BREAKERS Multiple-pole branch circuit breakers shall be common-trip type.

(f) CIRCUIT BREAKER CALIBRATION AND CHARACTERISTICS The individual breakers shall be calibrated and sealed to eliminate tampering or unauthorized changes in calibration. Breakers shall be interchangeable and capable of being operated in any position.

(g) INTERRUPTING CAPACITIES

(1) Single pole breakers for use on 208y/120-volt, 3-phase, 4-wire, or 120/240 volt single phase, 3-wire systems shall have 100-ampere frames and trip ratings of 20 amperes, with interrupting capacities of not less than 10,000 amperes asymmetrical. Single pole breakers for use on 277-volt, single phase circuits shall have 100-ampere

Information Handling Services, 1999
August 12, 1999 05:44:57

frames and trip ratings of 20 amperes, Class 2a, with interrupting capacities of 10,000 asymmetrical. Two- and three-pole breakers for 208y/120-volt, 3-phase, 4-wire systems shall have 100 ampere common trip frames and trip ratings from 15 to 100 amperes, with interrupting capacities of not less than 10,000 amperes, asymmetrical. Two- and three-pole breakers for 460y/265-volt systems shall have 100-ampere common trip frames and trip ratings from 15 to 100 amperes, Class 2d interrupting capacities of 14,000 amperes, symmetrical, 15,000 amperes asymmetrical at 480 volts.

(h) QUALITY Branch circuit panelboards shall be "General Electric", "Square D", "Westinghouse", "Federal Pacific", or equal.

(i) NAMEPLATES All panelboards shall be provided with engraved laminated plastic nameplates, having letters not less than 1/4" high, identifying each panel with the same designation utilized in the Panelboard Schedule and including voltage, phase and number of wires involved. Nameplates shall be bolted to the face of the panel door, or at the top of the panel face as directed.

16-A.7 MOTOR CONTROL CENTER

(a) GENERALLY Motor control center shall be Class I, Type C, as defined by NEMA Standards Publication "Industrial Control No. IC1-1965" Part 22. It shall be a totally enclosed, adequately ventilated, free standing, self-supporting motor control center consisting of structures bolted together to form one continuous unit divided into compartmented section, each separated by steel barriers. The structural sectional units shall be built of fabricated steel not less than 3/32-inch thick and so designed that vertical sections may be readily removed or future sections added. Each compartment shall be provided with individual doors and concealed hinges. Doors shall have quick-captive screw fasteners. Interlocks shall be provided so that the breaker must be in the "Off" position before the door can be opened and so the unit door cannot be closed with the breaker in the "On" position, except by consciously operating a permissive release device. Each compartment shall have a nameplate with the name of the circuit thereon. To effect easy checking and building maintenance procedures, all motor starter and feeder

Information Handling Services, 1999
August 12, 1999 05:44:57

designations shown on drawings, in schedule or in specification shall be followed exactly. The arrangement of individual units in the motor control center may be varied to suit the manufacturer's design practice.

(b) SUPPORT The motor control center shall be anchored to two 4-inch minimum channel iron sills, by tack welding or bolting. Sills shall be furnished by the Contractor to suit the motor control center and shall be leveled and grouted flush into the floor by the Contractor. Where a membrane waterproofed floor or pressure slab is indicated under the motor control center location, there shall be provided a 4-inch high reinforced concrete platform poured separately on top of finished floor slab. This platform shall not extend more than 2-inches in all directions beyond the maximum dimensions of the motor control center. The 4-inch channel sills specified above shall be furnished and installed in this platform.

(c) WIRING SPACES The structure shall be provided with horizontal and vertical wiring spaces for wiring to each compartment unit. Supports shall be provided to hold wiring rigidly in place.

(d) BUSES Horizontal and vertical copper bus, or aluminum bus Grade EC conforming to requirements of ASTM B236, shall be extended into each compartment structure for main service and incoming power to each unit of the completed assembly other than at the starter stab-in locations. The buses of motor control center shall be wrapped with arc and flameproof tape or shall be insulated with material which has comparable mechanical and electrical characteristics. The continuous rating of the main bus shall be 600 amperes at 600 volts as indicated on the drawings. The feeder bus to the line side of the protective device shall have continuous rating of 600 amperes or as indicated on the drawings. The current density shall not exceed 1,200 amperes per square inch for copper. The main buses and equipment ground bus shall be extended the same capacity the entire length of the board and provisions made for future extensions from either end by means of bolt holes or other approved methods. The motor control center section shall be provided with an uninsulated noncurrent carrying 1/4-inch by 2-inch copper bus bar which shall be suitably bolted to related bus bars in adjacent sections to provide a separate, integrated, continuous,

Information Handling Services, 1999
August 12, 1999 05:44:57

equipment ground bus. Ground bus shall be arranged for brazed or approved pressure connector terminations of the feeder and branch circuit ground conductors, etc., in accordance with the "Grounding" section of this specification.

(e) PROTECTION AND INTERRUPTING CAPACITIES The main protective device shall be a coordinated interrupter switch and high-interrupting-capacity-current-limiting fuses having a rating of not over 600 amperes, and motor starters and feeder protective devices shall have interrupting ratings of not less than 20,000 amperes.

(f) ARRANGEMENT It shall be possible to remove any unit without opening adjacent doors, disconnecting adjacent compartments, or disturbing the operation of any other unit in the control center. Units requiring the same size compartments shall be interchangeable. The design shall be such as to permit ready rearrangement of units at a later date (such as replacing three single units with a unit requiring three spaces) without cutting or welding.

(g) UNIT SECTIONS The motor control breaker units shall be of the plug-in type with a positive guidance mechanism for supporting the unit during its removal and replacement and for insuring alignment of stabs with vertical bus. The plug-in units shall have plated, pressure-type contacts of high-strength copper alloy. Padlock latches shall be provided so that each unit may be locked in the "Out" position with the contacts disconnected from the feeder line. The minimum interrupting capacity of the circuit breakers in the control center combination starters shall be equal to the interrupting capacity of the center's feeder. Each motor control unit section shall be equipped with a combination circuit breaker and magnetic starter to suit motor and with selector switch and/or push-buttons as indicated on the drawings. Circuit breakers shall be of the load break, disconnecting type with positive "On-Off" trip indication clearly visible from within or without the enclosure with long time delay thermal overload and instantaneous magnetic trip for selective protection against short circuits. Circuit breakers shall be as specified herein for Distribution Panelboards, except as indicated above. Circuit breakers with instantaneous adjustable magnetic trip only may be substituted in combination starters for thermal magnetic breakers provided the following requirements are satisfied:

Information Handling Services, 1999
August 12, 1999 05:44:57

(1) There is overload relay protection in each pole of the starter.

(2) The circuit breaker has the required fault current interrupting capacity for the location on the system.

Circuit breakers or fused switches to isolated starters connected to 480-volt circuits shall be rated at 480 or 600 volts, respectively, to meet requirements of Federal Specification W-C-375a for circuit breakers, except as herein modified. All control units shall be removable from the front of the board without access to the rear of the structure. Each control unit shall be effectively isolated from adjacent units, from the vertical wiring area and from the horizontal and vertical bus, and effectively ventilated for the maximum load that could be applied to each bus and to prevent abnormal starter tripping by the normally rated heater units in each control compartment.

(h) STARTERS Starters shall be of the full voltage with undervoltage protection or release, as indicated on drawings or required to suit the motor driven equipment. Starters shall be provided with a sufficient number of auxiliary contacts (N.O. and/or N.C.) to afford the control and interlocking required. Additional relays shall be provided if required to obtain the correct control. Each magnetic starter shall incorporate a control transformer located within the starter enclosure with wiring extended to associated accessories and to terminal boards for associated accessories remotely located. The "start-stop" push-button control stations for operating the motor starting equipment which are not indicated as part of the starter shall be mounted at the motors. Where "lock-out" type push-buttons are indicated or required, each shall be equipped with a safety latch and arranged to receive a suitable padlock. Padlocks and keys for same shall conform to Federal Specification FF-P-101c, Type EPA. Not less than three (3) padlocks shall be furnished. Two (2) keys shall be furnished for each lock provided. "Stop" push-button stations indicated on drawings to be located in the motor control center or control panel shall be of the "lock-out" type. These "stop" buttons shall be equipped with cylinder locks and keys. Two keys shall be furnished for each lock. Lock-out buttons may be omitted where disconnect switches are provided adjacent to the motor. Test-stop, start-stop,

Information Handling Services, 1999
August 12, 1999 05:44:57

lock-out, hand-off-automatic and/or disconnect switches or push-buttons shall be provided as shown on the drawings.

(i) CONTROL WIRING The control wires, number as required, from the "Start-Stop" or "Stop" push-button stations and "Hand-Off-Automatic" switches, if required, shall be run in the same conduit with the motor main leads unless otherwise indicated on the electrical drawings. The size of the control wires within the control center except control wiring totally within individual starter, shall be not less than No. 14 AWG and the size of the control wiring to remote devices shall be sufficient to provide satisfactory operation of the associated equipment. The control wires from control center starter location to separately mounted remote control panels, where indicated, shall be of the control cable type. Each control unit shall have a terminal board located within the same compartment, with each terminal marked to identify circuit control. Control wiring shall be 600-volt, Type TA, TBS, AVB, or SIS with minimum rated temperature of 90° C.

(j) INDICATING LIGHTS Each starter located in control center shall be provided with associated red and green indicating lights, semi-flush-mounted in front of compartment panel or on drawout unit, visible through the unit door, to show the "running" and "off" positions of starter. Where two-speed starters are provided, the indicating lights shall show the speed condition.

(k) FINISH The complete control center structure shall be given a primer coat and a finish coat of pearl-gray color, USA No. 61, quick-drying lacquer or baked-on enamel, applied as final factory operation after assembly, inside and out.

(l) MANUFACTURE AND TESTS Control centers shall be manufactured and tested in accordance with NEMA standards unless otherwise specified. All corresponding major component parts such as starters, circuit breakers, combination starters and circuit breakers, etc., shall be of the same manufacture, except where a manufacturer does not produce a frame size or type called for, and all like units on a project shall be interchangeable. For example, all starters may be of one manufacturer and all protective devices may be of another but not an assembly of several manufacturers. Motor control centers shall be as manufactured by "Westinghouse", "General Electric", "ITE", "Square D", or approved equal.

Information Handling Services, 1999
August 12, 1999 05:44:57

16-A.8 SAFETY AND DISCONNECT SWITCHES

(a) STANDARDS Safety and disconnect switches shall conform to governing industry NEMA standards, and shall be listed by Underwriters' Laboratories, Inc., where applicable.

(b) GENERALLY Switches shall be "heavy-duty" side operated, single throw, quick-make, quick-break type rated for not less than 240 volts for 208y/120 volt system and not less than 600 volts for 480 volt systems. Switches shall be fused with standard fuse clips or unfused as required, and shall be furnished with general purpose NEMA Type 1, enclosures, except that switches installed outside the building or otherwise exposed to the weather shall be provided with raintight NEMA Type 3R enclosures. All switches shall be furnished without safety interlocks. Service entrance switches shall be rated and listed for that duty.

16-A.9 FUSES

(a) TYPE AND QUALITY Where fault current does not exceed 10,000 RMS amperes, fuses shall be cartridge type conforming to Federal Specification W-F-791d, Type I, Style A. Fuses for service entrance switches and feeder protection switches and fuses for circuits where fault current exceeds 10,000 RMS amperes shall be NEMA Class J current-limiting fuses. Fuses shall be "Shawmut", "Buss", or equal. Fuses for motors shall be sized in accordance with motor or equipment manufacturer's recommendations. Fuses coordinated with motor control center interrupter switch shall be selected and furnished by the equipment manufacturer as required for complete coordination.

(b) GENERALLY All fuses shall bear the label of Underwriter's Laboratories, Inc., and shall be properly stored and protected until installed.

(c) SPARES Spares amounting to one complete duplicate set of each and every fuse installed under this contract shall, upon completion of the project, be turned over to the Resident Engineer in a neat metal box with hinged cover.

16-A.10 FEEDER, BRANCH, AND CONTROL CIRCUITS

(a) GENERALLY The Contractor shall furnish and install

Information Handling Services, 1999
August 12, 1999 05:44:57

such wiring as is required for a complete electric wiring system for light and power, including feeders, subfeeders and branch circuits, making proper connections to switches, panelboards, motors, and controllers and to each outlet in the building.

(b) FEEDERS Feeders shall be run and connected to the panels and switches throughout the project as shown on the riser diagram. Feeders shall be of sizes of wire as shown on drawings, and shall be installed in rigid steel conduit supported by hangers secured to structural beams and slabs. No wire shall be used for the support of conduits.

(c) FEEDER AND CIRCUITS Wherever practical, feeder conductors shall be continuous without splices between terminals. All conductors of a circuit shall be contained in the same raceway, except where indicated as multiple parallel runs.

(d) SPLICES AND CONNECTIONS The installation of wires and cables shall include all splicing of these wires and cables to each other and connecting them to panelboards, receptacles, switches, control boxes, lighting fixtures, motors, and all other electrical apparatus installed or re-connected under this contract.

(e) SOLID CONDUCTOR CONNECTIONS Where solid conductors are to be connected directly to the devices without the use of lugs, such as occurs at lighting switches and plug receptacles, the wires shall be formed into a loop to fit around the screws.

(f) REMOVAL OF COATING Where wires and cables are connected to metallic surfaces, the coated surfaces of the metal shall be polished before installing the mechanical connector. The lacquer coating of the conduits shall be removed where a ground clamp is to be installed.

(g) NEUTRAL CONDUCTORS Where single phase, 3-wire or 4-wire combinations are used for branch circuit distribution, the "hot" conductors must be of different phases; otherwise, a separate neutral will be required for each hot wire.

(h) AUTOMATIC CONTROL WIRING An overall automatic control system is being provided under another Section for the purpose of controlling and monitoring mechanical installations. Except for line voltage and power

Information Handling Services, 1999
August 12, 1999 05:44:57

supply circuits for the centralized equipment of this system, and for 110 volt or higher motor control circuit extensions to devices on this system, no work in connection with the control system shall be considered as being included as part of the Electrical Section work. Check all other Sections for electrical equipment furnished under such sections which shall be received and installed under this Section, including switches, controllers, detached motors, etc.

(i) INTENT AND RESPONSIBILITY Although it is the intent of the Drawings and Specification to delineate fully the motor control circuit wiring required for all permanent motorized equipment being provided at the project, the possibility of variations from the Drawings and Specification is anticipated due to differences between manufacturers of mechanical equipment and other such conditions. No notes, wiring diagrams or specifications shall be interpreted as limiting the scope of the motor control circuit wiring work. The electrical work shall include the responsibility for providing complete motor control circuit wiring required for the permanent equipment furnished under other sections, without introducing any additional costs to the Government, regardless of the indications in the Drawings and Specification.

16-A.11 CONDUITS

(a) GENERALLY Conduit raceway system shall be complete from point of origin to all outlets shown or specified. Installation shall be such that conduits will be concealed in all finished parts of the building, and where conduits are exposed, they shall run parallel with the building lines in a neat and workmanlike manner. Location of exposed runs will be subject to the approval of the Resident Engineer. No diagonal exposed runs will be permitted.

(b) RIGID CONDUIT shall be used for main services, feeders to panels and disconnect switches, exposed conduit to motors, exterior conduit, conduit 2" and larger, all conduit in concrete and where subject to mechanical injury. Rigid conduit shall be steel, coated with zinc-exterior and interior by the hot dip galvanizing process, produced to USA Specification C80.1, Federal Specification WW-C-581 and shall be listed with the Underwriters' Laboratories. All threads shall be coated with zinc by hot metalizing.

Information Handling Services, 1999
August 12, 1999 05:44:57

(c) ELECTRIC METALLIC TUBING may be used for remainder of wiring. EMT shall be mild steel, electrically welded, electro-galvanized and produced to USA Specification C80.3, Federal Specification WW-C-563 and shall be labeled with the Underwriters' Laboratories seal of inspection.

(d) ALUMINUM ELECTRICAL RIGID CONDUIT may be used in the building except it shall not be used in concrete or in fill or earth below slabs on grade. Conduit shall be U.L. approved and shall have an alloy designation of 6,063 with a T42 temper as manufactured by "Reynolds", "Alcoa", "Kaiser", or approved equal.

(e) FLEXIBLE CONDUIT Flexible conduit shall be of galvanized steel conforming in all respects to the latest Underwriters' Laboratories standards. Ends shall be square cut with a hacksaw and carefully reamed. For exterior and normally wet locations, flexible conduit shall be liquid-tight type with flexible galvanized steel tubing core, polyvinyl chloride (PVC) jacket. Terminations at boxes, cabinets, etc., shall be made only with approved fittings. Runs shall be continuous between terminations without couplings, and bends shall be such that inner radius is not less than five (5) times the trade size.

(f) SIZES Conduit sizes not shown on the drawings shall be in accordance with NEC rules. No conduit shall be less than 3/4" trade size, except that flexible conduit may be small as 1/2" trade size.

(g) CONDUIT IN SLABS Where conduit is placed in slabs, it must be done as soon as forms are in place, and in such manner as not to impair the strength of the slabs.

(h) CONDUIT IN EARTH Underground steel conduits shall be painted with two heavy coats of asphaltum paint before burial, and shall be at least 18" below finished grade.

(i) DRAINAGE Horizontal runs of conduit shall be so installed, if possible, to provide a natural drain for condensation, without pockets, or traps where moisture can collect.

(j) COMMON RACEWAYS Homerun circuits may be combined in a common conduit wherever advantageous, provided all requirements of the NEC are met.

(k) EXPOSED RACEWAY IN FINISHED AREAS Wiring noted to be run exposed in finished rooms shall be run in

Information Handling Services, 1999
August 12, 1999 05:44:57

"Wiremold" or equal surface raceway, or in conduit, as directed by the Resident Engineer.

(l) SPARE RACEWAY From each flush mounted panelboards, there shall be run two (2) 1" empty conduits to the ceiling, attic or joist space above, and two (2) 1" empty conduits to ceiling space below (except slab on fill), and terminated in junction boxes for future extensions from the spare circuits on the panel.

(m) CHANGES IN DIRECTIONS shall be made with smooth, even, long radius bends in conduit. Long radius trade elbows shall be used where necessary.

(n) TERMINATIONS Conduits shall be rigidly clamped to boxes by galvanized malleable iron bushing on inside and galvanized malleable iron locknut on outside and inside. Thin wall conduit shall be connected with approved E.M.T. threaded type box connectors and couplings.

(o) EXPANSION JOINTS Where conduit crosses an expansion joint in the concrete structure, a weather-tight expansion and deflection fitting shall be installed in the conduit. Fitting shall have copper braid jumper. Type EXDS by "O-Z" or approved equal.

(p) ENDS OF UNDERGROUND CONDUIT shall be sealed tight against entrance of water, dirt, etc., with a cable terminator, Type CRC by "O-Z" or approved equal. All conduits entering the building shall be sealed at wall with conduit entrance seal, Type FSK by "O-Z" or approved equal. Filling compound for sealing fittings shall be "O-Z" insulating compound or approved equal.

(q) PULL WIRE A #16 gauge steel pull wire shall be left in all empty conduits.

(r) CONDUITS THROUGH ROOF shall be installed in pitch pockets furnished and installed under this section by this Contractor, as approved by the Resident Engineer.

16-A.12 JUNCTION AND PULL BOXES

(a) GENERALLY The Contractor shall provide properly sized junction and pull boxes where indicated in the drawings and specifications, or where necessary for compliance with code requirements for cable installation, and as required to produce neat, functional, workmanlike wiring installations.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) MATERIAL Junction and pull boxes for use under normal electric work conditions shall be manufactured from galvanized code gauge sheet steel, and shall be furnished with flat screw covers.

(c) COVER INSTALLATION Where boxes are set flush in walls and ceilings, cover screws shall be flat head type properly countersunk. Arrange covers to completely cover openings in the building finish.

(d) STANDARD OUTLET BOXES Where acceptable to the Resident Engineer, standard outlet boxes may be used as junction and pull boxes.

(e) SPECIAL SHAPES If required by the building construction, provide junction and pull boxes in special sizes and shapes determined from field measurements in order to make neat and workmanlike installations.

(f) BARRIERS Should the local utility company or any other agency in authority require barriers between groups of feeders in pull boxes, they shall be provided at no additional cost to the Government.

(g) SEPARATION OF SUPPLIES If feeders and other wiring following the same routing are indicated on the plans as running through separate pull boxes, it shall be understood that it is intended to maintain a segregation of the wires and cables, and thereby to prevent the spreading of arcing faults between separate supplies.

(h) ACCESS PANELS Where a junction or pull box is installed in a furred ceiling or space, and where due to building finish, the sheet metal cover of the box exposed to view is not acceptable to the Resident Engineer, there shall be provided an approved access panel with suitable frame and supports in the finished surface in front of the box cover.

16-A.13 OUTLET BOXES

(a) GENERALLY There shall be provided and installed at every outlet a standard hot dipped galvanized outlet box of approved design and construction and of such form and dimension as best adapted to the specific location, kind of fixture or device to be used, and the number, size, and arrangement of conduits connecting thereto.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) INSTALLATION Unless otherwise specified or directed, outlet boxes shall be set with edges flush with the finished surface, and their position shall be carefully checked and corrected previous to final finishing.

(c) ANCHORING, STUDS, AND OPENINGS Outlet boxes shall be firmly anchored in place, and shall be provided with approved 3/8" fixture studs, where required. Fixture studs shall be applied to boxes from rear and securely bolted to box. Only such holes as are to be used for entering conduits shall be open; all other holes must be properly closed.

(d) EXPOSED WORK On exposed work, approved cast outlets, junction boxes or fittings shall be used, of such forms and dimensions as best adapted to the specific location or purpose.

(e) GANGS Four-inch boxes shall not be used where more than one switch or receptacle is installed but, except for adjacent dimming switches, solid gang boxes (up to 4-gang maximum) with suitable covers shall be used.

(f) EXTERIOR Exterior outlet boxes shall be approved marine type of cast iron with threaded boxes for conduit, and gasketed cover plate.

(g) COVERS All outlet boxes which require covers shall be provided with same, and they shall be of such construction and design as to fit and match exactly the outlet box on which they are installed. Switch boxes, etc., shall have covers aligned with the walls, floors, and trim. All outlet boxes to which no fixture or device is to be attached shall be fitted with blank covers. All outlet box covers of all types (except exposed work) shall match in design and color.

(h) SPECIAL CONSTRUCTION Special outlet boxes may be required where space conditions limit the use of standard boxes. Other special outlets shall be installed as indicated on the drawings or otherwise required.

(i) CENTERLINE HEIGHTS Unless otherwise shown, specified, or directed by the Contracting Officer, outlet boxes, etc., shall be located with their centerlines at the following elevations above the finished line:

(1) Wall Switches (Toggle Type)	4'-6" (Above Floor)

Information Handling Services, 1999
August 12, 1999 05:44:57

(2)	Duplex Wall Receptacles	1'-0" (Above Floor)
(3)	Duplex Wall Receptacles at Counters	0'-6" (Above Counter)
(4)	Clock, Bell, Horn Outlets	1'-0" (Below Ceiling or as noted)
(5)	Telephone Outlets at Base	1'-0" (Above Floor)
(6)	Telephone Outlets Wall	4'-0" (Above Floor or as noted)
(7)	Bracket Lights	7'-6" (Above Floor)

16-A.14 WIREWAYS

(a) GENERALLY Wireways shall be provided where shown on the plans, of sizes noted, and shall be code gauge steel with steel or bolted covers. Wireways in unfinished areas and wire closets shall be surface mounted. Wireways connected to CCC power panels shall be full panel width and depth and shall extend from panel bottoms through the raised floor level to permit easy access for equipment cabling by others. CCC area wireways shall be installed with fronts flush with finished wall. All wireways shall have full removable fronts.

16-A.15 WIRE AND CABLE

(a) GENERALLY All wire and cable for feeders and branch circuits, unless otherwise specified, shall be 600 volt thermoplastic insulated of the heat-resistant (75° C. operating temperature) and moisture-resistant THW type, shall conform to all of the latest requirements of the National Electrical Code, and shall meet all specifications of the ASTM. Conductors shall be soft drawn copper. Wire shall be Underwriters' Laboratories, Inc., approved. Wire sizes shown on the plans are A.W.G.-MCM, for copper conductors.

(b) BRANCH CIRCUITS Branch circuit wire #10 and smaller, except that run in or through lighting fixture enclosures, may be 600 volt thermoplastic insulated of the moisture-resistant TW type, of soft drawn copper, and otherwise similarly conforming to NEC and ASTM requirements and specifications.

Information Handling Services, 1999
August 12, 1999 05:44:57

(c) HIGH TEMPERATURE WIRE Wiring run within or through lighting fixture enclosures and wire subjected to high temperature at heating apparatus, etc., shall be rated for 90° C. operating temperature, types RHH or THHN.

(d) TINNING Any copper wire or cable in which the insulating material contains free sulphur (e.g., rubber compounds) shall have the conductor thoroughly tinned.

(e) COLOR CODING All sizes of wire and cable shall be factory color-coded, with a separate insulation color for each phase and neutral used consistently throughout. Color codes for respective systems shall match existing color codes. The neutral wire of all branch circuits shall have a white cover. Grounding conductors shall have a green cover. The name of the manufacturer, insulation type, voltage rating, and wire size shall be clearly and permanently imprinted throughout the length of each conductor. Color taping of black insulation will be acceptable for feeders only when the Contractor, within 30 days from notice to proceed, submits affadavits from three major suppliers stating that required color coded cable is not available, and only when approved by the Resident Engineer. Where color taping is allowed, it shall be applied in all junction and pull boxes in addition to terminations.

(f) DELIVERY Wire and cable shall be delivered to the site of the project in original packaging or on factory reels, fully identified with tags or labels, indicating the manufacturer's name and the date of manufacture.

(g) MINIMUM SIZES The minimum size wire for lighting or power shall be #12. All branch circuits more than 100 feet in length for 120 volts or more than 175 feet for 277 volts shall be not less than #10 for entire distance up to the first outlet. Control circuits shall be #14, except for runs exceeding 300 feet, where they shall be #12. No wire of any type smaller than #14 will be permitted on the job.

(h) CONDUCTOR TYPE Wire sizes #14 to #8 shall be solid, except as otherwise indicated. Wire sizes #6 and larger shall be stranded.

(i) SPLICES Splices in wires up to #8 AWG may be made with approved pressure indent crimping sleeves and tools, or

Information Handling Services, 1999
August 12, 1999 05:44:57

may be soldered joints, with fire rating of the completed splice conforming to requirements of Federal Specification W-S-610. Splices in wires #8 AWG to #4 AWG shall be made with pressure indent crimping sleeves and tools or with split bolt connectors.

(j) SOLDERED JOINTS Soldered joints shall be made by securely twisting the wire ends together, and thoroughly soldering the joint in an approved manner. Joints shall then be insulated by means of half-lapped layers of rubber tape of half-lapped layers of plastic electrical insulating tape. Where rubber tape is used it shall be covered with plastic tape. Tape shall be applied to approximately twice the thickness of the original insulation. Splices and joints shall occur only at accessible outlets or junction boxes.

(k) LUGS Lugs for cables No. 4 AWG and larger shall be bolted by not less than two (2) bolts through the lug tongue. Pressure indent or crimp type lugs, or lugs and connectors requiring the cutting short of wires or cables to accomplish their removal will not be accepted.

16-A.16 IDENTIFICATION AND TAGGING

(a) GENERALLY In addition to the nameplate requirements for equipment as specified herein, the Contractor shall properly identify all feeders, panel bus bars, separately mounted switches.

(b) ALL CABLES All feeders or cables shall be properly identified at each end, and in each wiring gutter, pull box, or junction box, with engraved fiber tags suitably fastened with twine.

(c) SWITCHES, LIGHTS, ETC. Toggle switches, pilot lights, etc., the function of which is not readily apparent, shall be provided with engraved laminated plastic nameplates bolted to the device plate, suitably describing the equipment controlled or indicated.

(d) NAMEPLATES Before fabricating any nameplates or engraved faceplates, the Contractor shall submit to the Resident Engineer for his approval a complete list of such items showing the proposed legend, letter size, nameplate size, mounting method, nameplate material and cross-reference to identify equipment on which each nameplate will be mounted.

Information Handling Services, 1999
August 12, 1999 05:44:57

(e) BUS BARS Phase identification letters shall be stamped into the metal bus bars of each phase of the main busses of each panelboard.

16-A.17 LOAD BALANCING

(a) MAXIMUM UNBALANCE The various branch circuits served from the panelboards vary in loading. The Contractor shall carefully balance the load on each phase when connecting the various branch circuits in each panelboard. When all load is turned on and the system is operating at 100% demand, the total unbalance shall not exceed ten percent (10%).

16-A.18 WIRING DEVICES

(a) GENERALLY The wiring devices as shown in symbol list on the drawings and/or as specified herein shall be furnished and properly installed in their respective outlets.

(b) PLATES Switch, telephone, and receptacle plates shall be .040 satin finish stainless steel single or as required for groups of switches under one gang-plate.

(c) SWITCHES, GENERALLY Flush switches shall be tumbler Type "T" rated, unless otherwise noted on the plans. Switch mechanism shall be completely enclosed in stable composition or ceramic housing. Terminal screws or connectors shall be designed to accommodate and firmly terminate up to #10 solid conductors. Install insulating barriers between adjacent 277 volt switches.

(d) LIGHTING SWITCHES Switches controlling lighting loads shall be rated at not less than 20 amperes.

(e) MOTOR SWITCHES Switches controlling or disconnecting motor loads less than 1/4 HP shall be HP rated, thermal overload type and approved for motor control or disconnect service.

(f) SWITCH POLES AND ORIENTATION Switches shall be single pole, double pole, 3-way or 4-way, as indicated by the symbol. Where tumbler switches operate vertically, single or double pole switch shall be "on" in the upper position. If operated horizontally, single or double pole switches shall be "on" in the left position.

Information Handling Services, 1999
August 12, 1999 05:44:57

(g) DEVICES Devices shall be one of the following makes and types, or approved equal:

	MANUFACTURER AND CATALOG NUMBER	
	ARROW	HUBBELL
(1) Switches		
S.P.---20A	1991-1	1221-1
D.P.---20A	1992-1	1222-1
3-Way--20A	1993-1	1223-1
4-Way--20A	1994-1	1224-1
(2) Receptacles		
Duplex,		
Grounding 15A 125V	5252-1	5252-1
Outdoor 15A 125V	5252-WP	---
3W,Pol.Gr.20A 250V	---	6810-G
4W, 3 Ph, Gr. 250V	---	7250-G

(3) Electrical Floor Duct Outlets: Square "D" Type G1, satin aluminum, complete with duplex grounding receptacle, 20A., 125V.

(4) Telephone Floor Duct Outlets: Regular: Square "D" Type G1, satin aluminum with bushed opening. Amphenol Type: Square "D" Type G4, satin aluminum with bushed opening.

(5) Clock Hanger Outlets: "P & S" No. 1544, 15A., grounding, recessed plug.

16-A.19 DRY TYPE TRANSFORMERS

(a) GENERALLY Sizes and characteristics of dry type transformers shall be as shown on the plans. Unless otherwise specified, the design, manufacture and testing of dry type transformers and the methods of conducting tests and preparing reports shall be in accordance with NEMA Standard Publication for Specialty Transformers, No. ST1-4 (USA-C89.1).

(b) WINDINGS AND TAPS Dry type transformers shall be provided with separate primary and secondary windings for each phase, except that three-phase transformers having ratings not exceeding 15 KVA may have separate

Information Handling Services, 1999
August 12, 1999 05:44:57

"Tee" connected windings. Each primary winding of each transformer having a rating not exceeding 30 KVA, shall be provided with not less than two taps, each providing a 5 percent increment below full rated voltage. Each primary winding of each transformer having a rating greater than 30 KVA shall be provided with either four or six taps, two of which shall provide 2-1/2 percent increments above full rated voltage and the remainder shall provide 2-1/2 percent increments below full rated voltage.

(c) INSULATION Transformers having ratings not exceeding 25 KVA shall have Class B, F or H insulation. Class B insulation shall be rated for continuous operation at rated KVA with a temperature rise of not over 80 degrees C. above a 40-degree C. ambient and with a maximum hot spot temperature of 150 degrees C. Class F (115 degree C. rise) or H (150 degree C. rise) insulation may be substituted for Class B insulation. Transformers having ratings exceeding 25 KVA shall have Class H insulation and shall be rated for continuous operation at rated KVA with a temperature rise of not over 150 degrees C. above a 40 degree C ambient and with a maximum hot spot temperature of 220 degrees C. Class F. shall have a maximum hot spot temperature of 185 degrees C.

(d) TERMINALS Each dry type transformer shall be provided with a suitable terminal compartment to accommodate the required primary and secondary wiring connections and side or bottom conduit entrance. Transformers having ratings not exceeding 25 KVA shall be provided with terminal leads equipped with factory installed connectors arranged and supported in workmanlike manner. Transformers having ratings exceeding 25 KVA shall have terminal boards equipped with factory installed clamp type connectors. The terminal compartment temperature shall not exceed 75 degrees C. when the transformer is operating continuously at rated load with an ambient temperature of 40 degrees C. Transformers having ratings not exceeding 10 KVA shall be U.L. listed for operation with connecting cables rated for use at 75 degrees C.

(e) SOUND RATING AND ISOLATION Noise levels of dry type transformers, determined in accordance with NEMA Standards for Specialty Transformers, shall not exceed the following:

Information Handling Services, 1999
August 12, 1999 05:44:57

TRANSFORMER RATING	NOISE LEVEL
Not over 9 KVA	40 db.
Over 9 but not over 50 KVA	45 db.
Over 50 but not over 150 KVA	50 db.
Over 151 but not over 300 KVA	60 db.

All dry transformers shall be mounted on approved vibration and noise isolating and dampening supports. Conduit connections to transformers shall be made with flexible metal conduit, not less than 18 inches nor more than 36 inches in length, or approved vibration isolating connectors.

(f) CONSTRUCTION Dry type transformers shall be air-cooled. Single phase transformers larger than 25 KVA and three-phase transformers larger than 15 KVA shall be fully enclosed in steel enclosures. Transformers smaller than the above shall be fully enclosed, in steel enclosures with or without compound fill, or shall have exposed cores, impregnated windings, and steel enclosures enclosing all live parts. Transformers shall be provided with electrostatic shielding where required by the schedule on the plans.

(g) MOUNTING Unless otherwise indicated on drawings, dry type transformers having ratings not exceeding 45 KVA shall be suitable for wall mounting, and transformers having ratings exceeding 45 KVA shall be suitable for floor mounting. Shop drawings of wall brackets and platforms for transformers having ratings exceeding 30 KVA shall be submitted for approval.

(h) CERTIFICATION The transformer manufacturer shall furnish written certification that all dry type transformers furnished by him are construced and tested in accordance with the Standards referenced herein.

16-A.20 UNDERFLOOR RACEWAY SYSTEMS

(a) GENERALLY Underfloor raceway systems shall consist of active cells in the cellular steel structural floor and header ducts, together with interconnections, special fittings, inserts and outlets. The cellular steel flooring will be furnished, permanently placed, and secured under another Section by the steel floor sub-contractor. All of the cutting and drilling necessary for the electrical work, other than pre-fabricated openings, is included under this Section of the specification.

Information Handling Services, 1999
August 12, 1999 05:44:57

(b) FLOOR CELLS The cells of the steel floors designated or shown as "active cells" on the plans are to be used as raceways for power and telephone wiring. Power wiring (120/208 volt) required in the floor shall be installed in the headers and floor cells as herein specified.

(c) EXTENT The system shall include all devices and materials necessary for installation of wiring into the cells of the flooring including service outlet fittings, cell ells, standard access units, slotted junction units, elbows, vertical and horizontal offsets, fittings for extension of wiring from the cells of floor and headers and all necessary conduit connections to cabinets, wire and telephone closet, compartment troughs, etc., as indicated on the drawings and as may be necessary for a complete installation.

(d) STRUCTURAL FLOOR WORK Where openings occur in active cells of the cellular steel flooring over supporting beams, etc., they shall be permanently closed with corrugated cover plates. These cover plates shall be installed by applying asphaltic compound to the bottom outer edges of the cover plates snapping them in place and securing with self-tapping screws. The cover plates are furnished with the steel floor and will be turned over to the Electrical Contractor on the project for installation. This Contractor shall be responsible for sealing all active cell joints and openings against the entrance of concrete.

(e) HEADER DUCTS The number and location of the header ducts shall be as shown on the drawings. The ducts shall be a maximum of 1-1/2 inches high with a minimum cross-sectional area of 8.4 square inches, shall be of rectangular cross-section and shall be constructed of steel. Access units shall be spaced as shown on the drawings. Ducts shall be furnished in maximum practicable lengths. Ducts shall be attached to cellular floor at intervals of not less than 5 feet by tack welding. The header duct system shall include all ducts, couplings, standard access units, large slotted access units, wire troughs , wall and floor elbows, offset fittings, supports, expansion fittings, etc., required for a complete installation. Adapters suitable for the floor covering specified shall be provided at all access and junction units. The tops of access and junction units shall have up and down height adjustment which can be made before and after concrete is poured. The adjustment

Information Handling Services, 1999
August 12, 1999 05:44:57

feature shall be designed to prevent seepage of concrete into header. Grommets shall be installed between the header duct and the cellular metal floor at all junction and access units. Couplings shall be furnished and installed complete with coupling grounding screws to maintain a continuity of ground. Sealing compound shallbe used to make all couplings watertight. Header duct shall be as manufactured by "Square D", "Jones and Laughlin", "Walker Bros.", "National Electric", or approved equal.

(f) MARKERS Suitable markers identifying active cells of each system shall be installed on the tops of active cells and finished flush at the screed line. When floor covering is placed, markers shall be extended through the covering with grommetted screws. One marker per system for every 200 square feet of floor area shall be installed. Markers shall be installed at ends of cells in occupied space.

(g) INSERTS shall be provided for each power and telephone outlet specified hereinafter. The inserts shall be formed from mild steel and shall be not less than 0.069 inches in thickness when uncoated and not less than 0.073 inches when coated. The joint between the insert and the duct shall be capable of withstanding a straight pull of 200 pounds for a period of one minute. The diameter of the opening in the cell shall be not less than 2 inches I.P.X. Each insert shall be such that it will provide a continuous metallic passage from the cell or raceway to the underside of the floor covering and shall provide a smooth wire-pulling radius without any obstructions within the cell or outlet.

(h) SERVICE OUTLET FITTINGS shall be as specified hereinbefore. The bidder shall include in his proposal all costs incident to the furnishing and installing service outlet fittings shown on the plans. In addition, the Contractor shall furnish the following fittings, in original cartons, for future installation:

(1) Ten power service outlets with receptacles.

(2) Five regular telephone outlets.

(3) Five amphenol type telephone outlets.

The exact locations of the service outlet fittings will be furnished to the Contractor at a time previous

Information Handling Services, 1999
August 12, 1999 05:44:57

to the completion of the building. Furnish and deliver to the Resident Engineer complete blanking assembly fittings in the amount of ten percent of the total amount of service outlet fittings specified herein. All electrical fittings in connection with the steel floor shall be approved by the Underwriters' Laboratories, Inc.

(i) TOOLS Contractor shall deliver to the Resident Engineer one complete set of tools, as furnished by the manufacturer of the system, which will be necessary to install future inserts.

(j) INSPECTION Before the finished floor is placed, inspection must show all headers, cabinets, etc., to be in place. The entire system shall be free from obstructions and moisture after floor fill is in place.

16-A.21 DOOR CHIME SYSTEM

(a) GENERALLY The Clinic Area shall be provided with a low voltage door chime system located and arranged as shown on the plans.

(b) CHIMES The unit shall be arranged for flush mounting, smartly styled, producing one note or two note chime tone and complete with 10 volt, 5 watt transformer.

(c) PUSHBUTTON surface mounted, weatherproof type, with neoprene diaphragm, phosphor-bronze contact springs, and brass backplate threaded for 3/4" conduit.

(d) MANUFACTURE "Edwards" Model C-82 chime and Model 1786-C pushbutton, or approved equal.

16-A.22 DOOR ALARM SYSTEM

(a) GENERALLY Furnish and install an alarm system for Clinic Area doors, consisting of door switches, remote annunciator and interconnecting wiring as shown on the plans.

(b) DOOR SWITCHES shall be "Edwards" No. 504, or approved equal, heavy duty door switch and bumper plate, brass finish, nickel plated. Depressing plunger shall open circuit. Contacts shall be rated 4 amperes at 24 volts, A.C. Mount switches in door head on strike side and bumper plate on door opposite.

Information Handling Services, 1999
August 12, 1999 05:44:57

(c) ANNUNCIATOR shall be "Edwards" No. 7633 utility station, or approved equal, with white dome, one clear lamp, one red lamp, buzzer, cut-off switch, 24 volts A.C., and device plate. Annunciator shall be flush mounted in a two-gang box at Watch Supervisor's Station in existing Control Room as directed by the Resident Engineer.

(d) TRANSFORMER shall be "Edwards" No. 998, or approved equal, 120 volt primary to 24 volt secondary, A.C. Surface mount transformer in Lower Level Mechanical Room.

(e) INSTALLATION Door switches shall be wired in series and connected to annunciator so that in normally closed position white lamp is lighted, and buzzer is off. (Transformer secondary connected directly to lamp). When any door is opened, red lamp shall light and buzzer shall sound until door is closed or buzzer switch is turned off.

16-A.23 ELECTRIC DOOR LOCK

(a) GENERALLY The main Clinic Area door shall be provided with an electric locking mechanism controlled from a remote switch as shown on the plans. The equipment and installation shall be coordinated with work under other sections to insure proper fit and compatibility.

(b) DOOR OPENER Mortise type, flush mounting, satin chrome finish, low voltage operated, for installation in door jamb, normally locked, "Edwards" No. 179, with No. 992, 16 volt, 10 watt transformer, or approved equal.

(c) PUSHBUTTON Snap-fit type, polished chrome finish, ivory center, insulated, rated 2.0 amps @ 8 volts, "Edwards" No. 620, with No. 147 stainless steel plate or approved equal.

16-A.24 FLUORESCENT DIMMERS

(a) GENERALLY Where shown on the plans, furnish and install fluorescent light fixture dimmers in single gang boxes. The Contractor shall carefully coordinate ballasts and dimmers to insure proper application and operation.

(b) DIMMERS shall be specifically designed for operation on fluorescent systems operating at 277 volts, with single lamp or two lamp ballasts having radio

Information Handling Services, 1999
August 12, 1999 05:44:57

interference suppressors. Each unit shall be capable of dimming a maximum of 16 and a minimum of 4, 40 watt rapid start lamps. Dimmers shall be of the solid state type, "Hunt" No. AF-527, or approved equal.

16-A.25 AUTOMATIC FIRE AND SMOKE DETECTION SYSTEM

(a) GENERALLY A new smoke and fire detection system shall be installed for the new building addition and shall be complete as shown on the drawings and as specified herein. The system shall be as manufactured by "Pyr-A-Larm", with respective equipment model numbers as specified hereinafter, or shall be an approved equal system compatible in all respects with the existing system. The system shall include central control panel, remote annunciator panels, and alarm initiating devices, conduit and wiring, installed in accordance with manufacturer's recommendations and approved installation drawings. The number and extent of zones shall be as shown on the plans.

(b) WIRING shall be installed in accordance with the National Electrical Code, checked and tested by the Contractor in accordance with the instructions provided by the manufacturer to insure that the system is free of grounds, opens, shorts and that insulation resistance between current carrying conductors is 10 megohms or greater.

(c) TESTS, ADJUSTMENT AND CERTIFICATION Upon completion of the installation and on written notification given to the manufacturer, a factory-trained technician shall be sent to the installation to perform all necessary electrical tests and adjustments and who shall submit to the Resident Engineer a Letter of Certification indicating that the system functions and conforms to requirements of these specifications.

(d) EQUIPMENT AND FUNCTIONS The system shall utilize ionization detectors and shall be electrically supervised against both short and open wiring faults in the detection circuit, the alarm circuit, and the alarm and trouble relay coils. A short or open wiring fault occurring in these circuits shall cause an audible and visual trouble indication at the control panel. The system shall function as follows when any detector operates or a manual station is pulled.

(1) The main and remote alarm devices will sound.

Information Handling Services, 1999
August 12, 1999 05:44:57

(2) The proper zone and fire indication will appear on the main control panel and on remote annunciator for CCC areas.

The system shall be capable of being expanded at any time and shall have no limitations as to the number of detectors per zone. The system shall be capable of having ionization detecting devices and manual stations connected across the same pair of wires. Automatic detection devices employing the combustion vapor detection principle will not be considered as functionally equivalent to the system specified herein.

(e) IONIZATION DETECTORS The ionization detectors shall be of the two chamber design, DIS 3/5a. The first or reference chamber shall compensate against sensitivity changes due to temperature, barometric pressure and humidity variations. The second or sensing chamber shall be open to the outside elements through a protective screening which will permit products of combustion to enter, while preventing insects and foreign matter from entering and causing false alarms. The ionizing material for the detection and reference chambers shall be Americium 241. The detector shall contain no hot filament tubes or moving parts and shall plug into a base having a neon alarm indicating lamp. The detector shall not require replacement or readjustment after a fire alarm has been given. The detector sensitivity shall be individually adjustable and set by the factory-trained technician at installation and shall thereafter be fixed. It shall be possible to accurately measure the detector's sensitivity with an appropriate instrument. Relative sensitivity adjustments providing no readout of discrete sensitivity will not be considered as being equivalent.

(f) MAIN CONTROL EQUIPMENT The main system control cabinet shall be mounted adjacent to the existing system cabinet in the Control Room and shall be interconnected with the existing main control cabinet as shown on the plans. All components of the main control panel shall be mounted within one common enclosure, shall be pre-wired to terminal strips and shall be securely mounted in a sheet steel housing finished in scratch resistance, baked, wrinkle red enamel. The panel cover shall be complete with a continuous hinge, lock and keys. Separate illuminated signal indications shall be provided for power, fire and trouble in addition to one indication for each zone. A nameplate shall be provided for each zone indication and shall be securely fastened to the panel with

Information Handling Services, 1999
August 12, 1999 05:44:57

machine screws. Control housing shall be surface mounted. The main control panel shall contain the following individual units of control equipment as required.

(1) The control-power unit for the automatic fire detection and alarm system shall be Model FIU-6 and listed by Underwriters' Laboratories, Inc., and state or municipal regulatory agencies, where required. The unit shall provide the following functions:

(aa) Furnish necessary DC power for operation of detectors and zone units.

(bb) Control fire alarm signals.

(cc) Control trouble signals.

(dd) Control supplementary equipment.

(ee) Provide power for detector neon visual indicators.

The unit shall operate from a 3-wire, 120 volt, 60 cycle power source and be operable over a range of 102-132 volts. The trouble circuit shall activate when the voltage drops below approximately 85 volts. The standby power consumption shall not exceed 10 watts, exclusive of supplementary equipment. The unit shall include power, fire and trouble lamps. It shall have an "off-on" switch for applying power and resetting the system. It shall have separate switches for silencing audible fire and trouble devices. Both fire and trouble circuits shall ringback when condition has been cleared to indicate that switch must be returned to "normal" position. The unit shall have a disconnect switch which, when set to "disconnect" position, shall isolate external circuits or devices that are alarm actuated. The trouble lamp shall be energized while the switch is in the disconnect position.

(2) Zone Indicating Units: The zone indicating units for the system shall be Model FIU-6, shall operate in conjunction with the Fire Indicating Unit and shall provide four (4) zone indications for each unit employed. The zone indicating unit shall perform the following functions:

Information Handling Services, 1999
August 12, 1999 05:44:57

(aa) Provide visual indication of the zone in which a trouble signal is initiated.

(bb) Provide visual indication of the zone in which the alarm initiating detector is located.

(cc) Provide supplementary non-powered alarm control circuits which shall be activated independently for each zone.

(dd) Provide zone controller power, rated at six (6) watts per zone for remote annunciator operation. To avoid misinterpretation and confusion, the alarm signals shall override trouble indications. A door switch which, when door is opened, isolated supplementary control circuits to permit testing, fire drills or repair work, without affecting supplementary equipment.

(g) REMOTE ANNUNCIATOR The remote annunciator panel shall be Model RAN-8, shall be flush mounted in CCC Room of the new building addition as shown on the plans, and shall duplicate visual and audible functions of the main control panel for CCC area only. All signals such as "Fire", "Power", "Trouble" and "Zone" shall be visually indicated. In addition, an internal buzzer shall call attention to trouble signals and provisions shall be made for connecting an external audible alarm device to call attention to alarm signals. A silence button, located on the front, when operated shall silence any external or internal audible fire or trouble signals, but shall not affect any of the visual signals in the annunciator unit. The annunciator panel shall be provided with nameplates to identify the several zones of the respective CCC area. Type RAL-1 remote alarm lamps shall be provided for zones beneath CCC Area raised floors and shall be located in the remote annunciator panel, with a glass enclosed schematic to indicate zone locations beneath the raised floor.

(h) BELLS The system alarm bells shall be die cast, dustproof, 115-volt, 60 cycle A.C. vibrating type, designed to mount directly on a standard 4" octagon outlet box. The system must be capable of adding or subtracting bells without changing resistance of the circuit. The system shall be capable of handling up to 42 bells and the bell circuit shall be supervised.

Information Handling Services, 1999
August 12, 1999 05:44:57

16-A.26 GROUNDING

(a) GENERALLY The grounded neutral of the secondary distribution system shall be supplemented by an equipment grounding system to properly safeguard the equipment and personnel. The equipment grounding system shall be designed so all metallic structures, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, portable equipment and other conductive items in close proximity with electrical circuits operate continuously at ground potential and provide a low impedance path for possible ground fault currents. The system shall comply with the National Electrical Code, modified as indicated on the project drawings and as hereinafter specified.

(b) GROUND BUS Provide and install a 2-inch by 1/4-inch minimum bare copper ground bus spaced one inch from the wall and not more than six inches above the finished floor in the new electrical vault where shown on the drawings. This ground bus shall be connected to the extended ground loop as shown on the drawings. The connection shall be minimum 3/0 stranded copper thermic weld connected to both ground bus and ground loop. The system neutral ground and the equipment ground system shall be connected to the common ground bus.

(c) SECONDARY SERVICES Shall be grounded at the supply side of each individual secondary disconnecting means and at the related transformer in accordance with the National Electrical Code. Each service disconnect enclosure shall be provided with a neutral disconnecting means and an insulated neutral stud which interconnects with the bare insulated neutral and uninsulated equipment ground buses to establish the system common ground point.

(d) CONDUCTORS The required equipment grounding conductors and straps shall be sized in compliance with N.E.C. Table 250-95 (1968 Edition). All equipment grounding conductors shall be provided with green insulation equivalent to the insulation on the associated phase conductors. At the Contractor's option, grounding conductors No. 8 AWG and larger may be bare copper. The related feeder and branch circuit grounding conductors shall be brazed to the grounding bar or connected with approved pressure connectors. A feeder serving several panelboards shall have a

Information Handling Services, 1999
August 12, 1999 05:44:57

continuous grounding conductor which shall be connected to each related cabinet bar.

(e) DISTRIBUTION SYSTEMS shall be provided with a separate green insulated equipment grounding conductor for each single or three-phase feeder and each branch circuit. The required grounding conductor shall be installed in the common conduit with the related phase and/or neutral conductors. Where there are parallel feeders installed in more than one raceway, each raceway shall have a green insulated equipment ground conductor. Single-phase branch circuits required for 120 and 277 volt lighting, receptacles, and motors shall be provided with a green insulated ground conductor installed in the common conduit with phase and neutral conductors. Flexible metallic conduit equipment connections shall be provided with suitable green insulated grounding conductors connected to approved grounding terminals at each end of the flexible conduit.

(f) CONNECTORS The Contractor shall determine the number and size of pressure connectors to be provided on all equipment grounding bars required in panelboards and other electrical equipment for the termination of equipment grounding conductors. In addition to the active circuits, provide pressure connectors for all three-phase spares and spaces.

(g) EXPANSION FITTINGS Each electrical expansion fitting shall be provided with an external flexible copper ground securely bonded by approved grounding straps on each end of the fitting, unless there is a U.L. approved built-in copper grounding device.

(h) TERMINALS Furnish and install in the same raceway with the associated phase and/or neutral conductors a green colored equipment ground conductor having the same type insulation and connected as described below. Each ground conductor shall be provided with spade tongue terminals or solderless pressure connectors to suit conditions.

(1) From green ground terminal of all receptacles to green 10-32 "washer-in-head" outlet box machine screw install minimum No. 14 AWG wire. Note: Receptacles with special cast bodies and factory designed and approved ground path will not require a separate ground jumper.

Information Handling Services, 1999
August 12, 1999 05:44:57

(2) From green 10-32 "washer-in-head" machine screw in ceiling outlet box or junction box through flexible metallic conduit to ground terminal in fixture, install minimum No. 14 AWG wire.

(3) From green 10-32 "washer-in-head" machine screw in ceiling outlet box of junction box through flexible metallic conduit to green 10-32 "washer-in-head" machine screw in switch outlet box in movable partitions, install minimum No. 14 AWG wire.

(4) From green 10-32 "washer-in-head" machine screw in junction box or disconnect switch through flexible metallic conduit to ground terminal in connection box mounted on single phase fractional horsepower motor, install minimum No. 14 AWG wire.

(5) From equipment ground bus in motor control center through conduit and flexible metallic conduit to ground terminal in connection box mounted on single or three-phase motor, install ground conductor sized as herein specified. Note: Where motor has separate starter and disconnect device, the ground conductor shall originate at the ground bar in the panelboard supplying these motors and be bonded to each starter and disconnect device enclosure also.

(6) From ground bar in panelboard or green 10-32 "washer-in-head" machine screw in junction box supplying surface metal raceway to receptacle or fixture ground terminals, install minimum No. 14 AWG wire.

(i) TESTS The completed equipment grounding system shall be subjected to a meggered test at each service disconnect enclosure ground bar to insure that the ground resistance, without chemical treatment or other artificial means, does not exceed five (5) ohms. Certified test reports of the ground resistance shall be submitted to the Resident Engineer for approval. Necessary modifications for compliance with the five (5)ohm value shall be accomplished without additional expense to the Government.

(j) SPECIAL SYSTEMS

(1) Provide and install ground plate assemblies on concrete floor under the raised floor in the CCC

Information Handling Services, 1999
August 12, 1999 05:44:57

Area as shown on the plans and as detailed on FAA Standard Dwg. No. DE-B-123. Provide and install 1-1/2" empty conduit, with pull wire and pull boxes as required, from the center groundplate to the new ground bus in the electrical vault. Interconnections between plates and between center plate and ground bus will be furnished and installed by others.

(2) Special precautions shall be taken to insure continuity of ground system to CCC and CDC area power panels, with measured resistance not exceeding five (5) ohms. Extensions of the green wire grounding systems to CCC and CDC equipment from branch circuit panelboard ground busses will be furnished and installed by others.

16-A.27 ELECTRIC HEAT BAND

(a) GENERALLY Furnish and install where shown on the plans electric heat band for freeze protection of cooling tower makeup water line. Band shall be installed around bare pipe, beneath insulation. Installation shall be coordinated with Mechanical Contractor. Band shall be installed over the entire length of exposed water piping, valves and connections and shall extend to 36 inches below grade.

(b) BAND shall be 15 feet in length, rated 105 watts at 120 volts. Band shall have moisture-proof vinyl jacket, integral thermostat and connections hermetically sealed, 12 inch long cold lead wire and molded male plug. Unit shall be U.L. approved and shall be "Easy-Heat" Model EZ-AB15, or approved equal.

16-A.28 LIGHTNING PROTECTION SYSTEM

(a) GENERALLY The Contractor shall furnish and install a complete lightning protection system as specified, as shown on the drawings, and in accordance with NFPA No. 78 "Lightning Code". A certificate of compliance with U.L. "Master Label" requirements shall be furnished to the Contracting Officer upon completion of the work.

(b) WORK INCLUDED The system shall include, but not be limited to, air terminals, stranded and twisted copper loop and down conductors, ground rods, clamps, supports, welded connections, and other accessories and work as required. The existing underground grounding loop shall be modified and extended as shown on the plans.

Information Handling Services, 1999
August 12, 1999 05:44:57

(c) INSTALLATION The loop or down conductors shall be bonded to all masses of metal such as structural members, conduits, ductwork, etc., that lie within six feet of any portion of the lightning protection system. Except for such bonding, system shall generally be run concealed. The cast-in-construction method shall be used wherever possible, including the system down conductors. Down conductors shall not be exposed on the outside of the building or in finished spaces except as specifically permitted by the Resident Engineer.

(d) COORDINATION The work of this system shall be carefully coordinated with correlated work provided under other sections in order to avoid interferences.

(e) BONDING The thermoweld process, or approved equal method shall be used for all bonding required in this system.

16-A.29 MANUAL TRANSFER SWITCH

(a) GENERALLY Furnish and install a manually operated transfer switch in the temporary electric service to the building as shown on the plans. The temporary power company service shall be connected to "normal" source lugs of the switch and outgoing service to the "load" lugs of the switch. "Emergency" source lugs shall not be connected and will be utilized for future connection of temporary emergency power.

(b) CONSTRUCTION The transfer switch shall consist of two mechanically interlocked, load break, bolted pressure switches in one free-standing, ventilated, weatherproof outdoor steel enclosure. Switches shall be vertically mounted. Switches shall be so designed that a positive wiping action is maintained on the contacts during opening and closing and shall be capable of 50 load break operations at 200% of rating at rated voltage. Switches shall be rated 1200 amperes, 480 volts, 3 pole, 4 wire, solid neutral. Switch handle shall be arranged for padlocking in either position and cabinet door shall also be arranged for padlocking. Units shall consist of two "Pringle Electrical Manufacturing Company", catalog R-1243-SN-NF switches, or approved equal, mounted and arranged as specified.

Information Handling Services, 1999
August 12, 1999 05:44:57

16-A.30 LIGHTING CONTACTOR

(a) GENERALLY Furnish and install a lighting contactor to control new security lighting from existing photocell controlled security lighting circuit as shown on the plans. The contactor shall be surface mounted in a NEMA 1 enclosure.

(b) CONSTRUCTION The contactor shall be electromagnetically operated, and shall not change contact position upon loss of control voltage. Positive locking shall be obtained without the use of hooks, latches, or semi-permanent magnets. Contactor shall be rated 250 volts, A.C., 30 amperes, 3 poles, single throw. Contactor shall be of rugged construction, substantially made and shall meet requirements of the Underwriters' Laboratories, Inc., "Standards for Safety Industrial Control Equipment UL 508", approved for tungsten lamp load to full rating. Contacts shall be renewable, of the brush or solid wiping type, silver to silver, or silver-tungsten alloy, protected by arcing contacts or other provision for inductive load, self-aligning, quick-make and quick-break and shall be provided with noise and vibration dampers for quiet operation. Contactor shall operate independently of gravity so that it may be mounted in any position. The control circuit shall be energized as indicated on drawings.

16-A.31 FIRE ALARM SYSTEM

(a) GENERALLY Connect to and extend existing fire alarm system as shown on the plans. All new equipment shall match existing equipment in appearance and shall be compatible with the existing system in all respects. The Contractor shall be responsible for the proper operation of the entire system after additions are made. System shall comply with requirements of Federal Specification W-F-369a and NFPA 72.

(b) DESIGN All equipment shall be listed by U.L. The system shall be electrically supervised, continuous ringing, closed circuit type. System shall be designed so that operation of any station sounds all signals continuously until station is restored to normal operation. Open circuits or grounds in any wiring or device

Information Handling Services, 1999
August 12, 1999 05:44:57

shall ring trouble bell only. Operating current shall be 115 volts, single phase, 60 cycle A.C. Breakglass stations shall be flush type and shall have provisions for fire drills without breaking glass. Double projector horns shall be surface mounted.

(c) QUALITY Equipment shall be as manufactured by "Standard Electric Time Company", "Cincinnati", "Simplex", "Edwards" or approved equal.

(d) WIRING Connecting wires shall be color coded to match existing color coding. All wiring shall be installed in separate fire alarm conduit system and shall be in accordance with the manfacturer's recommendations.

16-A.32 TELEPHONE SYSTEM ROUGH-IN

(a) GENERALLY The Contractor shall furnish and install a complete telephone raceway system for telephone company use, including conduit, outlet boxes, and fittings as required and/or shown on the plans. Installation shall employ the same methods and material as for lighting circuits under these specifications.

(b) RACEWAY Minimum size of conduit for telephone use shall be 3/4", and all conduit shall be left with #16 bare pull wires installed.

(c) TERMINATIONS Conduits shall be extended to panel or wire closet locations as shown on the plans and terminated in bushed ends.

16-A.33 LIGHTING

(a) LIGHTING FIXTURE SCHEDULE Fixtures furnished shall be similar in design and equal to those as listed in schedule on the drawings, complete with all lamps as noted.

(b) SUBSTITUTIONS Substitutions for scheduled fixtures shall be submitted within 30 days after contract has been signed, and shall be listed by manufacturer's catalog number with scale drawings showing metal gauges, finishes and photometric distribution curves.

(c) LABELS All fixtures shall carry U.L. and E.T.L. labels.

Information Handling Services, 1999
August 12, 1999 05:44:57

(d) INSTALLATION The Contractor shall do all necessary assembling, wiring, and installation which may be required to place all fixtures in satisfactory operation.

(e) LAMPS All lamps installed in fixtures and lamp holders shall be first line quality, as manufactured by "General Electric", "Westinghouse", "Sylvania", or equal. Unless otherwise noted, all fluorescent lamps shall be "standard cool white" type.

(f) BALLASTS AND SUPPRESSORS All fluorescent fixture ballasts shall be high power factor, C.B.M., E.T.L. rated ballasts, having thermal overload protection, "A" sound rating. All fluorescent fixtures shall be provided with radio interference suppressors. Dimming ballasts shall be provided where indicated and shall be coordinated with dimmers actually furnished.

(g) SUPPORTS Ceiling mounted fixtures shall be supported from the ceiling suspension system or other structural members, and not from the ceiling material alone.

16-A.34 EQUIPMENT FURNISHED BY OTHERS

(a) GENERALLY Certain items of equipment will be furnished and installed under other sections. It shall be the responsibility of this Contractor to verify the size and location of all such equipment from time to time as the job progresses and to rough in for and make final electrical connections to such equipment, as required and/or shown on the plans. Such electrical connections shall include all wiring, conduit, disconnect switches, outlet boxes, etc., as required for the same throughout the project.

16-A.35 TESTING

(a) GENERALLY At the time of final inspection and test, all connections at panels, switches, etc., and all splices must be made. All fuses must be in place and the circuits continuous from point of service connections to all switches, receptacles, outlets, etc. Each separate branch circuit with receptacles and switches connected shall

Information Handling Services, 1999
August 12, 1999 05:44:57

test free from short circuits and grounds, and shall have a minimum insulating resistance between conductors and between conductors and ground of 50 megohms when tested at 600 volts by Megger. If fixtures, lampholders, or appliances are also connected, the minimum resistance shall be 500,000 ohms. Power circuits and secondary feeder shall have a minimum insulation resistance as required or recommended by the National Electrical Code. The Contractor shall furnish the instruments, transformers, etc., for making the above tests. Tests shall be conducted in the presence of the Resident Engineer.

(b) MOTORS shall be tested for proper starting and direction of rotation.

(c) LIGHTING circuits shall be tested for proper operation on manual control, on automatic control where applicable, and for full range dimming where applicable.

(d) OTHER SYSTEMS including existing systems modified and/or extended, shall be operated for verification of proper performance.

(e) CRITICAL POWER SYSTEM circuit breaker tripping characteristics shall be verified by actual tests performed after installation. Certified test reports shall be submitted to the Resident Engineer for approval. Time characteristic curves for all critical power system breakers shall be submitted with test reports.

(f) OTHER TESTS The Contractor shall make all other tests as may be required by the Resident Engineer to prove the integrity of his work, and shall leave the complete electrical installation in first class condition and ready for operation. All defects or deficiencies in any of the electrical work shall be corrected in an approved manner without additional cost to the Government, and to the satisfaction of the Resident Engineer.

(g) TEST DATA The Contractor shall furnish to the Resident Engineer two (2) dated copies of all test readings, including the nameplate record of test instruments and the name and title of the person or persons who performed the test.

Information Handling Services, 1999
August 12, 1999 05:44:57

16-A.36 PAINTING

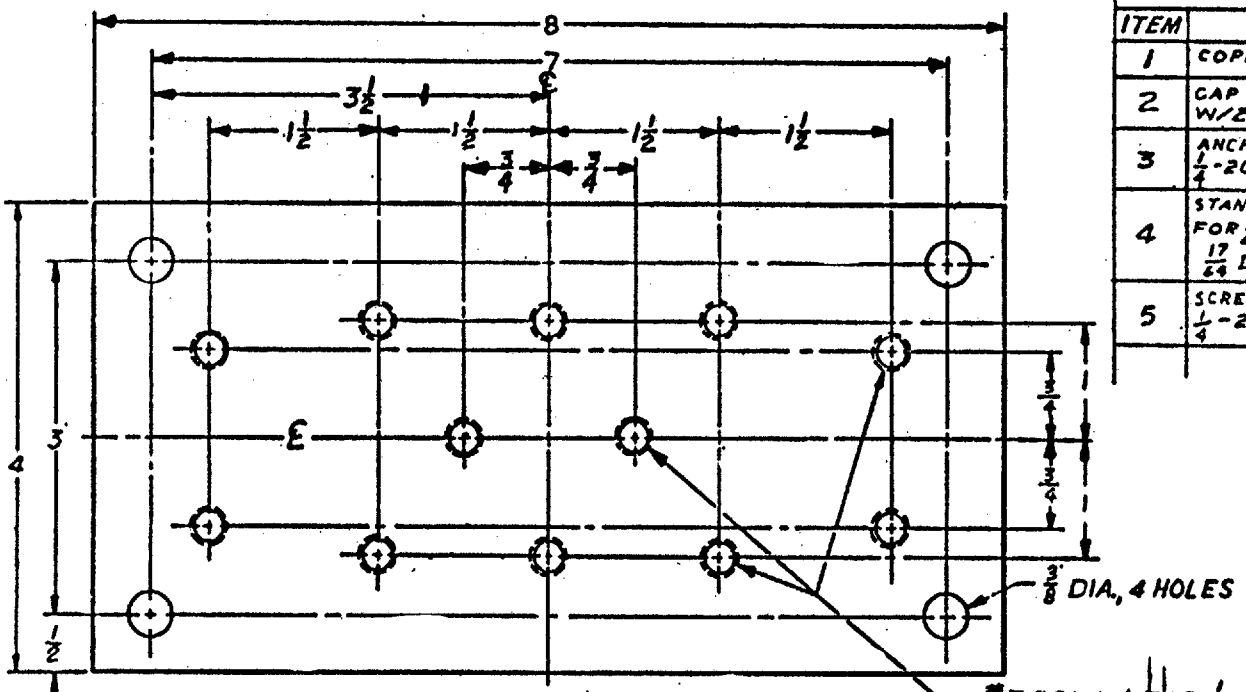
(a) GENERALLY All painting or preparation therefore shall be as called for in the GENERAL REQUIREMENTS FOR MECHANICAL AND ELECTRICAL WORK, except for coating of underground conduits, specified herebefore.

* * * * *

ATTACH:

Drawing DE-8-123

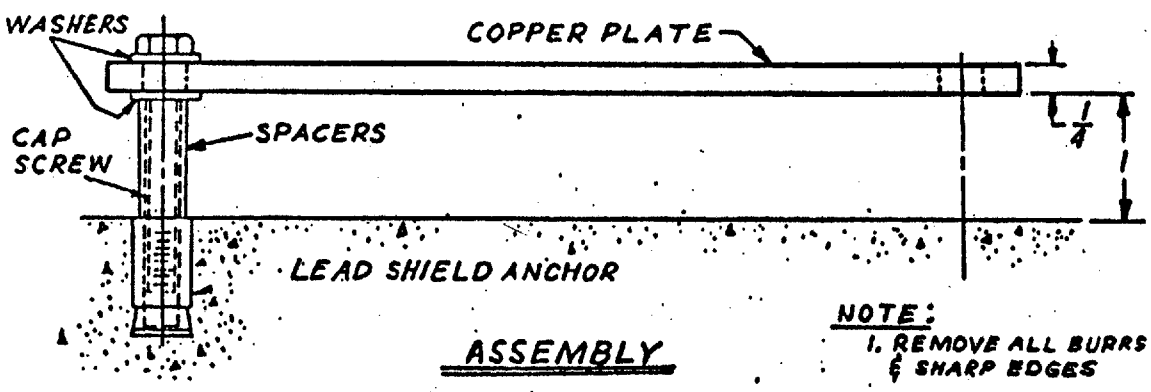
Information Handling Services, 1999
August 12, 1999 05:44:57



MATERIAL: 4 x 8 x ¼ COPPER BUS BAR
REQ'D: 1
SCALE: 1-1

HARDWARE LIST			
ITEM	DESCRIPTION	FINISH	REQ'D
1	COPPER PLATE ¼ x 4 x 8		1
2	CAP SCREW STEEL, ¼-20 x 2 W/2 ROUND WASHERS	CADMIUM PLATE	4
3	ANCHOR, LEAD SHIELD, FOR ¼-20		4
4	STAND-OFF OR SPACERS, STEEL, FOR ¼ BOLT 15/16 LONG 17/64 I.D. 7/16 O.D.	CADMIUM PLATE	4
5	SCREW, MACHINE, BRASS ¼-20 x 3/8 RH	N.P.	12

TOLERANCE
OVERALL & LOCATION DIMENSIONS ± 1/16
DIMENSIONS BETWEEN HOLES ± 1/32
NON-CUMULATIVE



ASSEMBLY

NOTE:
1. REMOVE ALL BURRS & SHARP EDGES

REV. LTR.	DATE	DESCRIPTION	CHECKED	APPROVED

FEDERAL AVIATION ADMINISTRATION
AERONAUTICAL CENTER OKLAHOMA CITY, OKLAHOMA

GROUNDING PLATE FOR ARTCC
MECH. - ASSY. - DETAIL

DESIGNED BY
DRAWN BY TANYAN
CHECKED BY
SUBMITTED BY
APPROVED BY
ISSUED BY
DATE 8-23-67
DRAWING NO. DE-B-123

☆U. S. GOVERNMENT PRINTING OFFICE : 1970 O - 372-122

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