

PROJECT MANUAL

**EARLY RELEASE PACKAGE #4
PARKING GARAGE
ST. LUKE'S CLEAR LAKE HOSPITAL
AND GARAGE
200 Blossom Street
Webster, Texas 77598**

PROJECT NO. 407480

**CONSTRUCTION ISSUE
02 MAY 2008**



OWNER:

MEDISTAR CORPORATION
7670 Woodway, Suite 160
Houston, TX 77063
TEL 713.266.8990

ARCHITECT:

PageSoutherlandPage
1100 Louisiana, Suite One
Houston Texas 77002
TEL 713.871.8484
FAX 713.871.8440

PROJECT MANUAL FOR:

**ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE
200 BLOSSOM STREET
WEBSTER, TEXAS**

PROJECT NO. 407480

DATE: MAY 2, 2008

**ARCHITECT: PAGESOUTHERLANDPAGE
ARCHITECTS / ENGINEERS / CONSULTANTS
1100 LOUISIANA, SUITE ONE
HOUSTON, TEXAS 77002
(713) 871-8484**

**CIVIL ENGINEER: WALTER P. MOORE & ASSOCIATES
3131 EASTSIDE
HOUSTON, TEXAS 77098
(713) 713 630 7300**

**M.E.P. ENGINEER: CCRD PARTNERS
808 TRAVIS, SUITE 200
HOUSTON, TEXAS 77002
(713) 237-8900**

**STRUCTURAL ENGINEER: HAYNES WHALEY ASSOCIATES
2000 W. SAM HOUSTON PARKWAY SOUTH
SUITE 1800
HOUSTON, TEXAS 77042
(713) 868-1591**

**PARKING CONSULTANT: LAM PARKING, INC.
1717 ST. JAMES PLACE, SUITE 118
HOUSTON, TEXAS 77056
(713) 871-0973**

Division	Section Title	Pages
	DOCUMENT GC – GENERAL CONDITIONS OF THE CONTRACT	
00500	SUMMARY OF THE WORK	1
DIVISION 1 - GENERAL REQUIREMENTS		
01035	MODIFICATION PROCEDURES	2
01040	COORDINATION	3
01050	FIELD ENGINEERING	2
01060	CODES AND STANDARDS	2
01061	ACCESSIBILITY REQUIREMENTS	3
01200	PROJECT MEETINGS	3
01330	SUBMITTAL PROCEDURES	7
01400	QUALITY CONTROL	3
01410	TESTING LABORATORY SERVICES	5
01561	TRENCH SAFETY SYSTEM	2
01562	TREE AND PLANT PROTECTION	3
01571	NPDES REQUIREMENTS	2
01576	WASTE MATERIAL DISPOSAL	1
01600	MATERIALS AND EQUIPMENT	4
01631	SUBSTITUTIONS	4
01670	SYSTEMS DEMONSTRATION	2
01700	CONTRACT CLOSEOUT	4
01710	CLEANING	2
01730	OPERATION AND MAINTENANCE DATA	5
01741	WARRANTIES	2
DIVISION 2 - SITE CONSTRUCTION		
02220	EARTHWORK UNDER BUILDING	9
02361	TERMITE CONTROL	2
02577	PAVEMENT MARKINGS	2
DIVISION 3 – CONCRETE		
03300	CAST-IN-PLACE CONCRETE	13
03410	PLANT-PRECAST STRUCTURAL CONCRETE	14
DIVISION 4 – MASONRY		
04810	UNIT MASONRY ASSEMBLIES	15
DIVISION 5 – METALS		
05500	METAL FABRICATIONS	9
05521	PIPE AND TUBE RAILINGS	6
DIVISION 6 - WOOD AND PLASTICS (NOT USED)		
DIVISION 7 - THERMAL AND MOISTURE PROTECTION		
07133	THERMOPLASTIC SHEET WATERPROOFING	3
07135	SHEET MEMBRANE WATERPROOFING	
07160	BITUMINOUS DAMPPROOFING	4
07551	APP-MODIFIED BITUMINOUS MEMBRANE ROOFING	9
07620	SHEET METAL FLASHING AND TRIM	5
07920	JOINT SEALANTS	8
DIVISION 8 - DOORS AND WINDOWS		
08110	STEEL DOORS AND FRAMES	4
ST.LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE		
PARKING GARAGE PACKAGE		
PSP #407480	CONSTRUCTION DOCUMENTS – 2 MAY 2008	TOC- 1

08213	PLASTIC FACED WOOD DOORS	2
08410	ALUMINUM ENTRANCES & STOREFRONTS	7
08710	DOOR HARDWARE	7

DIVISION 9 – FINISHES

09651	RESILIENT TILE FLOORING	4
09652	SHEET VINYL FLOOR COVERINGS	5
09653	RESILIENT WALL BASE AND ACCESSORIES	3
09900	PAINTING	9
09963	ELASTOMERIC COATINGS	10

DIVISION 10 – SPECIALTIES

10200	LOUVERS AND VENTS	5
10520	FIRE-PROTECTION SPECIALTIES	3

DIVISION 11 – EQUIPMENT (NOT USED)

DIVISION 12 – FURNISHINGS (NOT USED)

DIVISION 13 - SPECIAL CONSTRUCTION (NOT USED)

DIVISION 14 - CONVEYING SYSTEMS

14210	ELECTRIC TRACTION ELEVATORS	9
-------	-----------------------------	---

DIVISION 15 – MECHANICAL

15010	MECHANICAL GENERAL PROVISIONS	23
15050	BASIC MATERIALS AND METHODS	18
15090	PIPE HANGERS AND SUPPORTS	8
15180	INSULATION	9
15260	PIPING INSULATION	20
15401	DOMESTIC WATER SUPPLY SYSTEM	10
15405	DRAINAGE SYSTEMS	6
15500	FIRE PROTECTION SYSTEMS	9
15705	REFRIGERANT PIPING SYSTEMS	2
15803	AIR COOLED DX SYSTEMS	2
15990	TESTING, ADJUSTING AND BALANCING	3

DIVISION 16 – ELECTRICAL

16051	COMMON WORK RESULTS FOR ELECTRICAL	15
16055	OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY	7
16060	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS	11
16073	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS	10
16074	VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS	12
16075	IDENTIFICATION FOR ELECTRICAL SYSTEMS	12
16120	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES	13
16130	RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS	14
16133	UNDERGROUND DUCTS AND RACEWAYS FOR ELECT. SYSTEMS	23
16140	WIRING DEVICES	8
16211	ELECTRICITY METERING	3
16410	ENCLOSED SWITCHES AND CIRCUIT BREAKERS	15
16442	PANELBOARDS	15
16461	LOW-VOLTAGE TRANSFORMERS	9
16491	FUSES	4
16511	INTERIOR LIGHTING	12
16521	EXTERIOR LIGHTING	29

ST.LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
 PARKING GARAGE PACKAGE

END OF TABLE OF CONTENTS

DOCUMENT GC - GENERAL CONDITIONS OF THE CONTRACT

GENERAL CONDITIONS:

The 2008 Edition of "Medistar General Conditions – Contract AIA 111-1997," is hereby made a part of the Project Manual.

A copy of the document is bound in the Project Manual following this page.

END OF DOCUMENT GC

**Medistar General Conditions of Contract
Table of Contents
Attachment A**

ARTICLE 1 – GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

1.1.1 THE CONTRACT DOCUMENTS

1.1.2 THE CONTRACT

1.1.3 THE WORK

1.1.4 THE PROJECT

1.1.5 THE DRAWINGS

1.1.6 THE SPECIFICATIONS

1.1.7 THE PROJECT MANUAL

1.1.8; 1.1.9; 1.1.10; 1.1.11

THE PROJECT MANUAL (continued)

1.1.12; 1.1.13; 1.1.13.1; 1.1.14; 1.1.14.1; 1.1.15

1.2 EXECUTION, CORRELATION AND INTENT

1.2.1; 1.2.1.1; 1.2.1.2; 1.2.1.3; 1.2.1.4; 1.2.2

EXECUTION, CORRELATION AND INTENT (continued)

1.2.3; 1.2.3.1; 1.2.3.2; 1.2.3.3; 1.2.4; 1.2.5; 1.2.5.1; 1.2.5.2; 1.2.6;

1.3 OWNERSHIP AND USE OF ARCHITECT'S DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS

1.3.1; 1.3.1.1; 1.3.1.2

1.4 CAPITALIZATION

1.4.1

1.5 INTERPRETATION

1.5.1

ARTICLE 2 – OWNER

2.1 DEFINITION

2.1.1; 2.1.1.1

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

2.2.1; 2.2.2; 2.2.3; 2.2.4; 2.2.5; 2.2.6;

2.3 OWNER'S RIGHT TO STOP THE WORK

2.3.1

2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

2.4.1

ARTICLE 3 - CONTRACTOR

3.1 DEFINITION

3.1.1; 3.1.2

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY 1 CONTRACTOR

3.2.1; 3.2.2; 3.2.3

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

3.3.1; 3.3.2; 3.3.3; 3.3.4

3.4 LABOR AND MATERIALS

3.4.1; 3.4.2; 3.4.3.; 3.4.4; 3.4.5; 3.4.6

3.5 WARRANTY

3.5.1; 3.5.2; 3.5.3

3.6 TAXES

3.6.1

3.7 PERMITS, FEES AND NOTICES

3.7.1; 3.7.2; 3.7.3; 3.7.4; 3.7.5

3.8 ALLOWANCES

3.8.1; 3.8.2

3.9 SUPERINTENDENT/PROJECT MANAGER

3.9.1; 3.9.1.1; 3.9.1.2

3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

3.10.1; 3.10.2; 3.10.2.1; 3.10.2.1.1; 3.10.2.1.2; 3.10.2.1.3; 3.10.2.1.3.1; 3.10.2.1.3.2; 3.10.2.1.3.3;
3.10.2.1.3.4; 3.10.2.1.3.5; 3.10.2.1.3.6; 3.10.2.1.3.7; 3.10.2.2; 3.10.2.2.1; 3.10.2.2.2; 3.10.2.2.3; 3.10.2.2.4;
3.10.2.2.5; 3.10.2.3; 3.10.2.3.1.; 3.10.2.3.2; 3.10.2.3.3; 3.10.2.3.4; 3.10.2.3.5; 3.10.2.3.6; 3.10.2.3.7; 3.10.2.4
3.10.3; 3.10.4; 3.10.5; 3.10.6; 3.10.7; 3.10.8; 3.10.9; 3.10.9.1; 3.10.10; 3.10.11; 3.10.12
3.10.13; 3.10.13.1; 3.10.14; 3.10.15; 3.10.16; 3.10.17

3.11 DOCUMENTS AND SAMPLES AT THE SITE

3.11.1

3.12 SUBMITTALS

3.12.1; 3.12.2; 3.12.3; 3.12.4; 3.12.5; 3.12.5.1; 3.12.5.2; 3.12.5.3; 3.12.6; 3.12.7; 3.12.8; 3.12.8.1; 3.12.9;
3.12.10; 3.12.11

- 3.13 USE OF SITE
 - 3.13.1; 3.13.2
- 3.14 CUTTING AND PATCHING
 - 3.14.1; 3.14.2
- 3.15 CLEAN UP
 - 3.15.1; 3.15.2
- 3.16 ACCESS TO WORK
 - 3.16.1
- 3.17 ROYALTIES AND PATIENTS
 - 3.17.1
- 3.18 INDEMNIFICATION
 - 3.18.1; 3.18.1.1; 3.18.1.2; 3.18.1.3; 3.18.1.4; 3.18.2; 3.18.3
- 3.19 CONFIDENTIAL INFORMATION AND PUBLICITY
 - 3.19.1
- 3.20 ADDITIONAL REQUIREMENTS
 - 3.20.1; 3.20.2; 3.20.3; 3.20.4; 3.20.5

ARTICLE 4 – ADMINISTRATION OF THE CONTRACT

- 4.1 ARCHITECT
 - 4.1.1; 4.1.2; 4.1.3; 4.1.4
- 4.2 COMMUNICATION
 - 4.2.1
- 4.3 CLAIMS AND DISPUTES
 - 4.3.1; 4.3.2; 4.3.3; 4.3.4; 4.3.5; 4.3.6; 4.3.6.1; 4.3.6.2; 4.3.6.2.1; 4.3.6.3; 4.3.6.4; 4.3.7

ARTICLE 5 - SUBCONTRACTORS

- 5.1 DEFINITIONS
 - 5.1.1; 5.1.2
- 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK
 - 5.2.1; 5.2.2; 5.2.3; 5.2.3.1; 5.2.4; 5.2.5
- 5.3 SUBCONTRACTUAL RELATIONS
 - 5.3.1; 5.3.2
- 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS
 - 5.4.1; 5.4.2

ARTICLE 6 – CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

- 6.1 OWNER’S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS
 - 6.1.1; 6.1.2; 6.1.3; 6.1.4
- 6.2 MUTUAL RESPONSIBILITY
 - 6.2.1; 6.2.2; 6.2.3; 6.2.4; 6.2.5; 6.2.6
- 6.3 OWNER’S RIGHT TO CLEAN UP
 - 6.3.1

ARTICLE 7 – CHANGES IN THE WORK

- 7.1 CHANGES
 - 7.1.1; 7.1.2; 7.1.3; 7.1.4; 7.1.5
- 7.2 CHANGE ORDERS
 - 7.2.1; 7.2.2
- 7.3 CHANGE ORDER REQUIREMENTS
 - 7.3.1; 7.3.1.1; 7.3.1.2; 7.3.2; 7.3.2.1; 7.3.2.1.1; 7.3.2.1.2; 7.3.2.1.3; 7.3.2.1.4; 7.3.2.1.5
 - 7.3.2.2; 7.3.2.2.1; 7.3.2.2.2; 7.3.2.3; 7.3.2.3.1; 7.3.2.3.1.1; 7.3.2.3.1.2; 7.3.2.3.1.3; 7.3.2.3.1.3.1; 7.3.2.3.1.3.2; 7.3.2.3.1.4; 7.3.2.4; 7.3.2.4.1; 7.3.2.5; 7.3.2.6; 7.3.2.6.1; 7.3.2.6.2; 7.3.2.6.2.1; 7.3.2.6.3; 7.3.2.6.4.1; 7.3.2.6.4.2; 7.3.2.6.4.3; 7.3.2.7; 7.3.2.8; 7.3.2.9; 7.3.2.10; 7.3.2.10.1; 7.3.2.10.2; 7.3.2.10.3; 7.3.2.10.4; 7.3.2.10.5; 7.3.2.11; 7.3.2.11.1; 7.3.2.11.2; 7.3.2.11.3; 7.3.2.11.4; 7.3.2.11.5; 7.3.2.11.6; 7.3.2.12; 7.3.3
 - 7.3.4; 7.3.5; 7.3.6; 7.3.7; 7.3.7.1; 7.3.7.2; 7.3.7.3; 7.3.7.4; 7.3.7.5; 7.3.7.6; 7.3.7.7; 7.3.7.8; 7.3.8; 7.3.9; 7.3.10; 7.3.11; 7.3.12
- 7.4 MINOR CHANGES IN THE WORK
 - 7.4.1

ARTICLE 8 - TIME

- 8.1 DEFINITIONS
 - 8.1.1; 8.1.2; 8.1.3; 8.1.4
- 8.2 PROGRESS AND COMPLETION
 - 8.2.1; 8.2.2; 8.2.3; 8.2.4
- 8.3 DELAYS AND EXTENSIONS OF TIME
 - 8.3.1; 8.3.2; 8.3.3

ARTICLE 9 – PAYMENTS AND COMPLETION

- 9.1 CONTRACT SUM
 - 9.1.1
- 9.2 SCHEDULE OF VALUES
 - 9.2.1

ATTACHMENT A

- 9.3 APPLICATIONS FOR PAYMENT
 - 9.3.1; 9.3.1.1; 9.3.1.2; 9.3.1.3; 9.3.2; 9.3.3
- 9.4 CERTIFICATES FOR PAYMENT
 - 9.4.1; 9.4.2
- 9.5 DECISIONS TO WITHHOLD CERTIFICATION
 - 9.5.1; 9.5.2; 9.5.3; 9.5.4
- 9.6 PROGRESS PAYMENTS
 - 9.6.1; 9.6.2; 9.6.2.1; 9.6.3; 9.6.4; 9.6.5; 9.6.9; 9.6.7; 9.6.8
- 9.7 FAILURE OF PAYMENT
 - 9.7.1
- 9.8 SUBSTANTIAL COMPLETION
 - 9.8.1; 9.8.2
- 9.9 PARTIAL OCCUPANCY OR USE
 - 9.9.1; 9.9.2; 9.9.3
- 9.10 FINAL COMPLETION AND FINAL PAYMENT
 - 9.10.1; 9.10.2; 9.10.2.1.1; 9.10.2.1.2; 9.10.2.1.2.1; 9.10.3; 9.10.4; 9.10.5
- 9.11 LIQUIDATED DAMAGES
 - 9.11.1; 9.11.2

ARTICLE 10 – PROTECTION OF PERSONS AND PROPERTY

- 10.1 SAFETY PRECAUTIONS AND PROGRAMS
 - 10.1.1; 10.1.2; 10.1.3; 10.1.4; 10.1.5
- 10.2 SAFETY OF PERSONS AND PROPERTY
 - 10.2.1; 10.2.2; 10.2.3; 10.2.3.1; 10.2.3.2; 10.2.4; 10.2.5; 10.2.6; 10.2.7
- 10.3 EMERGENCIES
 - 10.3.1; 10.3.2

ARTICLE 11 – INSURANCE AND BONDS

- 11.1 CONTRACTOR’S LIABILITY INSURANCE
 - 11.1.1; 11.1.2; 11.1.2.1; 11.1.3
- 11.2 OWNER’S LIABILITY INSURANCE
 - 11.2.1
- 11.3 INTENTIONALLY OMITTED

- 11.4 PROPERTY INSURANCE
 - 11.4.1; 11.4.1.1
 - 11.4.1.2 INTENTIONALLY OMITTED
 - 11.4.1.3; 11.4.1.4; 11.4.1.5; 11.4.2
 - 11.4.3 INTENTIONALLY OMITTED
 - 11.4.4; 11.4.5; 11.4.6; 11.4.7; 11.4.8; 11.4.9; 11.4.10
- 11.5 PERFORMANCE BOND AND PAYMENT BONDS
 - 11.5.1; 11.5.2

ARTICLE 12 – UNCOVERING AND CORRECTION OF WORK

- 12.1 UNCOVERING OF WORK
 - 12.1.1; 12.1.2
- 12.2 CORRECTION OF WORK
 - 12.2.1; 12.2.2; 12.2.2.1; 12.2.3; 12.2.4; 12.2.5; 12.2.6; 12.2.7; 12.2.8; 12.2.9
- 12.3 ACCEPTANCE OF NONCONFORMING WORK
 - 12.3.1

ARTICLE 13 – MISCELLANEOUS PROVISIONS

- 13.1 GOVERNING LAW
 - 13.1.1
- 13.2 SUCCESSORS AND ASSIGNS
 - 13.2.1
- 13.3 WRITTEN NOTICE
 - 13.3.1
- 13.4 RIGHTS AND REMEDIES
 - 13.4.1; 13.4.2
- 13.5 TEST AND INSPECTIONS
 - 13.5.1; 13.5.2; 13.5.3; 13.5.4; 13.5.5; 13.5.6
- 13.6 INTEREST
 - 13.6.1
- 13.7 COMMENCEMENT OF STATUTORY LIMITATION PERIOD
 - 13.7.1; 13.8; 13.9; 13.10

ARTICLE 14 – TERMINATION BY THE CONTRACTOR

- 14.1 TERMINATION BY THE CONTRACTOR
 - 14.1.1; 14.1.2; 14.1.3; 14.1.4

14.2 TERMINATION BY THE OWNER FOR CAUSE

14.2.1; 14.2.2; 14.2.3; 14.2.4

14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

14.3.1; 14.3.2; 14.3.3; 14.3.4

14.4 TERMINATION FOR CONVENIENCE

14.4.1; 14.4.2

ARTICLE 15 – DELAGATION OF AUTHORITY DELEGATED

INTENTIONALLY OMITTED

ARTICLE 16 – GRATUITIES AND CONFLICTS OF INTERESTS

16.1 GRATUITIES

16.2 INTENTIONALLY OMITTED

ARTICLE 17 – USE OF THE OWNER’S NAME IN CONTRACTOR ADVERTISING PUBLIC RELATIONS

17.1

ARTICLE 18 – PUBLIC RECORDS

18.1 PUBLIC DISCLOSURE

18.2 CONFIDENTIAL INFORMATION

18.3 THE OWNER’S ROLE A STAKE HOLDER

MEDISTAR GENERAL CONDITIONS - CONTRACT AIA 111-1997

ARTICLE 1 – GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents consist of, in addition to the documents, if any, the Agreement between Owner and Contractor (Agreement), Conditions of the Contract (General and other Conditions), Drawings, Specifications, addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, or (2) a Change Order. Unless specifically enumerated in the Agreement, the Contract Documents do not include other documents such as bidding requirements (advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or portions of addenda relating to bidding requirements).

1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction (Contract). The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Architect and Contractor, (2) between the Owner and a Subcontractor or Sub-subcontractor or (3) between any persons or entities other than the Owner and Contractor. The Architect and Owner shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's and Owner's duties.

1.1.3 THE WORK

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

1.1.4 THE PROJECT

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner or by separate contractors.

1.1.5 THE DRAWINGS

The Drawings are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

1.1.6 THE SPECIFICATIONS

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards and workmanship for the Work, and performance of related services.

1.1.7 THE PROJECT MANUAL

The "Project Manual" is the bound volume or volumes which contain the Bidding Requirements, sample forms, Conditions of the Contract, General Requirements, Drawings and Specifications.

1.1.8 "City" means the City where the project is located, typically a municipal corporation and Home Rule City.

1.1.9 "Construction Schedule" means the activity and timeline schedule for the performance of this Work which shall be prepared by Contractor and delivered to Owner, in accordance with the Contract Documents.

1.1.10 "Governmental Authority" means any federal, state, county or municipal governing body, including Texas Department of State Health Service (TDSHS) and any department, agency or board thereof, having jurisdiction over the Work.

1.1.11 "Hazardous Materials" means those elements, materials, compounds, mixtures or substances, including but not limited to asbestos, which are contained in any list of hazardous substances adopted by the United States Environmental Protection Agency (the "EPA") or the list of toxic pollutants designated by Congress or the

ATTACHMENT A

EPA or which are defined as hazardous, toxic, pollutant, infectious, flammable or radioactive by any other Federal, State, or local statute, law, ordinance, code, rule, regulation, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning any hazardous, toxic or dangerous waste, substance or material, as now or at any time hereafter in effect including, without limitation, the Texas Water Code, Solid Waste Disposal Act (Chapter 361 of the Texas Health and Safety Code), Clean Air Act (Chapter 382 of the Texas Health and Safety Code), Hazard Communication Act 9 (Chapter 502 of the Texas Health and Safety Code), the Federal Comprehensive Environmental Response, Compensation and Liability Act, as amended, 42 U.S.C 9601 et seq., the Federal Toxic Substances Control Act, 15 U.S.C. 9601 et seq., the Federal Resource Conservation and Recovery Act, as amended, 42 U.S.C. 6901 et seq., the Federal Hazardous Material Transportation Act, The Federal Clean Air Act, the Federal Water Pollution Control Act, or rules and regulations of the EPA, or any other state or federal department, board, or agency, or any other agency or governmental board or entity having jurisdiction over the Work. Whether or not included in any such list, the term "Hazardous Materials" shall also be deemed to include all products or substances containing petroleum, asbestos, and polychlorinated biphenyls.

1.1.12 "Site" means those certain tracts of land located at the project location, as more particularly described in the Contract Documents and made a part hereof, and certain related property and appurtenances thereto.

1.1.13 "Date of Substantial Completion" shall mean the Date upon which Substantial Completion occurs.

1.1.13.1 "Substantial Completion" shall mean the Date of Substantial Completion and shall have the meaning set forth in Sub Article 9.8.1.

1.1.14 "Date of Final Completion" shall mean the date upon which final completion occurs.

1.1.14.1 "Final Completion": Shall mean the date of Final Completion and shall have the meaning set forth in Sub Article 9.10.1.

1.1.15 "Contract Milestone" means the date(s) identifying a major event in the Construction Schedule used to monitor the progress of the Work. The milestones shall be identified with zero duration.

1.2 EXECUTION, CORRELATION AND INTENT

1.2.1 The Contract Documents shall be signed by the Owner and Contractor as provided in the Agreement. If either the Owner or Contractor or both do not sign all the Contract Documents, the Architect shall identify such unsigned Documents upon request.

1.2.1.1 The Contractor has carefully reviewed all existing conditions and limitations affecting the Work, including all property lines, utility locations, existing improvements, elevations, and site and local conditions. All dimensions and clearances necessary to the Work, as indicated on the Drawings and contained in the Specifications, shall be verified by the Contractor at the jobsite and the Contractor shall promptly report all discrepancies to the Architect and the Owner for adjustment before any Work affected thereby is prosecuted.

1.2.1.2 If sufficient detailed information is lacking in the Contract Documents or if discrepancies appear among the Contract Documents, then the Contractor shall request the Owner's clarification or interpretation before proceeding with the Work.

1.2.1.3 The authority and priority of interpretation of the Contract Documents shall be in the following descending order:

- (a) Modifications
- (b) Owner-Contractor Agreement
- (c) General Conditions and Supplemental Conditions
- (d) Specifications and Drawings.

1.2.1.4 The Specifications and Drawings shall be equal in authority and priority. If the Specifications and Drawings contain internal conflicts or if there are conflicts between the Specifications and Drawings, quantity and prices shall be based on the most expensive combination of quality and quantity of work indicated. Contractor shall bring all inconsistencies to the attention of Owner and Architect for direction.

1.2.2 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become familiar with all local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

ATTACHMENT A

- 1.2.3 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results.
- 1.2.3.1 Severability: In the event any clause contained in the Contract Documents shall be determined, declared or adjudged invalid, illegal, unconstitutional or otherwise unenforceable, such determination, declaration or adjudication shall in no manner affect the other clauses of the Contract Documents, which shall remain of full force and effect as if the clause declared, determined or adjudged invalid, illegal, unconstitutional or otherwise unenforceable was not originally contained in the Contract Documents.
- 1.2.3.2 Reading Headings: The various headings contained in the Contract Documents are inserted for convenience only and shall not affect the meaning or interpretation of the Contract Documents or any provision thereof.
- 1.2.3.3 Cross References: Cross referenced Articles are references to Articles in these General Conditions unless otherwise specified.
- 1.2.4 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.
- 1.2.5 Technical terms not specifically defined in the Contract Documents shall have the meanings given in AIA Document, "Glossary of Construction Industry Terms", latest edition.
- 1.2.5.1 Technical terms not defined in the Contract Documents or the AIA Document, referenced in Sub Article 1.2.5, that are used to describe items of the Work and which, as so used, have a recognized technical or trade meaning, shall be held to have such recognized meaning.
- 1.2.5.2 Additional requirements are specified in the Specifications.
- 1.2.6 If the Specifications and Drawings specify particular products, manufacturer's trade names, or catalog numbers such particularity is done for the express purpose of establishing a standard of function, dimension, appearance, and quality of design, in harmony with the Work, and is not intended for the purpose of limiting competition. **HOWEVER, DURING THE DESIGN/PRICING PERIOD, CERTAIN SUBSTITUTIONS WILL BE ALLOWED ONLY with the Owners written approval.** The Contractor shall not substitute materials or equipment unless such substitution has been properly submitted in accordance with the Specifications and specifically approved in writing for use on the Project by the Owner.
- 1.3 OWNERSHIP AND USE OF ARCHITECT'S DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS
- 1.3.1 The Drawings, Specifications and other documents furnished by the Owner are instruments through which the Work to be executed by the Contractor is described. The Contractor may retain one contract record set. Neither the Contractor nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents furnished by the Owner, and unless otherwise indicated, the Owner shall be deemed the owner of them and will retain all common law, statutory and other reserved rights, in addition to the copyright. All copies, except the Contractor's record set, shall be returned or suitably accounted for to the Owner, upon completion of the Work. The Drawings, Specifications and other documents furnished by the Owner, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications and other documents furnished by the Owner appropriate to and for use in the execution of the Work under the Contract Documents. All copies made under this license shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents furnished by the Owner. Submittal or distribution to meet official regulatory requirements or for other purposes in connections with this Project is not be construed as publication in derogation of the Owner's copyright or other reserved rights.
- 1.3.1.1 All Drawings, Specifications, models, and other materials prepared or furnished pursuant to this Agreement are prepared specifically for the Owner in connection with this Project, and all title, ownership and copyright privileges to the overall design and construction expressed thereby are hereby assigned to and shall at all times be held by the Owner. Reproducible copies of all Drawings, data, disk files, copies of drawings for

ATTACHMENT A

CADD, Specifications, shop drawings, samples, and all other such materials shall be promptly delivered to the Owner upon demand and thereafter may be used by the Owner in whole or in part or in modified form for such purposes as it may be deemed advisable, without further employment of or payment of additional compensation to the Contractor, Subcontractor, suppliers, Architect or any other third party. The Contractor may retain a copy of each such item for information and reference in connection with the performance of its obligations under this Agreement, but shall not use the design expressed thereby for any other purpose without the prior written consent of the Owner. The Owner may use any and all documents as often as Owner desires, but should Owner use said documents on another project, then in such event, Contractor shall have no liability whatsoever for their usage, and the Owner agrees to release the Contractor from any liability or responsibility connected with such usage and further agrees to remove all registration seals, and other identification of the Contractor or its Subcontractors and suppliers from the Drawings, shop drawings, samples, and Specifications. Ownership and copyright privileges to the Owner does not entitle the Owner to extend any professional obligations or liabilities as are conveyed when the Contractor, Subcontractor, or supplier applies its seal or title block by CADD, electronic or other means beyond the scope of this Project as described herein.

1.3.1.2 The Drawings, Specifications and other documents prepared by the Architect, and copies thereof furnished to the Contractor are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect and consultants appropriate to and for use in the execution of the Work under the Contract Documents.

1.4 CAPITALIZATION

1.4.1 Terms capitalized in these General Conditions include those which are (1) specifically defined, (2) the titles of numbered articles and identified references to Articles, Sub Articles and Clauses in the document or (3) the titles of other documents published by the American Institute of Architects.

1.5 INTERPRETATION

1.5.1 In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

ARTICLE 2 – OWNER

2.1 DEFINITION

2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Owner" means the Owner; the Owner's authorized representative or Owner's authorized representative firm. Contractor shall provide to Owner a copy of all correspondence and notices sent on behalf of Owner under the terms of, or in connection with, this Agreement and shall permit Owner's Representative to attend and participate in all meetings on behalf of Owner.

2.1.1.1 Subject to the foregoing, the Owner shall retain the right to communicate directly with the Contractor and the Project Subcontractors and suppliers. The Owner will endeavor to keep the Contractor informed of the direct communication in order to permit the Contractor to properly coordinate its work.

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

2.2.1 The Owner shall, at the written request of the Contractor, prior to commencement of the Work, furnish to the Contractor reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract.

2.2.2 The Owner will furnish preliminary surveys describing physical characteristics, legal limitations, and a legal description of the Site.

2.2.3 Except for subcontractor permits and fees which are the responsibility of the Contractor's subcontractor per the Contract Documents, the Owner shall secure and pay for main building permit(s), impact fees, tap fees, materials testing, geotechnical and other necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

ATTACHMENT A

- 2.2.4 Information or services under the Owner's control that relate directly and solely to the Project will be furnished by the Owner with reasonable promptness to avoid delays in the orderly progress of the Work.
- 2.2.5 Contractor will be furnished full size black line sets of the Pricing Documents on paper *and Compact Disc*. (Quantity to be determined by agreement between Owner and Contractor). Additional Bid Documents may be purchased by the Contractor directly from the Owner's reproduction service (Triangle Reprographics). Reduced size drawings maybe issued for convenience of the Contractor but are not to be considered to be binding for contractual purposes. Contract Documents provided will not be updated for addenda or reprinted to include addenda changes. During construction, the Contractor will be provided **Ten (10) complete sets of Contract Documents for Contractors use and two sets for each subcontractor holding fully executed Contract(s) between Contractor and sub contractor**. All other sets required for construction shall be purchased from the printer at the purchaser's sole cost and at Owners preferred printing rate.
- 2.2.6 The foregoing are in additions to other duties and responsibilities of the Owner enumerated herein and especially those in respect to Article 6 (Construction by Owner or by Separate Contractors), Article 9 (Payments and Completion) and Article 11 (Insurance and Bonds).
- 2.3 OWNER'S RIGHT TO STOP THE WORK
- 2.3.1 If the Contractor fails to correct the Work which is not in accordance with the requirements of the Contract Documents as required by Sub Article 12.2 or fails to carry out Work in accordance with the Contract Documents, the Owner, by written order signed personally or by an authorized representative specifically so empowered by the Owner in writing, may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated and Contractor shall indemnify, defend and hold harmless Owner from all costs and expenses relating to said Work stoppage; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Sub Article 6.1.
- 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK
- 2.4.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may after such seven-day period give the Contractor a second written notice to correct such deficiencies within a second seven-day period. If the Contractor within such second seven-day period after receipt of such second notice fails to commence and continue to correct such deficiencies, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued which deducts from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Architect's and Owner's additional services and expenses made necessary by such default, neglect or failure. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. No action taken by the Owner hereunder shall affect any of the other rights or remedies of the Owner granted by the Contract or by law, nor relieve the Contractor from any consequences or liabilities arising from such deficiencies.

ARTICLE 3 – CONTRACTOR

3.1 DEFINITION

- 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Contractor" means the Contractor or the Contractor's authorized representative.
- 3.1.2 All specific Contractor personnel assigned to the Project shall be mutually approved by the Owner and the Contractor. Any changes to such personnel must be approved by the Owner.

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

- 3.2.1 The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the Owner pursuant to Sub Article 2.2 and shall at once report to the Architect and Owner errors, inconsistencies or omissions discovered. The Contractor shall not be liable to the Owner or Architect for damage resulting from errors, inconsistencies or omissions in the Contract Documents unless the Contractor recognized or should have recognized such error, inconsistency or omission and failed to report it to the Architect and the Owner. If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency, or omission in the Contract Documents without such notice to the

ATTACHMENT A

Architect and the Owner, the Contractor shall assume responsibility for such performance and shall bear the attributable costs for correction.

3.2.2 The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the Architect and the Owner at once. The Contractor shall confirm the physical surface characteristics of the Site and shall report any discrepancies to the Architect and Owner for adjustment before beginning the Work. No extra charges or compensation will be allowed for grade variations or discrepancies except by written agreement between the Contractor and the Owner before the Work begins.

3.2.3 The Contractor shall perform the Work in accordance with the Contract Documents and reviewed submittals pursuant to Sub Article 3.12.

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over, and Owner's approval of such matters shall not relieve Contractor of its responsibility for construction means, techniques, sequences, procedures, and for coordinating all portions of the Work under the Contract Documents.

3.3.2 The Contractor shall be responsible to the Owner for and shall indemnify, defend and hold harmless, the Owner in accordance with terms of Sub Article 3.18 against all claims and damages (including all attorney's fees and court costs) arising from acts and omissions or willful conduct of the Contractor's employees, Subcontractors and their agents and employees, and other persons performing portions of the Work under a contract with the Contractor.

3.3.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by person other than the Contractor.

3.3.4 The Contractor shall be responsible for inspection of portions of Work already performed under this Contract to determine that such portions are in proper condition to receive subsequent Work.

3.4 LABOR AND MATERIALS

3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated into the Work. The Contractor shall cause all labor, materials and other such items and services to be readily available as and when required in or needed for the orderly and timely prosecution of the Work.

3.4.2 The Contractor shall enforce strict discipline and good order among the Contractor's employees, Subcontractors and other persons carrying out the Contract. All personnel used in the performance of the Work shall be qualified by training and experience to perform their assigned tasks. The Contractor shall not use or permit to be used in the performance of the Work personnel who are incompetent, careless, unqualified, or who are unsatisfactory to the Owner.

3.4.3 Contractor represents that it is an Equal Opportunity Employer as described in Section 202 of Executive Order 11246 dated September 24, 1965, as amended and it agrees to comply with the provisions of paragraphs one through seven of Section 202 of said Executive order during the performance of this Agreement. Contractor certifies that it does not and will not maintain any facilities it provides for its employees in a segregated manner.

3.4.4 The Contractor shall not incorporate into the Project (i) any materials containing substances containing asbestos, PCBs or urea formaldehyde or (ii) any materials or combinations of materials considered to be hazardous or unlawful for the use intended according to any current EPA regulations, rules, laws or ordinances. Contractor shall provide manufacturer's certifications verifying the non-existence of these materials and Owner shall be entitled to rely on such certification in the performance of the Contractor's work.

3.4.5 After the Contract has been executed, the Owner and the Architect will consider formal requests for the substitution of products in lieu of those specified only under the conditions set forth in substitution section of the Specifications.

ATTACHMENT A

- 3.4.6 By making requests for substitutions based on Sub Article 3.4.5 above, the Contractor:
1. represents that the Contractor has personally investigated the proposed substitute product and determined that it is equivalent or superior in all respects to that specified, and is suitable for the intended purpose;
 2. represents that the Contractor shall provide the same warranty for the substitution that the Contractor would for that specified;
 3. certifies that the substitution can be incorporated into the Project without affecting any scheduled Critical Path Method (CPM) activity and the overall Project completion date.
 4. certifies that the cost data presented is complete and includes all related costs under this Contract, including all redesign costs (which are to be paid to others from funds paid by Contractor via a deductive Change Order to Contract), and waives all claims for additional costs related to the substitution which subsequently become apparent; and
 5. shall coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects at no additional cost to the Owner.

3.5 WARRANTY

3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required by the Contract Documents, that the work will be free from defects not inherent in the quality required and that the Work will conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. The Contractor's warranty excludes remedy for damage or defect caused by Owner's abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

3.5.2 In addition to the requirements of Sub Article 3.5 and Sub Articles 9.9, 9.10 and 12.2, the Contractor shall submit to the Architect for delivery to Owner the project warranty for the entire Work and special warranties required by the Contract Documents, on his letterhead and as identified in the Specifications. Submission and acceptance of all warranties are required as prerequisite to the Final Payment.

3.5.3 The Contractor shall obtain from all vendors and subcontractors warranties with respect to the machinery, equipment, and materials, used and installed as a part of the Work, which warranties (a) shall be in form, content and term consistent with the Contract Documents, and (b) shall specify that the warranties shall be enforceable by and for the benefit of the Owner, or the Owner's assignee, acting in its own name.

3.6 TAXES

3.6.1 Owner is not exempt from Texas sales and use taxes, however, Owner may provide Contractor with a completed Texas Sales and Use Tax Resale Certificate as evidence of the applicability of such resale status. Accordingly, Contractor shall pay Texas sales and use taxes to the proper authorities. Contractor and all Subcontractors to Contractor shall pay all Texas sales and use taxes.

3.7 PERMITS, FEES AND NOTICES

3.7.1 Unless otherwise provided in the Contract Documents, the Owner shall secure and pay for the main building permit(s) including site, garage structure, hotel/apartment structure and interior. Contractor shall secure all other sub contractor permits and governmental fees, licenses, inspections, including, but not limited to, certificates of inspection, and certificates of occupancy which may be required by authorities having jurisdiction over the Work which may be necessary for the proper execution and completion of the Work which are customarily secured after execution of the Contract and which are legally required at the time the pricing of the Work is received and approved by the Owner. The Contractor shall send one copy of all such permits and certificates to each to the Architect and the Owner.

3.7.2 The Contractor shall comply with and give notices as required by laws, ordinances, rules, regulations and lawful orders of public authorities bearing on performance or content of the Work.

3.7.3 It is not the Contractor's responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations. However, if the Contractor observes that portions of the Contract Documents are at variance therewith, the Contractor shall promptly notify the Architect and Owner in writing, and necessary changes shall be accomplished by appropriate Modification.

ATTACHMENT A

- 3.7.4 If the Contractor performs any Work knowing it to be contrary to such laws, statutes, ordinances, building codes, rules and regulations, without such notice to the Owner, the excess of costs which would have been incurred had the Contractor performed such Work in compliance with such laws in the first instance shall be paid by Contractor and not reimbursed by Owner.
- 3.7.5 Contractor agrees that the Project shall be constructed in compliance with the current understanding and current interpretation of the Americans with Disabilities Act of 1990, 42 U.S.C. Sections 12101 through 12213 and all updates in effect as of the date of this Contract, and with special adherence to any governing bodies having jurisdiction regarding access to the Project by the handicapped.
- 3.8 ALLOWANCES
- 3.8.1 The Contractor has included in the Contract Sum all allowances identified in the Contract Documents. ***The Contractor shall receive written approval of Owner prior to incurring any cost associated with these allowances.*** The Contractor shall keep separate and accurate records of all allowances and shall submit such record with each Application for Payment therefore. The Owner shall be responsible only for costs in excess of these allowances, if approved in writing, in advance. Items covered by such allowances shall be furnished for such amounts as the Owner may direct, or which the Contractor may select with the Owner's written approval. Any such items shall be considered part of the Work and the Contractor shall be fully responsible for such Work, regardless of who selected such materials or firm to do such Work, provided, however, that the Contractor shall not be required to employ persons against whom the Contractor makes a reasonable objection.
- 3.8.2 Unless otherwise provided in the Contract Documents:
1. materials and equipment under an allowance shall be selected timely by the Owner to avoid delay in the Work;
 2. allowances shall cover the cost to the Contractor of materials, labor and equipment required by the Work and all required taxes, unloading and handling at the Site, labor, and installation costs, less applicable trade discounts.
 3. Contractor's costs for overhead, profit/fee and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum and not in the allowances;
 4. whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order in accordance with provisions of Article 7. The amount of the Change Order shall reflect the difference between actual costs and the applicable allowances contained in the Contract Documents.
- 3.9 SUPERINTENDENT/PROJECT MANAGER
- 3.9.1 The Contractor shall employ, separately, and at a minimum, one to three assistant superintendents, a project engineer, a general superintendent, and project manager, who are competent individuals approved in writing by the Owner. At a minimum, a superintendent, who together with such necessary and competent assistants as the Contractor shall employ, shall be in attendance exclusively at the Project Site during progress of the Work. ***The superintendent, and project manager, shall be authorized to represent the Contractor.*** All communications given by the Owner or Owners representative to the general superintendent and/ or project manager shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing. Other communications shall be confirmed on written request in each case.
- 3.9.1.1 Contractor's superintendent(s) shall be on the Project Site at all times when the Work is in progress.***
- 3.9.1.2 Due to the difficult nature and complexity of this Project and the extraordinary degree of detail and coordination required to perform the Work, the Contractor's Superintendent and project manager shall have the sole responsibility to manage and coordinate all portions and phases of the Work in a timely manner so as to minimize RFIs, Requests for Clarifications, Revisions to the Work, changes to design, Change Orders to the Work, or delays to the completion of the Work. The Contractor's Superintendent and project manager shall be responsible for, but not limited to, determining coordination issues well in advance of the work being required onsite or being incorporated into the Work, scheduling, managing and documenting coordination meetings with the responsible Subcontractors, suppliers and contractors, advising the Owner and Architect of issues, proposed solutions, required review dates (allowing the Owner and Architect a minimum of two weeks for review and approval) and providing other coordination services required by the Contract.

- 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES
- 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's Construction Schedule for the Work. The Construction Schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required.
- 3.10.2 ***The Contractor shall provide the critical path scheduling and monthly updating thereof ("Construction Schedules") and all other necessary schedules in the interest of completing the Work in the most expeditious and economical manner.*** The parties acknowledge and agree that notwithstanding any theoretical delays or theoretical extensions of time for Substantial or Final Completion as may be shown on any schedules or printouts, the dates of Substantial or Final Completion for the Project shall be governed by Article 4 of the Agreement and shall be extended only in accordance with the procedures set forth for the same in Articles 7 and 8 of the General Conditions. The Construction Schedules shall indicate the following, and shall be revised as required by the conditions of the Work, subject to the Owner's approval:
- 3.10.2.1 Preliminary Schedule: ***The Contractor shall furnish the Owner a Preliminary Schedule for the Work to be attached to Contract AIA 111-1997. The Contractor shall update such schedule within fourteen (14) calendar days after the effective date of the Notice to Proceed.*** The Preliminary Schedule shall contain provisions for each of the key activities throughout the Contract and shall also include sufficient detail (as determined by the Owner) to allow for the effective management of the Contract for the first four (4) months of the Contract Time. The Contractor shall include information from major sub-contractors before completing the Preliminary Schedule. Furthermore, the Preliminary Schedule must demonstrate that the Contractor utilizes all available time for the Work provided by the Contract. The preliminary schedule may be provided in a summary level format. ***Upon acceptance by the Owner, the Preliminary Schedule shall be considered to be the Construction Schedule pending the development and acceptance of the final Construction Schedule as set forth below.*** The initial Construction Schedule shall be the Preliminary Schedule referenced herein. The Preliminary Schedule shall contain, at a minimum, the following items:
- 3.10.2.1.1 Documentation of all major activities included in the Contractor's Work. The number of activities covering the first four (4) months of the job shall be no less than 50 and no more than 125 (excluding submittals, fabrication and delivery activities.) The submittal schedule shall be no less than 25 and no more than 50 activities and shall be incorporated into the Preliminary Schedule. This documentation shall indicate durations for all activities in working days, with durations of no less than one (1) nor more than thirty (30) days per activity, with the exception of activities such as submittals, fabrication, or deliveries. In addition, the dollar value per activity shall not exceed \$100,000, except when an activity contains one item of equipment whose value exceeds \$100,000. The Preliminary Schedule shall be in a format and at a level of detail which is acceptable to the Owner. The Contractor shall employ as part of the Cost of the Work a scheduling consultant (approved by the Owner) to work with the Contractor throughout duration of the Work to track and evaluate the progress of the Work to ensure on time completion of the Project.
- 3.10.2.1.2 Identify all precedent relationships between the Contractor's activities, as well as those of Subcontractors, based on a thorough review of the Contract Documents, showing interface between separate Contractor's work.
- 3.10.2.1.3 A coding system which clearly identifies (as a minimum) the following items per each activity:
- 3.10.2.1.3.1 Original Contract or Change Order code that shall allow grouping by original Contract activities, by Change Order;
- 3.10.2.1.3.2 A coding nomenclature to identify individual Change Orders;
- 3.10.2.1.3.3 A responsibility code to identify General Contractor, Subcontractors, Owner, etc;
- 3.10.2.1.3.4 A code defining major areas of work;
- 3.10.2.1.3.5 Type of activity (submittal, fabrication, delivery, construction milestone, etc.) Code;
- 3.10.2.1.3.6 ***CSI division code identification;***
- 3.10.2.1.3.7 Activity descriptions and durations for preparation and processing of shop drawings, product data and samples, fabrication, delivery and installation/erection of products, materials and equipment;

ATTACHMENT A

- 3.10.2.2 Tabular reports containing the following:
- 3.10.2.2.1 A critical path (a continuous series of activities logically connected from the Notice to Proceed to the completion of the Project), with zero Float report with all activities sorted by total Float (first sort) and by early start (second sort);
- 3.10.2.2.2 A critical path report with all remaining activities grouped by major area of work (first sort), and sorted by total float (second sort), and early start (third sort)
- A late report with all remaining activities sorted by late start (first sort) and by late finish (second sort);
- 3.10.2.2.3 A late report with all remaining activities grouped by major area of work (first sort), sorted by late start (second sort) and by late finish (third sort);
- 3.10.2.2.4 A logic report with predecessor and successor activities sorted by activity identification in ascending order;
- 3.10.2.2.5 3-week look ahead report, grouped by major area of work (first sort) sorted by early start (second sort) and responsibility (third sort), covering all activity work for the for the following 3 weeks;

The term “float” or “slack” shall mean “the amount of time a task can slip before it affects another task’s dates or the project finish date. “Free slack” shall mean the amount of time a task can slip before it delays another task. “Total slack” shall mean the amount of time a task can slip before it delays the project finish date.

All reports in this Sub Article 3.10.2.2 shall contain activity identification, the original duration, remaining duration, percent complete, activity description, early dates, late dates and float.

- 3.10.2.3 Graphic diagrams of the following:
- 3.10.2.3.1 A summary report bar chart with the major areas of work (to be determined by the way the Contractor “codes” its activities);
- 3.10.2.3.2 A logic diagram showing a continuous activity flow from left to right. The activity numbers, description, duration, and total float shall be shown on the diagram. All contract milestones shall be graphically identified as such. The critical path shall be clearly identified.
- 3.10.2.3.3 A critical path bar chart report with all activities sorted by total float (first sort) and by early start (second sort);
- 3.10.2.3.4 A critical path bar chart report will all remaining activities grouped by major area of work (first sort), and sorted by total float (second sort), and early start (third sort);
- 3.10.2.3.5 A late bar chart with all remaining activities sorted by late start (first sort) and by late finish (second sort);
- 3.10.2.3.6 A late bar chart report with all remaining activities grouped by major area of work (first sort), sorted by late start (second sort) and by late finish (third sort);
- 3.10.2.3.7 A 3-week look ahead bar chart report, grouped by major area of work (first sort) sorted by early start (second sort) and responsibility (third sort), covering all activity work for the following 3 weeks.

All reports in this Sub Article 3.10.2.3, with the exception of 3.10.2.3.2, shall contain activity identification, the original duration, remaining duration, percent completion, activity description, early dates, late dates and total float for each activity.

- 3.10.2.4 Construction Schedule: Within thirty (30) calendar days after the effective date of the Notice to Proceed, the Contractor shall refine, expand, and define additional sub activities of major activities of the Preliminary Schedule to cover the entire Contract Time, incorporating any revisions and modifications required by the Owner, including quantity of activities, level of breakdown, any terminology, coding, or building zoning established by the Owner, and shall submit it to the Owner for review and approval. This expanded Preliminary Schedule shall be prepared in the detail and format required by the Owner including, at a minimum, the items set forth in Sub Article 3.10.2 and upon review by the Owner shall constitute the Construction Schedule. The number of activities in the proposed Construction Schedule which

incorporates the Preliminary Schedule and its activities shall be no less than 100 or more 250 *with a minimum of 50 submittal activities that shall be incorporated and coordinated into the schedule.* Contractor shall base the Preliminary Schedule and the Final Construction Schedule on Substantial and Final Completion of the Work within the Contract Time. Contractor shall clearly indicate in the Construction Schedule any special sequencing, use of multiple shifts, or use of overtime, all costs of which are included in the Contract Sum. Unless otherwise indicated, work hours shall be construed to be scheduled for 5 days per week, Monday through Friday, and 8 hours per day. In addition, the Contractor shall request input information from major sub-contractors before completing the Construction Schedule. The Construction Schedule submittal shall include the tabular and graphic reports required under Article 3.10.2.2 and 3.10.2.3.

- 3.10.3 Review of Construction Schedule: All submitted Schedule(s) shall be subject to the review by the Owner, and when reviewed in writing by the Owner, shall be identified as the Construction Schedule. The Contractor shall allow the Owner seven (7) calendar days for review of each schedule submittal. By reviewing the submitted Schedule(s) as the Construction Schedule the Owner is not assuming any of the Contractor's responsibility for the timely and orderly completion of the Work or the coordination of the performance of the Contractor's Work or its subcontractors with that of other contractors. ***The Owner's acceptance of the Contractor's proposed Construction Schedule shall be for the overall duration only, and any necessary adjustments made in the Construction Schedule by any error or inconsistency in same or by reason of the requirements of the orderly performance of the Work shall be made and the Work performed by the Contractor without additional compensation or extension of time.*** The final proposed Construction Schedule reviewed by the Owner shall be identified as the Construction Schedule and shall be the Construction Schedule used by the Contractor for monitoring progress of the Work.
- 3.10.4 Revisions to the Construction Schedule: If Contractor requires major changes to the Construction Schedule, through no fault of the Owner, the Contractor shall submit those changes for review and acceptance by the Owner, and shall follow the procedures outlined above in Sub Article 3.10, at no additional cost to the Owner. Contractor shall allow the Owner seven (7) days for review. No changes to the Construction Schedule or out of sequence work are allowed without a written authorization from the Owner. In no event, will additional time be added to the contract time.
- 3.10.5 Contract Milestones: In addition to any Contract Milestones set out in the Pricing Documents, the Owner and the Contractor shall establish no more than ten Contract Milestones for the completion of various components of the Work. These Construction Milestones shall be established on the basis of the Construction Schedule. The Contract Milestones shall be confirmed by Change Order and can not thereafter be changed except by Change Order.
- 3.10.6 Progress Construction Schedule Meeting: After the Contractor generates its Construction Schedule update, it shall arrange with the Owner representative for the Bi Weekly Construction schedule Meeting(s), to be held during the first week and third weeks of each month.
- 3.10.7 Construction Schedules: Throughout the term of the Contract the Contractor shall deliver a monthly updated Construction Schedule to the Owner at the monthly Owner/Architect/Contractor (OAC) meeting as required by the Owner. Such monthly Construction Schedule shall be generated from the previous month's accepted Construction Schedule, in the retaining logic mode, and shall show the actual progress of the Work (through the end of the previous month), setting forth actual start and finish dates, remaining duration, which shall be the basis for percentage completion and the projected schedule for completion of the remaining work activities under the Contract as reviewed and accepted at the monthly review meeting. All approved Change Orders shall be incorporated into the monthly update of the Construction Schedule. The latest updated and accepted Construction Schedule shall constitute the Construction Schedule. The Contractor shall also furnish a separate run of the Construction Schedule incorporating all fragments for change proposals which have been submitted regardless of whether an approved Change Order has been issued. Each monthly Construction Schedule shall be sequentially numbered and dated for identification, shall be in the form and substance requested by the Owner and shall include all tabular and graphic reports and backup on compact disc as outlined in this Article.
- 3.10.8 Monthly Progress Reports: The Contractor shall submit monthly, those reports detailed on Articles 3.10.2.2 and 3.10.2.3 with the exception of the logic diagrams shall be submitted when major logic changes, accepted in writing by the Owner, are made to the schedule or when the Owner deems necessary.
- 3.10.9 Monthly Meetings: The Contractor shall cooperate with the Owner in all matters concerning the Construction Schedule, and shall attend regularly scheduled review Critical Path Method (CPM) meetings with the Owner and the Architect, including a monthly review meeting conducted on the Work Site and held no later than the last day of the month. In the meeting the Contractor shall describe, on an activity-by-activity basis, all proposed revisions and adjustments to the Construction Schedule required to reflect

the current status of the Project and shall include the actual start and actual finish dates for all activities in progress or completed as appropriate; the estimated remaining duration for each activity in progress – progress calculations must be based on remaining duration (in days) for each activity; all logic changes pertaining to Change Order activities sequencing or durations, and corrections to schedule logic to avoid out of sequence progress. The purpose of this meeting is for evaluation of the updated Construction Schedule and shall not be used for modifying previously reviewed durations or percentages.

- 3.10.9.1 ***Following the monthly progress meeting, a complete update of the Construction Schedule based on the accepted progress, revisions, and adjustments agreed upon at the meeting shall be computed and submitted with each monthly pay request.*** This update shall be subject to review and acceptance by the Owner. Contractor shall not make any changes to the schedule without a written acceptance by the Owner. In the event that the Owner and Contractor can not agree on the monthly update, the Owner will direct the Contractor, at no cost to the Owner, to update the schedule as the Owner deems necessary.
- 3.10.10 Monthly Narrative: A narrative report (prepared by Contractors scheduling consultant) shall be submitted by Contractor with each monthly Schedule update. The narrative report shall include (i) a description of the activities and progress included in the two most critical paths, (ii) a description of the current and anticipated problem areas or delaying factors, their impact, and an explanation of the corrective actions taken, and (iii) a description of an activity-by-activity basis of all approved changes made since the previous and their impact on approved schedule change. This report, along with the Construction Schedule above shall be used in connection with the Contractor's Applications for Payment.
- 3.10.11 Effect of Schedules: Contractor acknowledges that no Construction Schedule or any other update of any schedule (whether accepted by the Owner, or the Architect) shall extend the Contract Time, adjust the Contract Milestones or modify the Construction Schedule unless and until such change is approved by the Owner in a written Change Order. If the Contractor requests an extension of the Contract Time or adjustment of the Contract Milestones, the Contractor's entitlement to such extension or adjustment shall be determined in accordance with the Contract Documents. If the Owner determines that the Contractor is not entitled to an extension of Contract Time or an adjustment of the Contract Milestones the Contractor must comply with the Contract Milestones and must achieve Substantial and Final Completion within the Contract Time. Contractor shall take such action as shall be necessary to bring the general progress of the Work into compliance with the Construction Schedule. The cost and expense of overtime, or any additional measures, shall be borne entirely by the Contractor, including any costs and damages incurred by the Owner, the Architect and/or other contractors caused from such overtime work or additional measures.
- 3.10.12 Changes: When changes in the Work are necessary, the Contractor shall submit within ten (10) calendar days of the change, to the Owner, a fragnet (Network analysis) for each individual Change. The fragnet shall illustrate how the Contractor proposes to incorporate the changed work and the time impact attributable to the change to the overall Construction Schedule, and Substantial and Final Completion dates. Additionally, the fragnet shall demonstrate the time impact based on the date the change is given to the Contractor, the status of construction at that point in time, and the event time computation of all affected activities using the latest accepted Construction Schedule. Time extension or adjustments shall be determined according to the Contract Documents. In cases where the Contractor does not submit a fragnet for a specific Change or delay within the specified period of time, then it is mutually agreed that the particular Change or delay has no time impact on the Contract completion date and no time extension is required. In the event that the Contractor and the Owner can not agree on the extension or reduction of time for a particular change or if the Contractor fails to submit revisions to the Construction Schedule as requested by the Owner, the Owner has the option of providing suggested logic and/or duration times in all subsequent reports. Contractor shall make such changes at no cost to the Owner. The suggested logic and/or duration times shall remain in effect until a Change Order is executed by the Owner and Contractor. If the Contractor has any objections to the data furnished by the Owner, the Contractor shall advise, in writing, fully supporting the objections with a counter plan, to the Owner no later than 10 calendar days after receiving the information from the Owner. The data provided by the Owner shall be used until the counter plan is reviewed and accepted by the Owner. If the Contractor does not submit a counter plan in the stipulated time, the Contractor is deemed to have concurred with the Owner's suggested logic/duration time changes to the Construction Schedule. The Owner provided logic shall be the basis of negotiations for reviewing time and cost performance of the Work subject to Sub Article 8.3.
- 3.10.13 Schedule Delays: If the Contractor (i) determines that it will not be able to perform the Work in accordance with the Contract Milestones and achieve Substantial or Final Completion within the Contract Time, (ii) is behind in the Work based on the Construction Schedule, or (iii) is, in the opinion of the Owner, delaying or failing to prevent delay by it or its Subcontractors in the progress of the Work, then the Contractor shall promptly submit to the Owner a plan, including proposed adjustments to the

ATTACHMENT A

Construction Schedule (rework), showing how the Contractor plans to mitigate impact upon other portions of the Work and the Project and how it plans to bring the Project in compliance with the Construction Schedule. The Contractor shall submit this rework plan at least seven (7) calendar days prior to commencing Work and no rework shall be commenced until such alternate plan is accepted by the Owner. Out of sequence Work in the critical path is not allowed and no payment shall be made for out of sequence Work.

3.10.13.1 In addition, the Owner shall have the right to immediately order the Contractor to accelerate completion of the late activities and any other activity which has been delayed by the late activities by whatever means necessary, without any additional cost to the Owner, and the Contractor shall comply with same.

3.10.14 Construction Schedule Float: The Contractor and Owner agree that the Schedule Float shall not be for the exclusive benefit of either Party.

3.10.15 Expedited Work: The Owner may request the Contractor to work overtime to expedite the completion of the Work or a portion of the Work at a time when the Contractor is otherwise in conformance with the Contract Documents and the Contract Schedule. In such event the Contractor agrees to work said overtime. The Contractor shall be reimbursed only for the Contractor's extra labor cost over the amount for regular time during the period of such overtime, including additional fringe benefit costs, insurance and taxes incurred by it with respect thereto and only those other actual costs of the Contractor directly related to said overtime, all of which must be approved in advance by the Owner. In no event shall the Contractor be entitled to reimbursement for costs incurred by bringing the Work back into compliance with the Construction Schedule. Certified payroll covering said overtime shall be submitted to the Owner for review and approval prior to payment by Owner. No commission or fee is to be charged by or allowed to the Contractor on account of overtime or costs related thereto, nor shall Contractor be compensated for any lost efficiency or production alleged to have resulted from said overtime work.

3.10.16 Compensable Delays: Notwithstanding anything contained in the Contract Document to the contrary, the Contractor shall never be entitled to an extension of time or additional compensation for delays (of whatever nature) to non-critical path activities or to additional compensation for schedule delays prior to the Final Completion Date, regardless of whether or not the Contractor could have completed the Work prior to the Final Completion Date and regardless of whether the Contractor has submitted a schedule showing that the Work could have been completed prior to the Final Completion Date.

3.10.17 The Contractor shall conform to the most recent, accepted Construction Schedule.

3.11 DOCUMENTS AND SAMPLES AT THE SITE

3.11.1 The Contractor shall maintain at the Site for the Owner one record copy of the Drawings, Specifications, addenda, Change Orders, approved Shop Drawings, Product Data, Samples, similar required submittals, and other Modifications, in good order and marked currently to record changes and selections made during construction. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work.

3.12 SUBMITTALS

3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor to illustrate some portion of the Work.

3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor or Subcontractor to illustrate materials or equipment for some portion of the Work.

3.12.3 Samples are physical examples which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. The purpose of these submittals is to show how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents.

3.12.5 The Contractor shall review, approve and timely submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors. Submittals made by the Contractor which are not required by the Contract Documents may be returned without action.

ATTACHMENT A

- 3.12.5.1 The Architect will take no action on Shop Drawings, Product Data, or Samples that have not first been certified, stamped, signed, notated, or checked and approved by the Contractor for use in Work.
- 3.12.5.2 The Architect will take no action on Shop Drawings, Product Data, Samples, or other required submittals that do not bear a Contractor's Shop Drawing Stamp with wording identical to the example specified in the "Submittals" section of the of the Specifications.
- 3.12.5.3 Shop Drawings, Product Data, or Samples that contain errors or that are incomplete will be rejected and any delay caused thereby will be the responsibility of the Contractor.
- 3.12.6 The Contractor shall perform no portion of the Work requiring prior submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been marked "No Exceptions Taken" or "Exceptions Noted" by the Architect. Such Work shall be in accordance with said marked submittals.
- 3.12.7 By approving and submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents that the Contractor has determine and verified materials, field measurements and field construction criteria related thereto, and has checked and coordinated the information contained within such submittals with the other requirements of the Work and the Contract Documents.
- 3.12.8 The Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's review of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and the Architect has given written acceptance or approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's review thereof.
- 3.12.8.1 Deviation from the requirements of the Contract Documents indicated on Shop Drawings, Product Data, and Samples, does not constitute the required notification "in writing" unless specific notation is made of each deviation on the submittal expressly labeling such as a deviation.
- 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals.
- 3.12.10 Information submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents.
- 3.12.11 When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Architect shall be entitled to rely upon the accuracy and completeness of such calculations and certifications.
- 3.13 USE OF SITE
- 3.13.1 The Contractor shall confine operations at the Site to areas permitted by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber the Site with materials and equipment.
- 3.13.2 The Contractor shall not disturb or interfere with the Owner's activities on the Site and the Contractor hereby indemnifies, defends and holds harmless the Owner from and against any damages that are not part of the Work that are caused by the Contractor to any existing improvements located on the Site and any future improvement made by the Owner to the Site.
- 3.14 CUTTING AND PATCHING
- 3.14.1 The Contractor shall be responsible for cutting, fitting or patching as required to complete the Work to make its parts fit together and work properly.
- 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

3.15 CLEAN UP

3.15.1 ***On a daily basis, the Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract.*** At completion of the Work the Contractor shall remove from and about the Project waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials. The Contractor shall remove broken, pitted, or scratched glass and replace with new glass, remove paint droppings, labels, spots, stains and dirt from finished surfaces, and clean plumbing fixtures, hardware, floors and equipment. The Contractor shall additionally comply with any other clean up and site organization requirements set forth in the Contract Documents.

3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so after written notice and the cost thereof shall be charged to the Contractor.

3.16 ACCESS TO WORK

3.16.1 The Contractor shall provide at all times the Owner and Architect access to the Work in preparation and progress wherever located.

3.17 ROYALTIES AND PATENTS

3.17.1 The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a patent; the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

3.18 INDEMNIFICATION

3.18.1 CONTRACTOR INDEMNIFICATION FOR THIRD PARTY CLAIMS. WITH RESPECT TO CLAIMS BROUGHT BY THIRD PARTIES AGAINST OWNER RELATING TO THE PROPERTY OR FACILITIES WITH RESPECT TO WHICH THIS AGREEMENT PERTAINS OR THE WORK PERFORMED UNDER THIS AGREEMENT, CONTRACTOR AGREES TO INDEMNIFY, PROTECT, DEFEND, AND HOLD HARMLESS OWNER ITS SUCCESSORS AND ASSIGNS, PARTNERS, SHAREHOLDERS, DIRECTORS, TRUSTEES, OFFICERS, EMPLOYEES, MEMBERS AND AGENTS, FROM AND AGAINST ANY AND ALL DEMANDS, CLAIMS, SUITS AND CAUSES OF ACTION AND ANY AND ALL LIABILITY, COSTS, EXPENSES, SETTLEMENTS, AND JUDGMENTS INCURRED IN CONNECTION THEREWITH (INCLUDING, WITHOUT LIMITATION, COURT COSTS AND ATTORNEY'S FEES, CHARGES, DISBURSEMENTS AND ADVANCES), WHETHER ARISING IN EQUITY, AT COMMON LAW, OR BY STATUTE, INCLUDING THE TEXAS DECEPTIVE TRADE PRACTICES ACT OR SIMILAR STATUTES OF OTHER JURISDICTIONS, OR UNDER THE LAW OF CONTRACTS, TORTS (INCLUDING, WITHOUT LIMITATION, NEGLIGENCE AND STRICT LIABILITY WITHOUT REGARD TO FAULT) OR PROPERTY, OF EVERY KIND OR CHARACTER, ARISING IN FAVOR OF OR BROUGHT BY ANY CONTRACTOR'S EMPLOYEES, AGENTS, SUBCONTRACTORS, OR REPRESENTATIVES, OR BY ANY GOVERNMENTAL AGENCY OR ANY OTHER THIRD PARTY (THE "CLAIMANT"), BASED UPON, IN CONNECTION WITH, RELATING TO OR ARISING OUT OF THE WORK OR CONTRACTOR'S ACTIONS OR INACTIONS UNDER THIS AGREEMENT, EVEN IF DUE IN PART TO OWNER'S CONCURRENT NEGLIGENCE OR OTHER FAULT, BREACH OF CONTRACT OR WARRANTY, VIOLATION OF THE TEXAS DECEPTIVE TRADE PRACTICES ACT, OR STRICT LIABILITY WITHOUT REGARD TO FAULT; PROVIDED, HOWEVER, THAT CONTRACTOR'S CONTRACTUAL OBLIGATION OF INDEMNIFICATION SHALL NOT EXTEND TO THE PERCENTAGE OF THE CLAIMANT'S DAMAGES OR INJURIES OR SETTLEMENT AMOUNT ATTRIBUTABLE TO OWNER'S NEGLIGENCE OR OTHER FAULT.

3.18.1.1 OWNER INDEMNIFICATION FOR THIRD PARTY CLAIMS, WITH RESPECT TO CLAIMS BROUGHT BY THIRD PARTIES AGAINST CONTRACTOR RELATING TO THE PROPERTY OR FACILITIES WITH RESPECT TO WHICH THIS AGREEMENT PERTAINS OR THE WORK PERFORMED UNDER THIS AGREEMENT, OWNER AGREES TO INDEMNIFY, PROTECT, DEFEND AND HOLD HARMLESS CONTRACTOR, ITS SUCCESSORS AND ASSIGNS, PARTNERS, SHAREHOLDERS, DIRECTORS, OFFICERS, EMPLOYEES, MEMBERS AND AGENTS, FROM AND AGAINST ANY AND ALL DEMANDS, CLAIMS, SUITS AND CAUSES OF ACTION AND ANY AND ALL LIABILITY, COSTS, EXPENSES, SETTLEMENTS, AND

JUDGMENTS INCURRED IN CONNECTION THEREWITH (INCLUDING, WITHOUT LIMITATION, COURT COSTS AND ATTORNEY'S FEES, CHARGES, DISBURSEMENTS AND ADVANCES), WHETHER ARISING IN EQUITY, AT COMMON LAW, OR BY STATUTE, INCLUDING THE TEXAS DECEPTIVE TRADE PRACTICES ACT OR SIMILAR STATUTES OF OTHER JURISDICTIONS, OR UNDER THE LAW OF CONTRACTS, TORTS (INCLUDING, WITHOUT LIMITATION, NEGLIGENCE AND STRICT LIABILITY WITHOUT REGARD TO FAULT) OR PROPERTY, OF EVERY KIND OR CHARACTER, ARISING IN FAVOR OF OR BROUGHT BY ANY OF OWNER'S EMPLOYEES, AGENTS, SUBCONTRACTORS, OR REPRESENTATIVES, OR BY ANY GOVERNMENTAL AGENCY OR BY ANY OTHER THIRD PARTY (THE "CLAIMANT"), BASED UPON, IN CONNECTION WITH, RELATING TO OR ARISING OUT OF OWNER'S ACTIONS OR INACTIONS UNDER THIS AGREEMENT, AND EVEN IF DUE IN PART TO CONTRACTOR'S CONCURRENT NEGLIGENCE OR OTHER FAULT, BREACH OF CONTRACT OR WARRANTY, VIOLATION OF THE TEXAS DECEPTIVE TRADE PRACTICES ACT, OR STRICT LIABILITY WITHOUT REGARD TO FAULT; PROVIDED, HOWEVER, THAT OWNER'S CONTRACTUAL OBLIGATION OF INDEMNIFICATION SHALL BE LIMITED TO THE PERCENTAGE OF THE CLAIMANT'S DAMAGES OR INJURIES OR SETTLEMENT AMOUNT ATTRIBUTABLE TO OWNER'S NEGLIGENCE OR OTHER FAULT.

- 3.18.1.2 CONTRIBUTION, IN THE EVENT THAT BOTH CONTRACTOR AND OWNER ARE ADJUDICATED NEGLIGENT OR OTHERWISE AT FAULT OR STRICTLY LIABLE WITHOUT REGARD TO FAULT WITH RESPECT TO DAMAGE OR INJURIES SUSTAINED BY THE THIRD PARTY CLAIMANT, THE CONTRACTUAL OBLIGATIONS OF INDEMNIFICATION SET FORTH IN SUB ARTICLES 3.18.1 AND 3.18.1.1 SHALL CONTINUE, BUT EACH OF CONTRACTOR AND OWNER SHALL INDEMNIFY THE OTHER (THE INDEMNITEE) ONLY FOR THE PERCENTAGE OF RESPONSIBILITY OF THE DAMAGE OR INJURIES ADJUDICATED TO BE ATTRIBUTED TO THE INDEMNITOR. IN SUCH A SITUATION, IT IS INTENDED THAT, TO THE EXTENT EITHER OWNER OR CONTRACTOR PAYS SUCH CLAIMANT FOR ITS COSTS, LOSSES, LIABILITIES, EXPENSES AND/OR JUDGMENTS ATTRIBUTED TO THE PERCENTAGE OF NEGLIGENCE, FAULT OR LIABILITY OR THE OTHER, THESE OBLIGATIONS OF INDEMNIFICATIONS SHALL FUNCTION AS A CONTRACTUAL ARRANGEMENT OF CONTRIBUTION. THIS CONTRACTUAL ARRANGEMENT OF CONTRIBUTION SHALL SURVIVE SETTLEMENT OF THE UNDERLYING THIRD PARTY CLAIM AND, PROVIDED THAT NOTICE AND THE RIGHT TO PARTICIPATE IN THE INVESTIGATION, DEFENSE AND RESOLUTION (INCLUDING SETTLEMENT) OF SUCH THIRD PARTY CLAIM HAS BEEN PROVIDED AS REQUIRED BY SECTION 3.18.1.3, SHALL APPLY TO VOLUNTARY SETTLEMENTS MADE BY EITHER CONTRACTOR OR OWNER WITH THE CLAIMANT.
- 3.18.1.3 NOTIFICATION. IT IS A CONDITION PRECEDENT TO THE INDEMNITOR'S CONTRACTUAL OBLIGATION OF INDEMNIFICATION UNDER THIS AGREEMENT THAT THE INDEMNITEE SHALL PROVIDE WRITTEN NOTICE TO THE INDEMNITOR OF THE THIRD PARTY CLAIM, DEMAND OR CAUSE OF ACTION WITHIN THIRTY (30) CALENDAR DAYS AFTER SUCH THIRD PARTY CLAIM, DEMAND OR CAUSE OF ACTION IS RECEIVED BY THE INDEMNITEE. IT IS FURTHER A CONDITION PRECEDENT TO THE INDEMNITOR'S CONTRACTUAL OBLIGATION OF INDEMNIFICATION UNDER THIS AGREEMENT THAT THE INDEMNITOR SHALL THEREAFTER HAVE THE RIGHT TO PARTICIPATE IN THE INVESTIGATION, DEFENSE AND RESOLUTION OF SUCH THIRD PARTY CLAIM.
- 3.18.1.4 CONSEQUENTIAL LOSSES, WITH RESPECT TO CLAIMS BETWEEN THE PARTIES. NEITHER PARTY, ITS SUBCONTRACTORS NOR THEIR RESPECTIVE AGENTS OR EMPLOYEES SHALL BE LIABLE TO THE OTHER FOR ANY CONSEQUENTIAL, SPECIAL, INCIDENTAL OR INDIRECT LOSSES OR DAMAGES OF ANY NATURE WHATSOEVER, INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS, INTEREST, INCREASED EXPENSE OF OPERATION OF ANY FACILITY OR EQUIPMENT, CONSTRUCTION CORRECTION OR REPAIR COSTS, WHETHER ARISING UNDER THE LAW OF CONTRACTS, TORTS (INCLUDING, WITHOUT LIMITATION, NEGLIGENCE OF EVERY KIND AND STRICT LIABILITY, WITHOUT FAULT), OR PROPERTY, OR AT COMMON LAW OR IN EQUITY, VIOLATION OF THE TEXAS DECEPTIVE TRADE PRACTICES ACT OR SIMILAR STATUTES OF OTHER JURISDICTIONS, OR OTHERWISE, AND WHETHER CAUSED BY UNAVAILABILITY OF THE EQUIPMENT, SHUT DOWNS OR SERVICE INTERRUPTIONS, OR OTHERWISE.
- 3.18.2 In claims against any person or entity indemnified under this Sub Article 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under this Sub Article 3.18 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a

ATTACHMENT A

Subcontractor under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

3.18.3 The obligations of the Contractor under this Sub Article 3.18 shall not extend to the liability of the Architect, the Architect's consultants, and agents and employees of any of them arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, Change Orders, designs or specifications, or (2) the giving of or the failure to give directions or instructions by the Architect, the Architect's consultants, and agents and employees of any of them provided such giving or failure to give is the primary cause of the injury or damage.

3.19 CONFIDENTIAL INFORMATION AND PUBLICITY

3.19.1 All information relating to the Project and the Work, and all information supplied to the Contractor by the Owner or the Architect are confidential and proprietary information of the Owner. Contractor and the Architect shall be subject to the terms of the Confidentiality and Non-Disclosure Agreement between Owner and Contractor and shall be executed as supplemental Contract Documents. The Contractor shall also require all Subcontractors and suppliers to treat such information as confidential and proprietary. Contractor shall not divulge or release any information concerning the Project to the public or any media representatives during the term of this Agreement without the Owner's prior written consent. In all Owner authorized public relations issues, credits shall recognize:

1. Medistar Corporation and it's affiliates, successors or assigns
2. Architect of Record
3. Others as may be determined by the Owner

3.20 ADDITIONAL REQUIREMENTS:

3.20.1 The Contractor shall halt the affected work if unsatisfactory results are anticipated and shall proceed only after receiving additional instructions from the Architect and Owner.

3.20.2 The Contractor shall establish and maintain bench marks, and all other grade, lines, and levels necessary for the Work; report errors and inconsistencies to the Architect, in writing, before commencing work; confirm the placement of the building on the Site to the Architect after all lines are staked out. The Contractor shall be responsible for the accuracy of the layout and shall make all corrections necessary to achieve an accurate layout of all Work. Refer to Specifications for additional requirements.

3.20.3 The Contractor shall arrange to accommodate and take into account all items described as "N.I.C." (Not in Contract) or "OFCI" (Owner Furnished Contractor Installed) work identified in the Contract Documents. When information is inadequate, the Contractor shall request further instructions before proceeding. Refer to the Contract Documents for additional requirements.

3.20.4 *The Contractor shall prepare quotations, for proposed changes in the Work as directed by the Owner and Architect. Quotations shall be in a "break-down" form giving the number of units, unit cost of materials, hours of labor, hourly cost of labor, tool costs, overhead and profit, and shall reflect credits including any and all written documentation associated with the proposed change from the Architect and or Engineers referencing ASI's, RFI's etc, as well as extras as outlined in Article 7.*

3.20.5 The Contractor shall secure all required inspection and occupancy certificates, and transmit them to the Architect. Refer to Specifications for additional requirements.

ARTICLE 4 – ADMINISTRATION OF THE CONTRACT

4.1 ARCHITECT

4.1.1 The Architect is the person lawfully licensed to practice architecture or an entity lawfully practicing architecture identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Architect" means the Architect or the Architect's authorized representative.

4.1.2 Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without the written consent of the Owner.

4.1.3 In case of termination of employment the Architect, the Owner shall appoint an architect against whom the Contractor makes no reasonable objection and whose status under the Contract Documents shall be that of the former architect.

ATTACHMENT A

4.1.4 Responsibility of the Architect: In addition to other matters, the Architect has agreed by separate contract with the Owner to perform the specific work relating to the Architect in the Contract Documents and observe the Work by assisting and working with the Contractor, to visit the Work Site at intervals appropriate to the stage of construction or as otherwise agreed between Owner and Architect and to endeavor to guard the Owner against defects and deficiencies in the Work. The Architect has also agreed to advise the Owner on the quality and acceptability of materials furnished and work performed, the manner, performance and rate of progress of the Work, the Architect's interpretation of the Drawings, Specifications and other Contract Documents, the acceptable fulfillment of the Contract on the part of the Contractor, to review and certify acceptance or nonacceptance of monthly Applications for Payment as prepared by the Contractor, and to certify Substantial and Final Completion. Except as provided in these General Conditions, the Architect has no authority to authorize any deviations or variations from, changes in or additions to the Contract Documents, nor to incur any expenses or monetary obligations for the account of the Owner in connection with the Work. The enumeration of the foregoing activities of the Architect shall not enlarge or diminish the Architect's obligations to the Owner pursuant to their professional services contract or to create any rights by the Contractor.

4.2 COMMUNICATION

4.2.1 *The Contractor shall communicate with the Owner through, and all decisions to be made by the Owner shall be made through the Owner's Designated Representative.*

4.3 CLAIMS AND DISPUTES

4.3.1 Definition. A Claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. Claims must be made by written notice to the other party hereto. The responsibility to substantiate Claims shall rest with the party making the Claim.

4.3.2 Continuing Contract Performance. Pending final resolution of a Claim, unless otherwise agreed in writing, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents, subject to the Owner's right to withhold disputed amounts pending resolution.

4.3.3 Waiver of Claims: Final Payment. The making of final payment shall constitute a waiver of Claims by the Owner except those arising from:

1. liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
2. failure of the Work to comply with the requirements of the Contract Documents; or
3. terms of warranties required by the Contract Documents.

4.3.4 Claims for Concealed or Unknown Conditions. If conditions are encountered at the Site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the observing party shall be given to the other party promptly before conditions are disturbed and in no event later than twenty one (21) calendar days after first observance of the conditions.

4.3.5 Claims for Additional Cost. If the Contractor wishes to make Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Sub Article 10.3.

4.3.6 Claims for Additional Time

4.3.6.1 If the Contractor wishes to make Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay only one Claim is necessary.

4.3.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions had an adverse effect on the critical path activities of the scheduled construction and that the total number of days of weather delay has exceeded the average number of days referred to in Sub Article 4.3.6.4 for the months in question.

4.3.6.2.1 In the event adverse weather impacts the critical path, but prior to acceptance of a time extension and without incurring additional costs, the Contractor shall take all reasonable efforts to regain the cost time by

resequencing the work. Pending acceptable and continued efforts to recover lost weather time, the schedule impact analysis will be postponed until such time that the work is not negatively impacted by adverse weather.

4.3.6.3 No changes in the Contract Sum or in the Contract Time shall be made except by prior written Change Order executed by the Owner in accordance with the General Conditions.

4.3.6.4 *The Contractor shall include in the Construction Schedule an average number of days of adverse weather conditions each such month. The number of days of adverse weather exceeding .25" of rain for each month shall be based upon records of the local office of the National Weather Service averaged over the immediately preceding 36 months.*

4.3.7 Injury or Damage to Person or Property. If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, of any of the other party's employees or agents, or of others for whose acts such party is legally liable, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 calendar days after first observance. The notice shall provide sufficient detail to enable the other party to investigate the matter. If a Claim for additional cost or time related to such Claim is to be asserted, it shall be filed as provided in Sub Articles 4.3.5 or 4.3.6.

ARTICLE 5 – SUBCONTRACTORS

5.1 DEFINITIONS

5.1.1 A Subcontractor is a person, entity or supplier who has a direct contract with the Contractor to perform or supply a portion of the Work. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or Subcontractors of a separate contractor.

5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

5.2.1 ***Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, within 30 calendar days of Contract Execution, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials and/or equipment) proposed for each principal portion of the Work and for each Contract and Subcontract exceeding \$25,000.*** The Owner will promptly reply to the Contractor in writing within fourteen (14) calendar days after the Owner's receipt of the Contractor's complete list of proposed subcontractors, stating if the Owner, after due investigation, has reasonable objection to any such proposed person or entity. The Owner's acceptance shall not be unreasonably withheld. If the Owner reasonably objects to a Subcontractor, the Contractor shall furnish the Owner with a written notice of another Subcontractor for consideration and shall not contract with the rejected Subcontractor. Failure of the Owner to reply promptly shall constitute notice of no reasonable objection.

5.2.2 The Contractor shall not contract with a proposed person or entity to which the Owner has made timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. The Contract Sum will be adjusted by the difference in cost occasioned by such change and an appropriate Change Order will be issued. However, no increase in the Contract Sum shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

5.2.3.1 All Subcontracts shall, so far as practicable, contain unit prices and any other feasible formulae for use in determining the cost of the changes in the Work. Unless otherwise agreed by the Owner, each Subcontract shall contain a provision for the retention as outlined in the specifications of the gross amount of all progress payments until Final Completion.

ATTACHMENT A

5.2.4 The Contractor shall not, without the prior written consent of the Owner, and without additional cost or extension in time to the Owner, replace any Subcontractor previously approved, or permit any such subcontract to be assigned or transferred, or allow that portion of the Work to be performed or items to be supplied by anyone other than the accepted Subcontractor.

5.2.5 All Subcontracts shall provide the same indemnity by the Subcontractor to Owner to that given by Contractor in Sub Article 3.18.

5.3 SUBCONTRACTUAL RELATIONS

5.3.1 By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement which may be at variance with the Contract Documents. Subcontractors shall similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

5.3.2 All subcontracts shall be specifically assignable by the Contractor to the Owner, and Contractor hereby irrevocably appoints the Owner its authorized attorney-in-fact to execute any such assignment in the event of the termination of this Contract pursuant to Article 14 hereof or otherwise. Each subcontract shall provide that it can be terminated upon forty-eight (48) hours written NOTICE FROM Contractor or Owner, and no subcontract shall, without the express approval of the Owner, provide for payment of any penalty or fee (except the Subcontractor's fee for services performed to the date of termination) in the event of termination of the subcontract.

5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

5.4.1 Each subcontract agreement for a portion of the Work assigned by the Contractor to the Owner shall provide that:

1. assignment is effective only after termination of the Contract by the Owner pursuant to Sub Article 14.2 or 14.4 and only for those subcontract agreements which the Owner accepts by notifying the Subcontractor in writing; and
2. assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

5.4.2 If the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted.

ARTICLE 6 – CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with same, including Work contracted under this Agreement, work relating to other portions of the Project or other work on the Site. Such work shall be performed by work forces which are compatible with the Contractor's work forces. If the Owner exercises the Owner's rights under this Sub Article an appropriate Change Order shall be executed.

6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the Site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with the other contractors. The Contractor shall participate and coordinate with other separate contractors and the Owner in reviewing their construction

ATTACHMENT A

schedules. The Contractor shall make any revisions to the Construction Schedule deemed necessary after a joint review by Owner. The Construction Schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner as the same may subsequently be revised in accordance with the foregoing.

6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights which apply to the Contractor under the General Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

6.2 MUTUAL RESPONSIBILITY

6.2.1 The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgement that the Owner's or separate contractors' completed or partially completed construction is fit and proper to receive of the Contractor's Work, except as to defects not then reasonably discoverable.

6.2.3 Costs caused by delays or by improperly timed activities or defective construction shall be borne by the responsible party thereof.

6.2.4 The Contractor shall promptly remedy damage wrongfully caused by the Contractor to completed or partially completed construction or to property of the Owner or separate contractors as provided in Sub Article 10.2.5.

6.2.5 Claims and other disputes and matters in question between the Contractor and a separate contractor shall be subject to the provisions of Sub Article 4.3 provided the separate contractor has reciprocal obligations.

6.2.6 The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Sub Article 3.14.

6.3 OWNER'S RIGHT TO CLEAN UP

6.3.1 If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish as described in Sub Article 3.15, the Owner may clean up and allocate the cost among those responsible as the Owner determines to be just.

ARTICLE 7 – CHANGES IN THE WORK

7.1 CHANGES

7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Disputed Change Order as defined in Sub Article 7.3.4, or Unilateral Change Order as defined in Sub Article 7.3.5, Construction Change Directive (CCD), or order for minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

7.1.2 A Change Order shall be based upon agreement among the Owner and Contractor; a Disputed Change Order or a Unilateral Change Order is issued by the Owner and as defined herein, may or may not be agreed to by the Contractor as defined herein. A CCD shall be used in the absence of total agreement on the terms of a Change Order.

7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly with the change in the Work involved, unless otherwise provided in the Change Order, CCD, Disputed, or Unilateral Change Order, or order for a minor change in the Work.

7.1.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are so changed in a proposed Change Order or Construction Change Directive that application

ATTACHMENT A

of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, then applicable unit prices shall be equitably adjusted.

7.1.5 No changes in the Contract Sum or in the Contract Time shall be made except by prior written CCD or Change Order executed by the Owner and Contractor in accordance with Articles 7 and 8 hereof. The Contractor releases and waives all claims for extras, changes or increases in the Contract Sum or the Contract Time for work that has not been authorized by the Owner in accordance with this Article 7. This release and waiver by the Contractor may not be modified by later course of conduct except by written agreement executed by the Owner or by the Contractor filing a Claim or Dispute in accordance with Article 4.3

7.2 CHANGE ORDERS

7.2.1 A Potential Change Order Requests (PCOR) is a written instrument prepared by the Contractor and submitted to the Owner for approval. A Change Order is a written instrument prepared by the Architect subsequent to Owners approval of PCOR and signed, (in order) by the Contractor, Architect, and Owner stating their agreement upon all of the following:

1. a change in the Work;
2. the amount of the adjustment in the Contract Sum, if any; and
3. the extent of the adjustment in the Contract Time, if any.

7.2.2 Methods used in determining adjustments to the Contract Sum shall include those listed in Sub Article 7.3

7.3 CHANGE ORDER REQUIREMENTS

7.3.1 Pricing Change Orders, Disputed and Unilateral Change Orders and Payment thereof; The Contractor and the Owner agree that the pricing of Change Orders, Disputed and Unilateral Change Orders shall be priced and paid on any of the following four (4) bases, subject to the prior written approval of the Owner:

7.3.1.1 On the basis of an agreed lump sum, properly itemized and supported by sufficient substantiating data to permit evaluation which shall include a breakdown of each item into labor (based on the current labor rate for each craft or type of worker), material, equipment and the percentage fees set forth herein.

7.3.1.2 On any other basis agreed to in advance, in writing by Owner and Contractor.

7.3.2 Other Pricing Requirements: The Contractor's Change Order Request and responses to Requests for Proposal shall also be based upon the following:

7.3.2.1 Definitions.

7.3.2.1.1 Changed Work: Those elements of the Work that are modified or changed, pursuant to executed Change Orders, Disputed Change Orders, Unilateral Change Orders and minor changes in the Work.

7.3.2.1.2 Change Order Processing Costs: The administrative and all overhead costs incurred by the Contractor and its Subcontractors in the processing, handling, estimating, Construction Schedule revisions, negotiations, and documentation of changes, Change Orders, Disputed and Unilateral Change Orders, minor changes in the Work, delay claims and the like. Change Order processing costs are included as a component of the allowed Contractor overhead/profit/fee defined in Sub Article 7.3.2.5.

7.3.2.1.3 Direct Costs: Material, labor, and construction equipment costs attributable to Changed Work. The Contractor shall submit Direct Costs of performing the Changed Work taking into account only the actual costs paid under which the Changed Work was performed.

7.3.2.1.4 Impact Costs: Any increased costs incurred in the performance of Unchanged Work as a result of Changed Work but are not included in an executed Change Order. The parties agree that Impact Costs shall be compensated solely and exclusively from the Fees as provided in Sub Article 7.3.2.5.

7.3.2.1.5 Unchanged Work: With respect to any particular change, that Work that is not modified, altered, increased in scope or decreased in scope as a result of the change, or in the case of a compensable delay, that Work that is not on the critical path of the then-current Contract Schedule.

7.3.2.2 Pricing of Proposals for Changed Work: Contractor agrees that in the contract sum, it has included sufficient staff to promptly prepare change estimates (within ten (10) calendar days) and has made sufficient provision in the original Contract Sum for all Change Order Processing Costs.

ATTACHMENT A

- 7.3.2.2.1 Pricing of Proposals for Changed Work on the Critical Path: Proposals for Changed Work which is on the critical path of the then-current Construction Schedule shall be prepared so as to minimize or eliminate delay or disruption to Unchanged Work.
- 7.3.2.2.2 Pricing of Change Proposals for Work with Schedule Float: Proposals for Changed Work which is not on the critical path of the then-current Construction Schedule shall be prepared so as to minimize the Direct Cost of the change, without affecting the then-current critical path.
- 7.3.2.3 Breakdown and Elements of Changed Proposals: Contractor's proposed pricing of Change Orders, Disputed and Unilateral Change Orders shall be supported with an individually quantified, itemized breakdown of all increases and decreases in the Contract Sum in at least the following detail:
- 7.3.2.3.1 Direct Costs.
- 7.3.2.3.1.1 Material: The estimated reasonable additional cost to the Contractor of material directly attributable to the applicable change detailed by trade, quantities, and unit costs and identified with specific itemized labor necessary to install the material;
- 7.3.2.3.1.2 Labor: The estimated reasonable additional cost to the Contractor of labor (including normal fringe benefits approved in advance by Owner) directly attributable to the applicable change detailed by trade, quantities, and unit costs and identified with specific itemized material to be installed or operation to be performed;
- 7.3.2.3.1.3 Construction Equipment: The estimated reasonable additional cost to the Contractor of construction equipment exclusively necessary for the applicable change for the time that such construction equipment will be actively used as a direct result of the applicable change as follows:
- 7.3.2.3.1.3.1 Owned Equipment: For equipment owned by the Contractor or any related business entity, regardless of whether Contractor leases such equipment from the related business entity, the cost shall be the lesser of (i) the Contractor's actual operating costs attributable to such equipment or (ii) 75% of the applicable rental rate listed in the latest edition of the AED Green Book.
- 7.3.2.3.1.3.2 Third Party Rental Equipment: For equipment actually rented by the Contractor from an unrelated third party the cost shall be the lesser of (i) the Contractor's actual rental cost to accomplish the applicable Changed Work or (ii) 75% of the applicable equipment rental rates based on the latest edition of the AED Green Book. A reasonable rental cost shall be allowed as determined by the Owner when required machinery and construction equipment is not listed. The rate applied shall be based on the daily/weekly/monthly rate determined by the Owner. In addition, the Contractor shall be allowed reasonable move-in and move-out charges on heavy equipment (if such equipment is specifically required for the applicable Changed Work), as determined by the Owner.
- 7.3.2.3.1.4 The latest edition of the AED Green Book for each year for the term of the Contract shall be furnished by the Contractor for the Owner's use during the term of this Contract. This book will not be returned at the end of the Contract. The cost of the book shall be a cost of the Work.
- 7.3.2.4 Jobsite Overhead Costs.
- 7.3.2.4.1 Working Jobsite Supervision: The estimated reasonable additional working jobsite Supervision costs incurred by Contractor directly attributable to the Changed Work. This shall not include any non working (i.e., supervision) personnel.
- 7.3.2.5 Overhead and Profit/Fees: The Contractor's overhead and profit/fee percentages shall include, among other costs related solely to the Changed Work, Contractor provided insurance per Article 11, Change Order Processing Costs, including without limitation, estimating, clerical and drafting costs, performed either at the jobsite or in the office, non-working jobsite supervision, jobsite General Conditions and requirements; all Construction Scheduling costs, Payment and Performance Bonds, warranty and extended warranty costs, shared office personnel; small tools (less than \$1,000 replacement value); incidental job burdens; profit, loss of profit, cost of idle equipment, home/regional/branch office overhead, consequential damages, and all corporate, regional or other office expenses and all other overhead costs including all costs required for Change Orders requiring an extension of time, all project, regional, and corporate overhead, profits and fees. The following overhead and profit/fees shall be calculated as a percentage of the total cost attributable solely to the Changed Work determined on the basis of a lump sum price or on the basis of allowable time and material cost actually and properly incurred pursuant to Sub Article 7.3.1.3 or any other basis agreed to in writing by the Owner and the

Contractor, and shall supersede all provisions in the equipment, MCA and NECA Labor Manuals and pricing guides:

<u>Type of Work Performed</u>	<u>% Markup for Overhead & Profit/Fees</u>
a) For the Contractor or Subcontractor that will actually perform the Changed Work, as its overhead and profit/fees.	As allowed in the Contract Documents -- if lump sum
b) For the Contractor's overhead & profit/fee for Changed Work performed by first tier Subcontractors (as distinguished from Sub-subcontractors)	As allowed in the Contract Documents -- of first tier Subcontractor's price.
c) For the first tier Subcontractor's overhead & profit/fee for Changed work performed by lower tier Sub-subcontractors.	As allowed in the Contract Documents -- of the first tier Sub-subcontractor's price.

7.3.2.6 Determination of Pricing:

7.3.2.6.1 Quantities: All Subcontractors, suppliers and the Contractor (for self performed work only) shall, prior to pricing; provide detailed, individual take-offs/quantity surveys for each individual component of all labor, material and equipment required for each component of the Changed Work. These quantities are hereinafter referred to as net sub-subtotal quantities. For similar materials, labor and equipment, first provide net quantities by subtracting the deleted quantity from the added quantity (for each individual component) to determine a net sub-subtotal quantity.

7.3.2.6.2 Pricing: the net sub-subtotal quantities of each item determined in accordance with Sub Article 7.3.2.6.1 shall then be priced to determine the cost or credit for each individual item. The sum of all costs and credits shall then be totaled to a single subtotal number for the changed work. The single subtotal shall then be used for the determination of overhead, profit/fees.

7.3.2.6.2.1 Subcontractor and Supplier Overhead, Profit/Fees: If the subtotal relating to Subcontractor and supplier pricing determined in Sub Article 7.3.2.6.2 is greater than zero, then the Subcontractor and supplier (only) shall apply the allowable overhead, profit/fee percentages in accordance with 7.3.2.5 to arrive at a sub-net total. If the subtotal is zero or less than zero, then no additional mark-ups or credits shall be applied and the subtotal becomes the sub-net total.

7.3.2.6.3 Contractor Overhead, Profit/Fees.

7.3.2.6.4.1 The Contractor shall add all the sub-net total costs determined in Sub Article 7.3.2.6.2.1 to the total subtotal costs for all Contractor self-performed work determined in accordance with 7.3.2.6.2, to provide a complete, inclusive net total cost or credit for all work indicated in the Changed Work.

7.3.2.6.4.2 If the net total cost determined in Sub Article 7.3.2.6.4.1 is greater than zero, then the Contractor shall apply the Contractor allowable overhead, profit and fee percentages in accordance with 7.3.2.5 to provide the total price for the Changed Work.

7.3.2.6.4.3 If the net total cost is zero or a credit, then no additional overhead, profit, fees or credits are applied. The net total then becomes the total credit for the pricing directive.

7.3.2.7 After the cost and Construction Schedule issues have been reviewed and approved by the Owner, a Change Order will be issued. No payment will be made to the Contractor until all required signatory parties execute the Change Order.

7.3.2.8 Deductive Change Order: For net deductive Change Orders the Change Order credit shall be equal to the direct cost of the deleted material, labor and equipment comprising the credit. No deduction will be made for overhead and profit/fee on net deductive Change Orders.

7.3.2.9 Labor Rates: Prior to the submission of its first Application for Payment, the Contractor shall submit to the Owner for its approval the hourly labor rates including separate calculations for each individual component of the normal payroll taxes, insurance, fringe benefits, and other labor rate components per trade classification which the Contractor proposes to be used by it and its Subcontractors in the

ATTACHMENT A

preparation of costs proposals. The proposed hourly labor rates shall be substantiated with certified backup information showing the complete makeup of the rates. The submitted information shall not include any percentage markups for overhead, profit or fee. Upon approval of the proposed hourly rates by the Owner, the Contractor may submit cost proposals accordingly. All labor rates shall include an acceptable percentage for Worker's Compensation Costs.

- 7.3.2.10 Electrical Change Orders: In addition to all other requirements for the pricing of Change Orders involving the electrical Subcontractor, Change Orders shall be priced in the following manner:
 - 7.3.2.10.1 All material costs shall be the reasonable estimated cost to the Contractor and/or Subcontractor;
 - 7.3.2.10.2 Equipment ownership or rental costs, as appropriate, shall be determined in accordance with Sub Article 7.3.2.3.1.
 - 7.3.2.10.3 Labor man-hours applied to a Changed Work task shall not be greater than the hours listed in the Electrical Means Estimating Manual adjusted for the project location, in effect at the time of the applicable Changed Work. A copy of the current edition shall be furnished by the Contractor to the Owner for its use. The manual will not be returned at the end of the Contract. All cleanup and warranty costs shall be considered to be included in the labor rates:
 - 7.3.2.10.4 No additional labor shall be added for any non-productive/non-working personnel or for any supervision. All miscellaneous materials, tools, clean up, and warranty shall be deemed to be included in the stated labor rate
 - 7.3.2.10.5 An additional allowance equal to 1% of the listed material cost will be allowed for all applicable miscellaneous material, waste, and clean up.
- 7.3.2.11 Mechanical, Plumbing, and Site Utilities Change Orders; In addition to all other requirements for the pricing of Changed Work involving the Mechanical, Plumbing and Site Utilities Subcontractors, Changed Work shall be priced in the following manner;
 - 7.3.2.11.1 All material costs shall be the reasonable estimated cost to the Contractor and/or Subcontractor;
 - 7.3.2.11.2 Equipment ownership or rental costs, as appropriate, shall be determined in accordance with Sub-Article 7.3.2.3.1.
 - 7.3.2.11.3 Labor man hours applied to a Changed Work shall not be greater than the hours listed in the current edition adjusted for the project location in effect at the time of the applicable Means Mechanical Estimating Manual and 90% of the listed value. A copy of each applicable edition of the Means estimating Manual shall be furnished by the Contractor to the Owner for its use. The manual will not be returned at the end of the Contract.
 - 7.3.2.11.4 Shipping costs shall be based on a per occurrence basis;
 - 7.3.2.11.5 All miscellaneous materials, tools, clean up, and warranty shall be deemed to be included in the stated labor rate.
 - 7.3.2.11.6 No additional labor shall be added for any no-productive/non-working personnel or for any supervision.
- 7.3.2.12 Cost of Bond Premiums: All Payment and performance Bond premiums, if any, are included in overhead, profit/fees (Sub Article 7.3.2.5) and shall not be separately compensated.
- 7.3.3 After the Contractor and the Owner have agreed to the pricing of Changed Work and a Change Order has been prepared by the Architect and executed by the Contractor, Architect and the Owner, the Contractor shall be paid on account of such Change Order as provided in the Contract Documents. The Owner and the Contractor acknowledge and agree that Change Orders include payment for all costs associated with the applicable change both with respect to Changed Work and Unchanged Work, whether direct, indirect, impact or consequential in nature and any and all Claims which Contractor may have relating to the applicable change, including, but not limited to delay, acceleration, interference, hindrance, loss of efficiency, extended overhead, crowding or stacking of trades, work out of sequence, ripple effect, restricted access, manpower availability, overtime, constructive acceleration, cumulative effect of changes, multiple crews, loss of morale, increased storage or material handling, and/or all impact Claims. The Contractor's acceptance of payment pursuant to such Change Order shall constitute a waiver and release by the Contractor of any such Claims, costs, expenses or other items (direct, indirect, impact or consequential) relating to the change specified in the Change Order.

- 7.3.4 Disputed Change Order: If the Owner and the Contractor are unable to agree that a change has occurred which should result in a change in the Contract Sum or an adjustment in the Contract time, the Owner may issue a Change Order (“Disputed Change Order”) ordering the Contractor to proceed with the performance of the Work in question and the Contractor shall expeditiously proceed with the Work involved and shall maintain records from which to determine whether any additional costs are incurred. Contractor shall use all reasonable efforts to minimize cost, time, and impacts to others. The Contractor hereby acknowledges and agrees that the Owner shall not be obligated to pay the Contractor on account of such Work or to extend the Contract Time until such time as the Contractor submits pricing for Change Order request in accordance with the Contract Documents and until any dispute as to the entitlement to a change in Contract Sum or adjustment in Contract Time is resolved between the Contractor and Owner.
- 7.3.5 Unilateral Change Order: In the event that the Owner and the Contractor are agreed that Contractor is entitled to a change and (i) prior to the Contractor’s submittal of a Change Order request in proper form and substance and, (ii) are unable to agree on the pricing of any change in the Contract Sum or an adjustment in the Contract Time, or, (iii) in the event Owner must direct and/or add work in excess of \$5,000.00, the Owner may issue, in accordance with Sub Article 7.3.1, a Change Order (“Unilateral Change Order”) ordering the Contractor to proceed with the performance of the Work in question and the Contractor shall expeditiously proceed with the Work involved.
- 7.3.6 Duty to Proceed: In the event that the Owner issues a Disputed Change Order or a Unilateral Change Order pursuant to this Article, the Contractor agrees that it shall diligently perform the Work in accordance with such Disputed Change Order or Unilateral Change Order and agrees that it shall execute the Disputed Change Order or Unilateral Change Order. Failure of the Contractor to proceed with the written directives of Owner with respect to any change pursuant to this Article shall be considered a default under the terms of the Contract Documents.
- 7.3.7 Allowable Costs: In the event that the Owner approves a Change Order on a time and material basis pursuant to Sub Article 7.3.1.3, or in the event that the Owner issues a Unilateral Change Order, allowable costs incurred shall be governed by this Sub Article 7.3.7.
- 7.3.7.1 A Change Order issued on a time and material basis pursuant to Sub Article 7.3.1.3 or a Unilateral Change Order shall both direct the Contractor do the Work, indicating expressly the intention to treat the items as changes in the Work, and setting forth the kind, character, and limits of the Work as far as can be ascertained, the terms under which the changes to the Contract Sum shall be determined and the maximum change in the Contract Sum allowed thereunder. The prior approval of the Change Order on a time and material basis or the Unilateral Change Order shall be subject to submission, review and approval and incorporation (as appropriate) into a Change Order prior to any payments. No costs exceeding the estimated maximum amount set forth in the applicable Change Order will be paid without additional written approval of Owner.
- 7.3.7.2 The Contractor shall maintain such records as the Owner deems required to distinguish the direct cost of time and material Work from the cost of other operations. It shall furnish daily, on forms approved by the Owner, reports of time and material Work. The reports shall itemize all costs for labor, materials, and equipment rental and give total costs to date for the cost reimbursable work. For laborers, the reports shall include hours worked, rates of pay, names and classifications, and certified payrolls. For equipment, the reports shall include size, type, identification number, rental rate, and hours of operation. All records and reports shall be made immediately available to the Owner upon request. The cost of furnishing such reports shall be included in the Contractor’s overhead and profit/fee percentages (Sub Article 7.3.2.5).
- 7.3.7.3 All time and material reports, including daily time sheets shall be signed daily by the Contractor and the Owner. The Owner shall compare its records with the Contractor’s reports and Contractor shall make the necessary adjustments and compile the costs of time and material work. When such reports are agreed upon and signed by both parties, they shall become the basis of payment after a Change Order has been executed and to the extent provided in this Article 7. In no event shall such signed reports authorize payment in excess of the authorized estimated maximum total change in the Contract Sum referenced in the applicable Change Order.
- 7.3.7.4 Labor costs, including welfare and fringe benefits, taxes and insurance shall be the actual labor costs incurred in the time and material work. Allowed is no more than (1) working foreman, but not including other nonworking personnel, supervisory or administrative personnel.
- 7.3.7.5 Material costs shall be the cost of all materials purchased and used in the Work and shall be the actual cost of such material, including any applicable taxes, and where applicable, freight and delivery charges. The Owner reserves the right to approve materials and sources of supply of material, or if necessary to facilitate the progress of the Work, or to furnish the materials to the Contractor.

ATTACHMENT A

- 7.3.7.6 The Contractor's cost and the time that machinery or construction equipment is required and efficiently used shall be determined in accordance with 7.3.2.3.1.
- 7.3.7.7 Construction equipment and tools purchased for use on the Project having a replacement value of \$2,000 or less each, whether or not consumed or used, shall be considered small tools and shall be included in overhead, profit/fee and, upon Project completion, become property of the Owner; or by written authorization of the Owner may be retained by the Contractor. (Sub Article 7.3.2.5).
- 7.3.7.8 Costs shall be substantiated by invoices complete with pricing. In no event shall the cost of such items exceed the average current retail prices at which the items are available in the quantities required, delivered to the Work Site, less cash or trade discounts.
- 7.3.8 Time Limitations for Return of Change Orders; The Contractor shall execute all Change Orders within seven (7) days of receipt from Architect and shall return them to the Architect for execution and be forwarded to Owner be Architect within three (3) days after execution.
- 7.3.9 Record keeping and Audit: For purposes of this Contract, the Contractor and Subcontractors shall keep complete and accurate financial records of all cost incurred in performing such Work under this Contract on the Work Site and shall make these records available to the Owner for audit and copying. No payment under Article 7 shall be made by the Owner unless such records are kept and until such records have been made available to and approved by the Owner. The Contractor shall maintain a log of all Potential Change Order Requests ("PCORs") resulting from each issue that Contractor believes is a change to the Contract (i.e. RFPs, RFIs, Field Orders, Contractor Change Requests, Claims, etc.) requiring an adjustment for money, time and/or both. Each PCOR shall be numbered sequentially by the Contractor. A copy of the log shall be transmitted to the Owner no less than once a month.
- 7.3.10 Time Impact of Changes: Regardless of time impact on Construction Schedule, Contractor shall submit a fragnet with each Changed Work issue, and change and/or Potential Change Order Request. This fragnet shall identify all activities impacted by the change. Contractor's entitlement, if any, to an extension of Contract Time with respect to any change shall be determined in accordance with the provisions of Articles 3 and 4.
- 7.3.11 Pending final determination of cost to the Owner, amounts in dispute may not be included in Applications for Payment.
- 7.3.12 When the Owner and Contractor agree on adjustments in the Contract Sum and Contract Time, such agreement shall be effective immediately and shall be recorded by preparation and execution of an appropriate Change Order.
- 7.4 MINOR CHANGES IN THE WORK
- 7.4.1 The Architect, with consent of the Owner, will have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Without adjustment in Contract Sum or extension in time, notwithstanding that such minor changes constitute Changed Work, such changes shall be effected by written order and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly.

ARTICLE 8 – TIME

- 8.1 DEFINITIONS
- 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial and Final Completion of the Work.
- 8.1.2 The date of commencement of the Work is the date established in the Notice to Proceed. The date shall not be postponed by the failure to act by the Contractor or of persons or entities for which the Contractor is responsible.
- 8.1.3 The date of Substantial Completion is the date certified by the Architect and approved by the Owner in accordance with Sub Article 9.8. The Date of Final Completion is the date the Architect issues a final Certificate for Payment approved by Owner in accordance with Sub Article 9.10 of the General Conditions.
- 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

8.2 PROGRESS AND COMPLETION

8.2.1 Time, as stated in the Contract Documents, is of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

8.2.2 The Contractor shall provide to the Owner bi weekly progress reports outlined as follows:

- a) Cover Sheet with Project rendering Photo and verbal identification of Project, Consultants and Owner
- b) Contract Status Report
- c) Schedule Status Report
- d) Weather and Labor Report
- e) Action Item agenda - Org. Date/No./Item/Who/When/ Notes-Resolution
- f) Resolved Pending Items log
- g) Change Order Log
- h) RFI Log
- i) Submittal Log
- j) Schedule Trend Chart
- k) Project Progress Photos
- l) Distribution List

8.2.3 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor. The date of commencement of the Work shall not be changed by the effective date of such insurance. Unless the date of commencement is established by a Notice to Proceed given by the Owner, the Contractor shall notify the Owner in writing not less than five days or other agreed period before commencing the Work to permit the timely filing of mortgages, mechanic's liens and other security interest.

8.2.4 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion and Final Completion within the Contract Time.

8.3 DELAYS AND EXTENSIONS OF TIME

8.3.1 If the Contractor is delayed in the performance of the Work by a gross negligent act of the Owner or the Architect, or by an employee, agent or representative of either, or by Changes in the Work (and then only to the extent provided in an agreed Change Order) or by the combined action of workmen (either those employed on the Work or in any industry essential to the conduct of the Work), which in no way was caused by or resulting from default or collusion on the part of the Contractor, or subject to the proviso contained in this Sub Article 8.3.1 by strikes, lockouts, or embargoes generally affecting the locality of the Project, or by fire, unavoidable casualties, national emergency, or extreme adverse weather conditions during construction, beyond the applicable number of days for the month(s) in question in accordance with Sub Article 4.3.6.4 (but which affected the critical path of the project), and provided that (a) Contractor exercises reasonable diligence to overcome the impediment of such causes of delay (all of the foregoing causes for delay being hereinafter collectively referred to as "Excusable Delays"), and (b) within five (5) days after the commencement and ten (10) days after the expiration of any such Excusable Delay, the Contractor delivers to the Owner written request for extension for such Excusable Delay, and such requests are reviewed and approved by the Owner, then the Contract Time shall be extended by Change Order. In the case of a continuing cause of delay of a particular nature, the Contractor shall be required to make only one such request with respect thereto.

8.3.2 In no event shall the Owner become obligated to pay the Contractor any amount in excess of the Contract Sum, for occurrences such as abnormal field conditions, delays due to labor disputes, unusually severe weather, delays due directly or indirectly to the failure of any party including, without limitation, Contractor, any Subcontractor, Sub-subcontractor, materialman or laborer for all other causes of lost time which could not reasonably anticipated and which result in added costs, or claims which are not recoverable as changes under specific provisions of the Contract Documents, unless Contractor submits with the Contractor's request for extension, and the Owner approves a Change Order specifying the amount by which the Contract Sum will increase due to such delay.

8.3.3 Except for the Contractor's right to terminate this Contract pursuant to the provisions of Article 14 of the General Conditions, Change Orders per Article 7, and Claims and Disputes per Article 4.3, the Contractor's sole remedy for any delay by the Owner will be an extension or extensions of time as set forth in this Article, unless the same shall have been caused by acts constituting intentional interference by the Owner with the Contractor's performance of the Work and then only to the extent that such acts continue after the

ATTACHMENT A

Contractor's notice to the Owner of such intentional interference. The Owner's exercise of any of its rights under Article 7 hereof, regardless of the extent or number of such changes, or the Owner's exercise of any of its remedies of suspension of the Work, or requirement of correction or re-execution of any defective work shall not, under any circumstances, be construed as intentional interference with the Contractor's performance of the Work.

ARTICLE 9 –PAYMENTS AND COMPLETION

9.1 CONTRACT SUM

9.1.1 The Contract Sum is the Contract Sum set forth in the Agreement and the same may be adjusted in accordance with the Contract Documents.

9.2 SCHEDULE OF VALUES

9.2.1 Two weeks prior to the first Application for Payment, the Contractor shall submit to the Owner a schedule of values (AIA G703) allocated to various portions of the Work, prepared in such form and detail and supported by such data to substantiate its accuracy as the Architect and Owner may require. This schedule (Schedule of Values), when approved by the Architect and Owner, shall be used as a basis for reviewing all Contractors' Applications for Payments.

9.3 APPLICATIONS FOR PAYMENT

9.3.1 In each Application for Payment, (AIA G702 and G703 including Owners Down Date Waiver), the Contractor shall certify to such matters as the Owner shall require, including without limitation, that the Work covered by such Application for Payment has been completed in accordance with the Contract Documents, and shall also certify that there are no known mechanics' or materialmen's liens outstanding at the date of the Application, that all due and payable bills with respect to the Work have been paid to date or are included in the amount requested in the current Application, that all bills or obligations for which funds were requested in all previous Applications and for which payment has been received from Owner, have been paid, and that except for such bills not paid but so included, there is no known basis for the filing of any mechanics' or materialmen's liens on the Work, and that waivers from all Subcontractors and materialmen have been obtained in such form as to constitute an effective waiver of lien under the laws of the state in which the project is located. To the extent Contractor has any of the items or any of the information with respect to the present Application for Payment which is requested under Sub Article 9.6.2.1 regarding previous Applications for Payment, Contractor shall submit such items together with the Contractor's Application for Payment. Contractor shall submit its payment application no later than the last day of each month and in accordance with Article 3 and this Article 9. Contractor must list any approved Change Order(s) as individual line item(s) below Division 16 on the G703 Schedule of Values continuation sheet and bill according to percent complete.

9.3.1.1 Such applications may not include requests for payment on account of changes in the Work which have been properly authorized by Construction Change Directives but not yet included in Change Orders.

9.3.1.2 Such applications may not include requests for payment of amounts the Contractor does not intend to pay a Subcontractor or material supplier because of a dispute or other reason.

9.3.1.3 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site, for subsequent incorporation in the Work. *If approved in advance by the Owner and Lender, payment may similarly be made for materials and equipment suitably stored off the site, at an insured location. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include applicable invoices, insurance, storage and transportation to the site for such materials and equipment stored off the site. Payment for offsite stored materials is decided solely by the Owner.*

9.3.2 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner, provided said Work is approved for payment by the Owner. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interest or encumbrances in the favor of the Contractors, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to Work.

9.3.3 As long as Owner has made all payments due and owing, if, during the course of construction the Project, any materialmen's, mechanics' or other similar lien or claim thereof is filed by any Subcontractor, Sub-subcontractor, materialman or laborer, and if the Contractor has not caused such lien to be released and discharged, or has not filed a bond in lieu thereof, within fifteen (15) days after the filing thereof, the Owner shall have the right to withhold the same from the next succeeding Applications for Payment, and the Contractor shall pay all amounts due with respect to such Applications for Payment in excess of the amounts paid by the Owner, out of the Contractor's own funds, until such liens and claims are satisfactorily removed. If any such liens or claims remain filed or otherwise imposed against the Project or the Owner, Contractor shall cause such liens or claims to be released, bonded around or otherwise discharged to Owner's reasonable satisfaction, and if the Contractor has not so removed or discharged such liens or claims within fifteen (15) days, the Owner shall have the right to pay all sums necessary to obtain such release and discharge and deduct all amounts so paid from the Contract Sum. The Contractor shall indemnify, defend and hold harmless the Owner from all claims, losses, demands, causes of actions or suits of whatever nature arising out of any such lien or that part of the Work covered thereby.

9.4 CERTIFICATES FOR PAYMENT

9.4.1 The Architect will, within three days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Sub Article 9.5.1.

9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's observations at the site and the data comprising the Application for Payment, that the Work has progressed to the point indicated and that, to the best of the Architect's knowledge, information and belief, quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to minor deviations from the Contract Documents correctable prior to completion and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation by the Architect that the Contractor is entitled to payment in the amount certified, subject to Owner's approval.

9.5 DECISIONS TO WITHHOLD CERTIFICATION

9.5.1 The Architect may decide not to certify payment and may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Sub Article 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, or if the Owner does not agree with such representations and determinations made by the Architect, such party will notify the Contractor and other party respectively as provided in Sub Article 9.4.1. If the Contractor and such party cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner and to which the Owner will authorize. The Architect may also decide not to certify payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole or a part of a Certificate of Payment previously issued, and the Owner may withhold payment, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss because of:

1. defective Work not remedied;
2. third party claims filed or reasonable evidence indicating probable filing of such claims;
3. failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
4. reasonable evidence that the portion of the Contract Sum then remaining unpaid will not be sufficient to complete the Work, in which event no additional payments will be due to the Contract under this Contract until and unless the Contractor at its sole cost, performs a sufficient portion of the Work so that such portion of the Contract Sum then remaining unpaid is determined by the Architect to be sufficient to so complete the Work;
5. damage to the Owner or another Contractor;
6. reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
7. persistent failure to carry out the Work in accordance with the Contract Documents.

9.5.2 If at any time, the Owner, in its sole, good faith judgment, determines that the portion of the Contract Sum then remaining unpaid will not be sufficient to complete the Work in accordance with this Agreement, or after an inspection of the work, agree with the representations and determinations made by the Architect by virtue of the Architect's issuance of the Certificate for Payment, or if the Contractor is then in default of any of its obligations under this Agreement, no additional payment will be due Contractor unless and until

Contractor at its sole cost has performed a sufficient portion of the Work so that the portion of the Contract Sum then remaining unpaid is determined by the Owner to be sufficient to complete the Work in accordance with this Agreement. For the purposes of determining if the portion of the Contract Sum then remaining unpaid will be sufficient to complete the Work, the Owner has the sole right to use whatever method of determination that Owner wishes to use. When the above reasons for withholding certification are satisfied, certification will be made for amounts previously withheld.

9.5.3 *The Contractor acknowledges that Owner will not accept or process a payment request until the Contractor provides an updated Construction Schedule submitted in accordance with Article 3 and which is accepted by the Owner.*

9.5.4 If the Contractor fails or refuses to furnish the information and Construction Schedule data which, in the sole judgment of the Owner, is necessary for verifying the Contractor's progress, the Contractor shall be deemed not to have provided an Application for Payment.

9.6 PROGRESS PAYMENTS

9.6.1 After the Architect has issued a Certificate for Payment and it is approved by Owner, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect. No monthly progress payments shall be made during the first two (2) months without a Preliminary Schedule that has been accepted by the Owner, nor after the first three (3) months without a Construction Schedule that has been accepted by the Owner, with the exception of cost for Bond, Insurance and Mobilization. No monthly certificates of payment will be approved if the as-builts are not current as of that month. Prior to the 30th day of each month, the Owner, Architect, and the Contractor shall inspect the work and such evidence as required by the terms of the Contract to determine quantities completed to date. Remaining durations shall determine the percentage completion of each activity to generate the earned value of each activity. Progress shall be based on work in place and projected through the last day of the month. This information shall be used by the Contractor to generate its Application for Payment as well as its Construction Schedule update.

9.6.2 The Contractor shall promptly pay each Subcontractor, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled, reflecting percentages actually retained from payment to the Contractor on account of such Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in similar manner.

9.6.2.1 The Contractor shall use all sums advanced to it pursuant to this Contract solely for the purpose of performance of the Work in accordance with the Drawings and Specifications. Together with the submission of each Application for Payment, beginning with the second Application for Payment, the Contractor shall furnish to the Owner a detailed statement accounting for the disbursement of funds received from the Owner on the previous Application for Payment. Such statement shall itemize all disbursements to Subcontractors and suppliers. Payment to Subcontractors, materialmen and other parties furnishing labor and materials in connection with performance of the Work shall be accompanied by an unconditional release of mechanics' and materialmen's liens from the Contractor and each Subcontractor in the form approved by the Owner covering all sums due through the effective date of such previous Application for Payment and a conditional release of liens through the effective date of the current Application for Payment conditioned only upon receipt of such payment from each party. At 95% complete, no further payments will be approved or paid unless all closeout documents have been completed, submitted, and accepted by the Owner. As a condition for receipt of Final Payment, Contractor shall require all such parties to submit a full and final unconditional release of mechanics' and materialmen's lien rights for all sums due under their respective contracts, purchase orders or other agreements, but at Owner's request Contractor shall cause a formal closing to occur at a title company selected by Owner whereat full and final lien releases shall be delivered by Contractor and each Subcontractor and payments shall be made directly to each Contractor and Subcontractor. However, no provision hereof shall be construed to require the Owner or the Architect to see to it that monies advanced to the Contractor are properly disposed or applied.

9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

9.6.4 Neither the Owner nor Architect shall have an obligation to pay or ensure payment of money to a Subcontractor except as may otherwise be required by law.

9.6.5 Payment to material suppliers shall be treated in a manner similar to that provided in this Article 9.

ATTACHMENT A

- 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work that is not in accordance with the Contract Documents.
- 9.6.7 In no event shall any interest be due and payable by the Owner to the Contractor, or to any Subcontractor, or to any other party on any of the sums that the Owner is permitted to retain pursuant to any of the terms provisions of the Contract Documents.
- 9.6.8 Payment for Stored Materials: Application for Payment for on-site stored materials shall include invoices provided by Contractor. Owner and Contractor shall verify its quantities. The Contractor shall be paid 75% of the value (or the amount allowed by the Lender) of the off-site stored materials; 25% balance of stored materials cost shall be paid once stored materials are "work in place". No payment shall be made for the production of Shop Drawings
- 9.7 FAILURE OF PAYMENT
- 9.7.1 If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, after receipt of the Contractor's Application for Payment, or if the Owner does not pay the amount certified by the Architect and approved by Owner (subject to retainage in accordance with the Contract Documents), then the Contractor may, (after fourteen additional days after the date that the payment was due and owing) provide written notice to the Owner and Architect, and stop the Work until payment of the amount owing and not disputed by Architect or Owner, has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, which shall be accomplished as provided in Article 7.
- 9.8 SUBSTANTIAL COMPLETION
- 9.8.1 Substantial Completion of the Work or a designated portion thereof which the Owner agrees to accept separately is the stage in the progress of the Work or such separate portion when the Architect issues its Certificate of Substantial Completion and the Owner approves the same in accordance with 1). Sub Article 9.8.2 hereof, 2). the Contract Documents Substantial Completion requirements and 3). the Work or designated portion thereof is sufficiently complete for its intended purpose.
- 9.8.2 When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Sub Article 9.8.2 and the Specifications. The Contractor shall proceed promptly to complete and correct items on the list of items to be completed or corrected. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not in accordance with the requirements of the Contract Documents, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect to the satisfaction of the Owner and the Architect. The date that the Architect inspects and accepts the Work or such designated portion thereof and the Owner approves such Certificate of Substantial Completion (which approval will not be unreasonably withheld or delayed), shall be the date of Substantial Completion of that portion of the Work, and shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall fully and finally complete the Work and fully perform the Contractor's obligations under the Contract Documents, including without limitation, finishing all items on the list accompanying the Certificate to the satisfaction of the Owner and Architect. However, in all cases all incomplete Work shall be completed within ninety (90) days of the Date of Substantial Completion.
- 9.9 PARTIAL OCCUPANCY OR USE
- 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under SubArticle 11.4.1.5 and authorized by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the periods for correction of the Work and commencement of warranties required by the Contract Documents. Consent of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.
- 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion(s) of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

9.10 FINAL COMPLETION AND FINAL PAYMENT

9.10.1 Final Completion is the stage in the progress of the Work when the Work is fully and finally completed in accordance with the Contract Documents, the Contractor has fully performed its obligations under the Contract Documents, and all of the documents required for Final Payment have been delivered to the Owner in acceptable form. ***Upon receipt of written notice from the Contractor that the Contractor believes the Work is complete and that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspections.*** When the Architect and the Owner find the Work has been fully and final completed under the Contract Documents and the Contract has been fully performed, the Architect will promptly issue a final Certificate of Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's observations and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents, and that the entire balance found to be due the Contractor and noted in said final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in SubArticle 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

9.10.2 ***Upon Final Completion of the Work, application by the Contractor, certification by the Architect, delivery of the documents required under the Contract Documents, and upon approval of the Owner (which approval will not be unreasonably withheld or delayed), the Owner shall make Final Payment reflecting adjustment in retainage, if any, for such Work or portion thereof as provided in the Contract Documents.*** Neither Final Payment nor any remaining retained percentage shall become due until the Contractor submits to the Owner (with a copy to Architect) (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts unpaid by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after Final Payment is currently in effect and will not be cancelled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) if required by the Owner, other data establishing payment or interests or encumbrances arising out of the Contract, to the extent and in such from as may be designated by the Owner, and (6) a full and complete unconditional release (unless a formal closing is required pursuant to Sub Article 9.6.2.1) of mechanics' and materialmen's lien rights for all sums due to any and all Subcontractors and Sub-subcontractors, executed by the Contractor and all such parties, in form and substance approved by the Owner, and being effective through the date of Final Payment, and (7) all other closeout documentation required by the Contract Documents. If a Subcontractor refuses to furnish a release or waiver required by the Owner the Contractor may, at the Owner's sole option, furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all monies that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

9.10.2.1.1 The Contractor shall furnish to the Owner the original final release of lien executed and acknowledged by all Subcontractors and materialmen who have performed any Work. The form of final release of lien shall be the current edition of the ***AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims"***.

9.10.2.1.2 In addition, the Contactor shall submit a final statement of accounting as set out hereinafter:

- 9.10.2.1.2.1 Final Statement of Accounting: The Contractor's final statement of accounting must reflect all Owner approved adjustments to the Contract Sum, including:
- a) The original Contract Sum
 - b) Additions and deductions resulting from:
 - Previous Change Orders
 - Cost changes resulting from application of unit prices.
 - Deductions for uncorrected Work.
 - Deductions for re-inspection costs
 - Other adjustments as applicable.
 - c) The total Contract Sum, as adjusted.
 - d) Previous payments.
 - e) Sums remaining due.

ATTACHMENT A

The Owner shall prepare a final Change Order reflecting Owner accepted adjustments of the Contract Sum which were not previously made by Change Order.

- 9.10.3 If, after Substantial Completion of the Work, Final Completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Owner and Architect concur, the Owner may, at its sole discretion, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims. The making of final payment shall constitute a waiver of claims by the Owner except as provided in SubArticle 4.3.3.
- 9.10.4 Acceptance of final payment by the Contractor, Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment. Such waivers shall be in addition to the waiver described in SubArticle 4.3.3.
- 9.10.5 Warranties required or provided by the Contract Documents shall commence on the date of Substantial Completion of all of the Work unless otherwise provided in the Certificate of Substantial Completion.
- 9.11 LIQUIDATED DAMAGES
- 9.11.1 Time is of the essence of this Agreement. Accordingly, Contractor agrees and warrants that it shall cause both Substantial and Final Completion of the Work to occur on or before the Scheduled Substantial and Final Completion Dates. The Owner will suffer financial loss if Substantial and Final Completion of the Work does not occur on or before the Scheduled Completion Dates. If Substantial or Final Completion of the Work does not occur on or before the Scheduled Substantial and Final Completion Dates, the Contractor (and the Contractor's Surety) shall be liable for and shall pay to the Owner the sum identified in the Contract Documents as liquidated damages for each calendar day after the Scheduled Substantial and Final Completion Dates have occurred.
- 9.11.2 Contractor and Owner acknowledge and agree that because of the unique nature of the Project and the Work, it is difficult or impossible to determine with precision the amount of damages that would or might be incurred by Owner as a result of the Contractor's failure to cause Substantial or Final Completion of the Work to occur on or before the Scheduled Substantial and Final Completion Dates. It is understood and agreed by the parties that (i) Owner will be damaged by failure of the Contractor to meet such obligations, (ii) it would be impracticable or extremely difficult to fix the actual damages resulting therefrom, (iii) any sums which would be payable under this Agreement are in the nature of liquidated damages, and not a penalty, and are fair and reasonable, and (iv) such payment represents a reasonable estimate of fair compensation for the losses that may reasonably be anticipated from such failure.

ARTICLE 10 – PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY PRECAUTIONS AND PROGRAMS

- 10.1.1 The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions, devices, and programs in connection with the performance of the Contract. ***Contractor shall be responsible for requiring all persons at the Site to wear hardhats and other required safety clothing and equipment at all times and for having first aid equipment at the Project Site at all times and in compliance with all legal and OSHA requirements. Requirements of government safety officials shall be completely implemented.***
- 10.1.2 In the event the Contractor encounters on the site pre-existing material reasonably believed to be asbestos or polychlorinated biphenyl (PCB) which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner and Architect in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the Owner and Contractor if in fact the material is asbestos or polychlorinated biphenyl (PCB) and has not been rendered harmless. The Work in the affected area shall be resumed in the absence of asbestos or polychlorinated biphenyl (PCB), or when it has been rendered harmless, by written agreement of the Owner and Contractor.

ATTACHMENT A

- 10.1.3 The Contractor shall not be required, pursuant to Article 7, to perform without consent any Work related to asbestos or polychlorinated biphenyl (PCB), (subject to Sub Article 3.4.4). The Contractor shall not incorporate into the Project (i) any materials containing asbestos, PCBs or urea formaldehyde or (ii) any materials or combination of materials considered to be hazardous or unlawful for the use intended according to any current EPA regulations, rules, laws or ordinances. Contractor shall provide manufacturer's certifications verifying the non-existence of these materials and Owner shall be entitled to rely on such certifications in the performance of the Contractor's work under this Sub Article 10.1.3.
- 10.1.4 TO THE FULLEST EXTENT PERMITTED BY LAW, THE OWNER SHALL INDEMNIFY AND HOLD HARMLESS THE CONTRACTOR, ARCHITECT, ARCHITECT'S CONSULTANTS AND AGENTS AND EMPLOYEES OF ANY OF THEM FROM AND AGAINST CLAIMS, DAMAGES, LOSSES AND EXPENSES, INCLUDING BUT NOT LIMITED TO ATTORNEYS FEES, ARISING OUT OF OR RESULTING FROM PERFORMANCE OF THE WORK IN THE AFFECTED AREA IF IN FACT THE MATERIAL IS ASBESTOS OR POLYCHLORINATED BIPHENYL (PCB) AND HAS NOT BEEN RENDERED HARMLESS, PROVIDED THAT SUCH CLAIM, DAMAGE, LOSS OR EXPENSE IS ATTRIBUTABLE TO BODILY INJURY, SICKNESS, DISEASE OR DEATH, OR TO INJURY OR DESTRUCTION OF TANGIBLE PROPERTY (OTHER THAN THE WORK ITSELF) INCLUDING LOSS OF USE RESULTING THEREFROM, BUT ONLY TO THE EXTENT CAUSED IN WHOLE OR IN PART BY NEGLIGENT ACTS OR OMISSIONS OF THE OWNER, ANYONE DIRECTLY OR INDIRECTLY EMPLOYED BY THE OWNER OR ANYONE FOR WHOSE ACTS THE OWNER MAY BE LIABLE, REGARDLESS OF WHETHER OR NOT SUCH CLAIM, DAMAGE, LOSS OR EXPENSE IS CAUSED IN PART BY A PARTY INDEMNIFIED HEREUNDER, BUT ONLY TO THE EXTENT OF OWNER'S NEGLIGENT ACTS OR OMISSIONS. SUCH OBLIGATION SHALL NOT BE CONSTRUED TO NEGATE, ABRIDGE, OR REDUCE OTHER RIGHTS OR OBLIGATIONS OF INDEMNITY WHICH WOULD OTHERWISE EXIST AS TO A PARTY OR PERSON DESCRIBED IN THIS SUB ARTICLE 10.1.4.
- 10.1.5 If reasonable precautions are inadequate to prevent foreseeable bodily injury or death to persons resulting from a pre-existing material or substance encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and the Architect in writing. The Owner, Contractor and Architect shall then proceed in the same manner described in Sub Article 10.1.2.
- 10.2 SAFETY OF PERSONS AND PROPERTY
- 10.2.1 The Contractor shall take responsible precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to:
1. employees on the Work and other persons who may be affected thereby;
 2. the Work, materials and equipment to be incorporated therein, whether in storage on or off site, under care, custody or control of the Contractor or the Contractor's Subcontractor or Sub-subcontractor's; and
 3. other property at the Site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.
- 10.2.2 The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.
- 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.
- 10.2.3.1 The Contractor shall protect excavations, trenches, and buildings from damage caused by dirt, debris, wind, rain water, spring water, ground water, backing up of drains or sewers, and provide pumps, equipment, and enclosures to provide this protection. The Contractor shall (a) construct and maintain necessary temporary drainage, (b) perform plumbing necessary to keep the excavation and floors at and below grade free dirt, debris, and water free, and (c) provide adequate means to achieve complete protection to personnel, construction and property adjoining the Project site. The foregoing Work shall be all in accordance with all foregoing Federal, State, local regulations, laws, rules, guidelines, and ordinances.
- 10.2.3.2 The Contractor shall perform the Work in a manner to protect new and existing improvements located on the site.

ATTACHMENT A

- 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods is allowed and are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision or properly qualified personnel and in full compliance with the law.
- 10.2.5 The Contractor shall promptly remedy damage and loss to property referred to in Sub Articles 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, Subcontractor, Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they are liable and for which the Contractor is responsible under Sub Articles 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Article 3.18.
- 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and the Architect.
- 10.2.7 The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.
- 10.3 EMERGENCIES
- 10.3.1 In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor due to an emergency shall be determined as provided in Sub Article 4.3 and Article 7.
- 10.3.2 ***In an emergency which imminently affects safety, health, life, the Work or property adjacent to the Site, the Contractor shall notify the Owner as early as possible that such an emergency exists.*** At the same time, absent special instructions from the Owner, the Contractor shall immediately act as its own discretion to minimize such threatened loss or injury. Contractor agrees to follow the instructions of the Owner. Compensation to which the Contractor is entitled on account of emergency work shall be on time and material basis as identified in Article 7.

ARTICLE 11 – INSURANCE AND BONDS

11.1 CONTRACTOR'S LIABILITY INSURANCE

- 11.1.1 The Contractor shall purchase from and maintain in a company or companies licensed or authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor (***and Owner as an additional insured***) from claims set forth below. Such claims may arise out of or result from the Contractor's operation under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable for:
1. claims under State or Federal Workers' Compensation statutes which are applicable to the Work to be performed;
 2. claims for damages because of bodily injury, occupational sickness, disease or death of the Contractor's employees;
 3. claims for damages because of bodily injury, sickness, disease or death of any person other than the Contractor's employees;
 4. claims for damages caused by false arrest, detention or imprisonment, malicious prosecution, wrongful eviction, invasion or violation of the right of privacy, slander or libel committed by the Contractor or any of the Contractor's employees or Subcontractors;
 5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
 6. claims for damages because of bodily injury, death of a person or property damage arising out of the ownership, maintenance or use of a motor vehicle;
 7. claims for bodily injury or property damage arising out of completed operations of the Contractor or any of its Subcontractors; and
 8. claims involving contractual obligations applicable to the Contractor's obligations as defined in Sub Article 3.18.

ATTACHMENT A

11.1.2 The insurance required by Sub Article 11.1.1 shall be written for limits not less than those specified in the Contract Documents. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from date of commencement of Work until the Final Payment and termination of any coverage required to be maintained after Final Payment.

11.1.2.1 Insurance and Minimum Limits Required by Contract:

Workers' Compensation and Employers' Liability:

Medical & Indemnity	Statutory Limits for Texas
Bodily Injury by Accident	\$500,000 Each Accident
Bodily Injury by Disease	\$500,000 Policy Limit
Bodily Injury by Disease	\$500,000 Each Employee

Commercial General Liability: (to be written on an ISO CG001 Form, 1990 or subsequent revision of this Form, approved for use in Texas)

General Aggregate	\$3,000,000
Products/Completed Operations Aggregate	\$1,500,000
Personal and Advertising Injury	\$1,500,000
Each Occurrence	\$1,500,000
Fire Damage	\$75,000
Medical Payment	\$5,000

The Commercial General Liability shall be endorsed to include a provision that the General Aggregate shall apply to this Project only and shall not be impaired by losses at any other of the Contractor's projects:

Business Automobile:

Each Accident – Combined Single Limit Basis	\$2,000,000
---	-------------

Umbrella or Excess Liability:

General Aggregate	\$15,000,000
Each Occurrence	\$15,000,000

The Contractor's commercial General Liability and Business Automobile policies shall contain an Additional Insured endorsement in favor of the Owner and affiliates. Contractor's Commercial General Liability, Business Automobile and Workers' Compensation policies shall contain Waiver of Subrogation endorsements in favor of the Owner and affiliates.

11.1.3 Prior to Notice to Proceed, certificates of insurance acceptable to the Owner shall be filed with the Owner. These certificates of insurance and the insurance policies required by Sub Article 11.1 shall contain a provision that coverages afforded under the policies will not be cancelled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. If any of the foregoing insurance coverages are required to remain in force after Final Payment, an additional certificate evidencing continuation of such coverage shall be submitted with the Final Application for payment as required by Sub Article 9.10.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished to the Owner by the Contractor promptly but in any event within ten (10) days of the change in coverage/limits or claims paid.

11.2 OWNERS' LIABILITY INSURANCE

11.2.1 The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

11.3 INTENTIONALLY OMITTED

11.4 PROPERTY INSURANCE

11.4.1 If required by the Contract Documents, the Owner shall purchase and maintain property insurance in a company or companies authorized to do business in the jurisdiction in which the Project is located. Such insurance shall be written on a builder's risk "all-risk" or equivalent policy from including the perils of Flood and Hurricane. The limit of this policy shall be the amount of the initial Contract Sum, plus value of all subsequent Contract modifications and cost of materials supplied or installed by others, comprising the total

ATTACHMENT A

value for the entire Project and the Site on a replacement cost basis. An exception to this shall be that the total value for the perils of Flood and Hurricane shall be a minimum of \$5,000,000. This policy, or these policies, shall have the maximum deductibles as identified in the Contract Documents, per loss, to be paid by the Contractor without cost to the Owner whether provided by the Owner or the Contractor. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until Final Payment has been made as provided in Sub Article 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Sub Article 11.4 to be covered, whichever is later. The insurance shall include interests of the Owner, the Contractor, Subcontractors, Sub-subcontractors and Suppliers in the Project. The form of policy for this coverage shall be Completed Value. If the Owner is damaged by the failure of the Contractor to maintain such insurance, then the Contractor shall bear all reasonable costs properly attributable thereto.

- 11.4.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, hurricane, flood, windstorm, false-work, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's, Owner's, and Contractor's services and expenses required as a result of such insured loss.
- 11.4.1.2 INTENTIONALLY OMITTED
- 11.4.1.3 The Contractor shall pay deductibles on any insurance including builder's risk insurance.
- 11.4.1.4 Property insurance shall cover portions of the Work stored off site and portions of the Work in transit.
- 11.4.1.5 Partial occupancy or use in accordance with Article 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.
- 11.4.2 Boiler and Machinery Insurance. The Contractor shall purchase and maintain boiler and machinery insurance if required by the Contract Documents. Insurance shall specifically cover such insured objects during installation and until final acceptance by the Owner and shall include interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors and Suppliers in the Work, as well as the Owner and Contractor named as additional insured.
- 11.4.3 INTENTIONALLY OMITTED
- 11.4.4 If the Owner requests in writing that insurance for risks other than those described herein or in the Specifications for other special causes of loss be included in the property insurance policy, the Contractor shall, if possible, include such insurance, and the cost thereof shall be charged to the Owner by appropriate Change Order.
- 11.4.5 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the Site by property insurance under policies separate from those insuring the Project, or if after Final Payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Sub Article 11.4.7 for damages caused by fire or other causes of loss covered by this separate property insurance to the extent of such insurance collected by the Owner. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.
- 11.4.6 Prior to Notice to Proceed: the Contractor shall file with the Owner a certificate of insurance that includes evidence of insurance coverages required by this Sub Article 11.4. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be cancelled or allowed to expire, and that its limits will not be reduced, until at least 30 days prior written notice has given to the Owner.
- 11.4.7 Waivers and Subrogation. The Owner and Contractor waive all rights against each other and any of their Subcontractors, Sub-subcontractors, agents and employees, each of the other, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Sub Article 11.4 or other property insurance applicable to the Work, to the extent of proceeds actually received, except such rights as they have to proceeds of such insurance held by either as fiduciary. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be

ATTACHMENT A

effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

- 11.4.8 A loss insured under property insurance obtained by Contractor shall be adjusted by the Contractor as fiduciary and made payable to the Contractor as fiduciary for the insured, as their interests may appear, subject to requirements of any applicable mortgage clause and of Sub Article 11.4.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.
- 11.4.9 If required in writing by a party in interest, the Contractor as fiduciary (for insurance purchased by Contractor) shall, upon occurrence of an insured loss, give bond for proper performance of the Contractor's duties. The cost of required bonds shall be charged against proceeds received from the fiduciary. The Contractor shall deposit in a separate account proceeds so received, which the Contractor shall distribute in accordance with such agreement as the parties in interest may reach. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in Work in accordance with Article 7.
- 11.4.10 The Contractor as fiduciary shall have power to adjust and settle their loss with insurers.

11.5 PERFORMANCE BOND AND PAYMENT BONDS

- 11.5.1 The Contractor shall furnish bonds written by a Treasury Listed and A.M. Best Rated A-VI or better Surety. The Surety shall be licensed or authorized to do business in the jurisdiction in which the Project is located covering faithful performance of the Contract and payment of obligations arising thereunder. The limits and other provisions of such bonds shall be as stipulated in the bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.
- 11.5.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall permit a copy to be made.

ARTICLE 12 – UNCOVERING AND CORRECTION OF WORK

12.1 UNCOVERING OF WORK

- 12.1.1 If a portion of the Work is covered over contrary to the Architect's or the Owner's request or to requirements specifically expressed in the Contract Documents, and if required in writing by the Architect, it must be uncovered for the Architect's observation and be replaced at the Contractor's expense without change in the Contract Time.
- 12.1.2 If a portion of the Work has been covered over which the Architect or Owner has not specifically requested to observe prior to it being covered, the Architect or the Owner may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be charged to the Owner. If such Work is not in accordance with the Contract Documents, the Contractor shall pay such costs unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

12.2 CORRECTION OF WORK

- 12.2.1 The Contractor shall promptly correct Work rejected by the Architect or the Owner or failing to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear costs of correcting such rejected Work, including additional testing and inspections and compensations for the Architect's services and expenses made necessary thereby.
- 12.2.2 If, within one year after the last date of Substantial Completion of the Work, or after the date for commencement of warranties established under Sub Article 9.9.1. or during the terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. This period of one year shall be extended with respect to portions of Work first performed

ATTACHMENT A

after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work. This obligation under this Sub Article 12.2.2 shall survive acceptance of the Work under the Contract and termination of the Contract. The Owner shall give such notice promptly after discovery of the condition.

- 12.2.2.1 The Contractor shall, in accordance with the Contract Documents, furnish and assign to the Owner Certificates of Guaranty/Warranties to include all materials, equipment, and workmanship from the various manufacturers, suppliers, Subcontractors and Sub-contractors who furnish or perform any portion of the Work.
- 12.2.3 The Contractor shall remove from the Site portions of the Work which are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.
- 12.2.4 If the Contractor fails to correct nonconforming Work within a reasonable time, the Owner may correct it in accordance with Sub Article 2.4. If the Contractor does not proceed with correction of such nonconforming Work within a reasonable time fixed by written notice from the Architect, the Owner may remove it and store the salvable materials or equipment at the Contractor's expense. If the Contractor does not pay costs of such removal and storage within ten days after written notice, the Owner may upon ten additional days' written notice sell such materials and equipment at auction or at a private sale and shall account for the proceeds thereof, after deducting the costs and damages that should have been borne by the Contractor, including compensation for Architect and Owner services and expenses made necessary thereby. If such proceeds of sale do not cover costs which the Contractor should have borne, the Contract Sum shall be reduced by the deficiency. If payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner.
- 12.2.5 The Contractor shall bear the cost of correcting destroyed or damaged construction (of the Owner or separate contractors work) whether completed or partially completed caused by the Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents.
- 12.2.6 Nothing contained in this Sub Article 12.2 shall be construed to establish a period of limitation with respect to other obligations which the Contractor might have under the Contract Documents. Establishment of the time warranty period as described in Sub Article 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which the proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.
- 12.2.7 Contractor shall provide limited services as requested by the Owner throughout the one (1) year or other specified warranty period. Limited services shall be defined as meetings, follow-up calls, and visits to the Site when requested by the Owner to review functions, materials, or equipment which the Owner believes are not performing properly or as shown in the Contract Documents.
- 12.2.8 Contractor shall coordinate all work with the Owner and/or consultants during the warranty period.
- 12.2.9 The Contractor's express warranties herein shall be in addition to, and not in lieu of any other remedies, that the Owner may have under the Contract and the Contract Documents, at law, or in equity, for defective Work or other failure of the Contractor to perform its Work in accordance with the Contract Documents.

12.3 ACCEPTANCE OF NONCONFORMING WORK

- 12.3.1 If the Owner prefers to accept Work which is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not Final Payment has been made.

ARTICLE 13 – MISCELLANEOUS PROVISIONS

13.1 GOVERNING LAW

- 13.1.1 The Contract shall be governed by the laws of the State where the project is located.

13.2 SUCCESSORS AND ASSIGNS

ATTACHMENT A

- 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.
- 13.3 WRITTEN NOTICE
- 13.3.1 Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended, or if delivered at or sent by registered or certified mail to the last business address known to the party giving notice.
- 13.4 RIGHTS AND REMEDIES
- 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies imposed or available by law.
- 13.4.2 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing. Inspection or observation by, payment by, or tentative approval or acceptance by, the Owner or the Architect, or the failure of the Owner or the Architect to perform any inspection or observation hereunder shall not constitute a final acceptance of the Work or any part thereof and shall not release the Contractor from any of its duties or obligations to perform under the Contract Documents.
- 13.5 TEST AND INSPECTIONS
- 13.5.1 Tests, inspections and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so the Architect may observe such procedures. ***The Owner shall bear costs of tests, inspections or approvals which do not become requirements until after bids are received or negotiations concluded.***
- 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Sub Article 13.5.1, the Owner will instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so the Architect may observe such procedures. The Owner shall bear such costs except as provided in Sub Article 13.5.3.
- 13.5.3 If such procedures for testing, inspection or approval under Sub Articles 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents or applicable law, the Contractor shall bear all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's and Owner's services and expenses.
- 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect and Owner.
- 13.5.5 If the Architect is to observe tests, inspections or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.
- 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.
- 13.6 INTEREST
- 13.6.1 Uncontested payments due and unpaid sixty (60) days after payment date provided for under the Contract Documents shall bear interest from the date payment is due at such rate of when validly applied, equal to the prime rate plus 1% (per annum) in effect at the time the payment is due as identified in the Wall Street Journal.

13.7 COMMENCEMENT OF STATUTORY LIMITATION PERIOD

13.7.1 As between the Owner and Contractor:

1. before Substantial Completion. As to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion;
2. between Substantial Completion and Final Certificate for Payment. As to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of issuance of the final Certificate for Payment; and
3. after Final Certificate for Payment. As to acts or failures to act occurring after the relevant date of issuance of the final Certificate of Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any warranty provided under Sub Article 3.5, the date of any correction of the Work or failure to correct the Work by the Contractor under Sub Article 12.2, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last.

13.8 ***Contractor shall not divulge or release any information concerning the Project to the public or any media representatives during the term of this Agreement without the Owner's prior written consent.***

13.9 Approval by the Owner of any of the Work shall not relieve the Contractor of responsibility for the construction, coordination or the constructability of such details. ***No Plans, Drawings, Specifications or other documents which have been approved by the Owner shall be revised or changed by the Contractor without the Owner's consent.***

13.10 Contractor represents that it is an equal opportunity employer as described in Section 202 of Executive Order 11246 dated September 24, 1965, as amended and it agrees to comply with the provisions of paragraphs on through seven of Section 202 of said Executive Order during the performance of this Agreement. Contractor certifies that it does not and will not maintain any facilities it provides for its employees in a segregated manner.

ARTICLE 14 – TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 TERMINATION BY THE CONTRACTOR

14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 60 days through no act or fault of the Contractor or Subcontractor, Sub-subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor, for any of the following reasons:

1. issuance of an order of a court or other public authority having jurisdiction;
2. an act of government, such as a declaration of national emergency, making material unavailable;
3. because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Sub Article 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents.

14.1.2 If one of the above reasons exists, the Contractor may, upon ten additional day's written notice to the Owner and Architect, terminate the Contract. Upon such termination, Contractor shall retain all sums of money theretofore paid hereunder to the Contractor and provided: (1) that no liens or claims have been filed of record with respect to Work performed hereunder or that all such liens and claims have been satisfied in the manner provided in the Contract Documents; (2) that the Contractor delivers to the Owner (a) the Contractor's affidavit and final conditional Subcontractor, Sub-subcontractor, and supplier lien waivers of

termination, (b) final conditional Subcontractor, Sub-subcontractor, and supplier lien waivers for all subcontracts and supply agreements that have been fully performed on the date of termination, and (c) an assignment to the Owner, to the replacement contractor, or to the Owner's designee of all subcontracts and supply agreements), and (3) the remaining sums are sufficient (in the Owner's opinion) to complete the Project; then the Owner shall pay to the Contractor (i) all retainage, if any, theretofore retained hereunder by the Owner in respect of the Work properly performed to the date of such termination (other than the retainage relating to portions of the Work performed by Subcontractors under subcontracts that have not been fully performed on the date of termination, which retained amounts will continue to be paid at the time and in the manner specified in the Agreement), and (ii) a sum of money equal to the portion of the Contract Sum attributable, according to the Schedule of Values, to the portion of all Work performed hereunder by the Contractor prior to termination for which payments have not theretofore been made by Owner.

14.1.3 If the Work is stopped for a period of 60 days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has persistently failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon ten additional days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner as provided in Sub Article 14.1.2.

14.1.4 In addition to the rights of the Contractor to terminate as set out in Sub Article 14.1.1, the Owner may also elect to terminate the Contract for causes set forth in Sub Article 14.1.1 (except for Sub Article 14.1.1.3) which have occurred through no fault of Owner by giving ten days notice to the Architect and the Contractor, in which event the Contractor shall be entitled to the sums as provided in Sub Article 14.1.2.

14.2 TERMINATION BY THE OWNER FOR CAUSE

14.2.1 The Owner may terminate the Contract if the Contractor:

1. fails to commence the Work in accordance with the provisions of the Contract Documents, or if the Contractor refuses or fails after notice to supply enough properly skilled workers or proper materials;
2. fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
3. after notice thereof by Owner disregards laws, ordinances, or rules, regulations or orders of a public authority having jurisdiction; or
4. otherwise is guilty of material breach of a provision of the Contract Documents.

14.2.2 When any of the above reasons exist, the Owner, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven (7) days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

1. take possession of the Site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
2. accept assignment of subcontractors pursuant to Sub Article 5.4; and
3. finish the Work by whatever reasonable method the Owner may deem expedient.

14.2.3 When the Owner terminates the Contract for one of the reasons stated in Sub Article, 14.2.1 the Contractor shall not be entitled to receive further payment until the Work is finished fully and finally completed.

14.2.4 Any right or remedy exercised by the Owner shall not be deemed a waiver of any other right or remedy of the Owner. If after any breach, default or failure by Contractor, the cost to the Owner of the performance of the balance of the Work, including reasonable compensation for the Architect's additional services made necessary thereby, is in excess of the unpaid balance of the Contract Sum, the Contractor shall be liable for, and shall pay the Owner for, such excess costs upon demand.

14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

14.3.1 The Owner may, with or without cause, provide written direction to the Contractor to suspend, delay or interrupt the Work for less than 120 consecutive days.

14.3.2 If the Project is suspended by Owner for more than 120 consecutive days, the Contractor shall be compensated for services performed prior to notice of such suspension. When the Project is resumed, the Contractor's compensation shall be equitably adjusted to provide for expenses incurred in the interruption and resumption of the Contractor's services.

ATTACHMENT A

14.3.3 An adjustment shall be made for increase in the cost of performance of the Contract, including profit on the increased cost of performance, caused by suspension, delay or interruption. No adjustment shall be made to the extent:

1. that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or
2. that an equitable adjustment is made or denied under another provision of this Contract.

14.3.4 Adjustments made in the cost of performance may have a mutually agreed fixed or percentage fee.

14.4 TERMINATION FOR CONVENIENCE

14.4.1 The Owner shall have the right to terminate the Contract with or without cause (which includes but is not limited to the matters set forth in Sub Article 14.2.1 of the General Conditions) at any time by giving to the Contractor twenty-four (24) hours written notice thereof. Upon receipt of such notice, the Contractor immediately shall terminate performance of the Work and make every reasonable effort to mitigate its losses and damages hereunder, provided, however, in connection with such termination the Contractor shall perform such acts as may be necessary to preserve and protect that part of the Work theretofore performed hereunder. Upon any such termination without cause, the Contractor may retain all sums previously paid to the Contractor, provided: (1) that no liens or claims have been filed of record with respect to Work performed hereunder or that all such liens and claims have been satisfied in the manner provided in the Contract Documents, and (2) that the Contractor delivers to the Owner: (a) the Contractor's affidavit and final conditional release of lien with respect to the Work performed through the date of termination, (b) final conditional Subcontractor, Sub-subcontractor, and supplier lien waivers for all subcontracts and supply agreements that have been fully performed on the date of termination, and (c) upon Owner request make an assignment to the Owner, to the replacement Contractor, or to the Owner's designee of all subcontracts and supply agreements. Owner will pay to the Contractor (i) all retainage, if any, therefore retained hereunder by the Owner in respect of the Work properly performed to the date of such termination (other than the retainage relating to portions of the Work properly performed by Subcontractor's under subcontracts that have not been fully performed on the date of termination, which retained amounts will continue to be paid at the time and in the manner specified in the Agreement), and (ii) a sum of money equal to the portion of the Contract Sum attributable, according to the Schedule of Values, to the portion of all Work performed hereunder by the Contractor prior to termination for which payments have not theretofore been made by Owner.

14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall:

1. Cease operations as directed by the Owner in the notice;
2. Take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
3. Except for Work directed to be performed prior to the effective date of termination or to be assigned to the Owner per Sub article 14.4.1, terminate all existing Subcontracts and purchase orders and enter into no further Subcontracts and purchase orders.

ARTICLE 15 – DELEGATION OF AUTHORITY DELEGATED

INTENTIONALLY OMITTED

ARTICLE 16 – GRATUITIES AND CONFLICTS OF INTEREST

16.1 Gratuities: The Contractor shall not participate in or permit the offer or gift of any gratuity (in the form of entertainment, gifts, or otherwise) to any director, officer, employee or agent of the Architect or Consultants of the Architect by the Contractor, any Subcontractor or any employee, agent or representative of the Contractor.

16.2 INTENTIONALLY OMITTED

ARTICLE 17 – USE OF THE OWNER'S NAME IN CONTRACTOR ADVERTISING
PUBLIC RELATIONS

17.1 ***The Contractor shall not allow announcement, publication or other use of Work/Project related copy without receiving the prior written approval of the Owner.***

ARTICLE 18 – PUBLIC RECORDS

ATTACHMENT A

- 18.1 Public Disclosure: All records, documents, Drawings, Specifications, Project Manual and other material relating to the Project and the Work, including materials submitted by prospective or actual Bidders, may be subject to public disclosure.
- 18.2 Confidential Information: During the course of the pre-bidding and bidding process and the course of the Work under any contract awarded, the Owner may accept materials clearly and prominently labeled "TRADE SECRET" or "CONFIDENTIAL" as determined by the submitting party. Under no circumstances, however, will the Owner be responsible or liable to the submitter or any other party for the disclosure or non-disclosure of any such labeled materials, whether the disclosure or non-disclosure is deemed required by law by an order of the court, by contract, or occurs through inadvertence, mistake or negligence on the part of the Owner, the Architect, or their officers, employees, consultants, contractors, venture's agents or representatives.
- 18.3 The Owner's Role a Stake Holder: In the event of litigation concerning the disclosure or nondisclosure of any material submitted by a submitting party, the Owner's sole involvement will be as a stake holder retaining the material until otherwise ordered by a court, and the submitting party is responsible for otherwise prosecuting or defending any action concerning the materials at its sole expense and risk.

END

SECTION 00220 - SOIL INVESTIGATION DATA

PART 1 - PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Provisions established within the Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.2 INVESTIGATION

- A. An investigation of subsurface soil conditions at the proposed St. Luke's Clear Lake Hospital & Parking Garage site, authorized by Owner, entitled "Geotechnical Engineering Report, Clear Lake Hospital and Parking Garage, Webster, Texas" dated September 14, 2007 and these investigations were made by Terracon, Houston, Texas.

1.3 REPORT

- A. The reports are bound herein for information only.
- B. Report and log of borings are available for Contractor's information but is not a warranty of subsurface conditions, nor is it a part of the Contract Documents.

1.4 RESPONSIBILITY

- A. Bidders are expected to examine the site and subsurface investigation reports and then decide for themselves the character of the materials to be encountered.
- B. The Architect and Owner assume no responsibility for variations of subsoil quality or conditions.

PART 2 - PART 2 - PRODUCTS (Not Used)

PART 3 - PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 00500 - SUMMARY OF THE WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Bidding Requirements, the General and Supplementary General Conditions and Division 1, General Requirements, of this project manual apply to all work required for this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS:

- A. The specifications and construction document package set forth the requirements necessary for the construction of a 5-tier 297,858 s.f. open parking garage as indicated in the drawings and specifications.

END OF SECTION

SECTION 01027 - APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
 - a. Contractor's Construction Schedule.
 - b. Application for Payment forms, including Continuation Sheets.
 - c. List of subcontractors.
 - d. Schedule of allowances.
 - e. Schedule of alternates.
 - f. List of products.
 - g. List of principal suppliers and fabricators.
 - h. Schedule of submittals.
 - 2. Submit the Schedule of Values to the Architect at the earliest possible date but no later than 7 days before the date scheduled for submittal of the initial Applications for Payment.
- B. Format and Content: Use the Project Manual table of contents as a guide to establish the format for the Schedule of Values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the Schedule of Values:
 - a. Project name and location.
 - b. Name of the Architect.
 - c. Project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value.
 - 1) Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Break principal subcontract amounts down into several line items.
 - 4. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.
 - 5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.

- a. Differentiate between items stored on-site and items stored off-site. Include requirements for insurance and bonded warehousing, if required.
 - 6. Provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
 - 7. Schedule Updating: Update and resubmit the Schedule of Values prior to the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.
- 1.4 APPLICATIONS FOR PAYMENT
 - A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.
 - 1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.
 - B. Payment-Application Times: Each progress-payment date is indicated in the Agreement. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
 - C. Payment-Application Forms: Use AIA Document G702 and Continuation Sheets G703 as the form for Applications for Payment.
 - D. Application Preparation: Complete every entry on the form. Include notarization and execution by a person authorized to sign legal documents on behalf of the Contractor. The Architect will return incomplete applications without action.
 - 1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.
 - 2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.
 - 3. Attach the Modification summary as required in Division 1.
 - E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to the Architect by a method ensuring receipt within 24 hours. One copy shall be complete, including waivers of lien and similar attachments, when required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Architect.
 - F. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics liens from subcontractors, sub-subcontractors and suppliers for the construction period covered by the previous application.
 - 1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
 - 2. When an application shows completion of an item, submit final or full waivers.
 - 3. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
 - 4. Waiver Delays: Submit each Application for Payment with the Contractor's waiver of mechanics lien for the period of construction covered by the application.
 - a. Submit final Applications for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 - 5. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to the Owner.
 - G. Initial Application for Payment: Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment, include the following:
 - 1. List of subcontractors.
 - 2. List of principal suppliers and fabricators.
 - 3. Schedule of Values.
 - 4. Contractor's Construction Schedule (preliminary if not final).
 - 5. Schedule of principal products.
 - 6. Schedule of unit prices.
 - 7. Submittal Schedule (preliminary if not final).

8. List of Contractor's staff assignments.
 9. List of Contractor's principal consultants.
 10. Copies of building permits.
 11. Copies of authorizations and licenses from governing authorities for performance of the Work.
 12. Initial progress report.
 13. Report of preconstruction meeting.
 14. Certificates of insurance and insurance policies.
 15. Performance and payment bonds.
 16. Data needed to acquire the Owner's insurance.
 17. Initial settlement survey and damage report, if required.
- H. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.
1. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
 2. Administrative actions and submittals that shall precede or coincide with this application include:
 - a. Occupancy permits and similar approvals.
 - b. Warranties (guarantees) and maintenance agreements.
 - c. Test/adjust/balance records.
 - d. Maintenance instructions.
 - e. Meter readings.
 - f. Startup performance reports.
 - g. Changeover information related to Owner's occupancy, use, operation, and maintenance.
 - h. Final cleaning.
 - i. Application for reduction of retainage and consent of surety.
 - j. Advice on shifting insurance coverages.
 - k. Final progress photographs.
 - l. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.
- I. Final Payment Application: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:
1. Completion of Project closeout requirements.
 2. Completion of items specified for completion after Substantial Completion.
 3. Ensure that unsettled claims will be settled.
 4. Ensure that incomplete Work is not accepted and will be completed without undue delay.
 5. Transmittal of required Project construction records to the Owner.
 6. Certified property survey.
 7. Proof that taxes, fees, and similar obligations were paid.
 8. Removal of temporary facilities and services.
 9. Removal of surplus materials, rubbish, and similar elements.
 10. Change of door locks to Owner's access.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01035 - MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing contract modifications.

1.3 SUBMITTALS

1. Submit to the Architect with in 15 days of notice to proceed the following estimating aids for use in confirming requests for changes in construction costs.
 - a. One copy of the current Means Facilities Construction Cost Data.
 - b. One copy the current Means data for Excel® spread sheets.
 - c. One copy of the current data bases for all disciplines.

1.4 MINOR CHANGES IN THE WORK

- A. The Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or Contract Time, on AIA Form G710 or other form as determined by the Architect, Architect's Supplemental Instructions.

1.5 CHANGE ORDER PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: The Architect will issue a detailed description of proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 1. Proposal requests issued by the Architect are for information only. Do not consider them as an instruction either to stop work in progress or to execute the proposed change.
 2. Within 20 days of receipt of a proposal request, submit an estimate of cost necessary to execute the change to the Architect for the Owner's review.
 - a. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.
 3. Submit a comparative cost analysis using Means Data for Excel spread sheets using the latest Means cost data and including all adjustments to the cost as delineated in the Means estimating methods.
- B. Contractor-Initiated Proposals: When latent or unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.
 1. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
 2. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

4. Comply with requirements in Section "Product Substitutions" if the proposed change requires substitution of one product or system for a product or system specified.

C. Proposal Request Form: Use AIA Document G709 for Change Order Proposal Requests.

1.6 ALLOWANCES

- A. Allowance Adjustment: For allowance-cost adjustment, base each Change Order Proposal on the difference between the actual purchase amount and the allowance, multiplied by the final measurement of work-in-place. Where applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 1. Include installation costs in the purchase amount only where indicated as part of the allowance.
 2. When requested, prepare explanations and documentation to substantiate the margins claimed.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or the Contractor's handling, labor, installation, overhead, and profit. Submit claims within 21 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. The Owner will reject claims submitted later than 21 days.
 1. Do not include the Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in Contract Documents.
 2. No change to the Contractor's indirect expense is permitted for selection of higher or lower-priced materials or systems of the same scope and nature as originally indicated.
 3. Submit a comparative cost analysis using Means Data for Excel spread sheets using the latest Means cost data and including all adjustments to the cost as delineated in the Means estimating methods.

1.7 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: When the Owner and the Contractor disagree on the terms of a Proposal Request, the Architect may issue a Construction Change Directive on AIA Form G714. The Construction Change Directive instructs the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. The Construction Change Directive contains a complete description of the change in the Work. It also designates the method to be followed to determine change in the Contract Sum or Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.
 2. Submit a comparative cost analysis using Means Data for Excel spread sheets using the latest Means cost data and including all adjustments to the cost as delineated in the Means estimating methods.

1.8 CHANGE ORDER PROCEDURES

- A. Upon the Owner's approval of a Proposal Request, the Architect will issue a Change Order for signatures of the Owner and the Contractor on AIA Form G701.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01040 - COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:
 1. General project coordination procedures.
 2. Conservation.
 3. Coordination Drawings.
 4. Administrative and supervisory personnel.
 5. Cleaning and protection.

1.3 COORDINATION

- A. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.
 1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
 3. Make provisions to accommodate items scheduled for later installation.
- B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
 1. Prepare similar memoranda for the Owner and separate contractors where coordination of their work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 1. Preparation of schedules.
 2. Installation and removal of temporary facilities.
 3. Delivery and processing of submittals.
 4. Progress meetings.
 5. Project closeout activities.
- D. Conservation: Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.
 1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the Work.

1.4 COORDINATION OF SPACE

- A. Coordinate use of Project space and sequence of installation of mechanical, and electrical work, which is indicated diagrammatically on Drawings. Follow routings shown for pipes, ducts, and conduits as closely as practicable, with due allowance for available physical space; make

runs parallel with lines of building. Utilize space efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

- B. In finished areas except as otherwise shown, conceal pipes, ducts, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.
- C. Coordinate use of project space in conjunction with other contractors providing Electrical, Mechanical, Plumbing, Process Utility Systems as directed by the Owner. Building construction modification changes in routing of systems shall not occur without prior Owner approval.

1.5 COORDINATION OF HIERARCHY

- A. Contractor shall coordinate, prior to installation, all piping, conduits, cable trays, ductwork, etc., not specifically noted on the drawings as having detailed horizontal locations or vertical elevations. Coordination shall include, but not limited to, detailed routing (both horizontal and vertical), access, sequence, affect on work of other trades, installation methods, anchors, supports, schedule and finishes. Installations shall provide maximum clearances, installed parallel and perpendicular to the building lines and coordinated with other trades. Contractor shall submit detailed requests for any deviations, and obtain approval, prior to installation.
- B. Installations that have not been coordinated, providing maximum clearance or affect work of other trades, shall be removed and reinstalled at no additional cost.

1.6 SUBMITTALS

- A. Coordination Drawings: Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
 - 1. Show the relationship of components shown on separate Shop Drawings.
 - 2. Indicate required installation sequences.
 - 3. Comply with requirements contained in Section "Submittals."
- B. Staff Names: Within 15 days of commencement of construction operations, submit a list of the Contractor's principal staff assignments, including the superintendent and other personnel in attendance at the Project Site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.
 - 1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 GENERAL COORDINATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

3.2 CLEANING AND PROTECTION

- A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at Substantial Completion.

- B. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.
- C. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:
 - 1. Excessive static or dynamic loading.
 - 2. Excessive internal or external pressures.
 - 3. Excessively high or low temperatures.
 - 4. Thermal shock.
 - 5. Excessively high or low humidity.
 - 6. Air contamination or pollution.
 - 7. Water or ice.
 - 8. Solvents.
 - 9. Chemicals.
 - 10. Light.
 - 11. Radiation.
 - 12. Puncture.
 - 13. Abrasion.
 - 14. Heavy traffic.
 - 15. Soiling, staining, and corrosion.
 - 16. Bacteria.
 - 17. Rodent and insect infestation.
 - 18. Combustion.
 - 19. Electrical current.
 - 20. High-speed operation.
 - 21. Improper lubrication.
 - 22. Unusual wear or other misuse.
 - 23. Contact between incompatible materials.
 - 24. Destructive testing.
 - 25. Misalignment.
 - 26. Excessive weathering.
 - 27. Unprotected storage.
 - 28. Improper shipping or handling.
 - 29. Theft.
 - 30. Vandalism.

END OF SECTION

SECTION 01050 - FIELD ENGINEERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. General: This Section specifies administrative and procedural requirements for field-engineering services including, but not limited to, the following:
 1. Land survey work.
 2. Civil-engineering services.
 3. Damage surveys.
 4. Geotechnical monitoring.

1.3 SUBMITTALS

- A. Certificates: Submit a certificate signed by the land surveyor or professional engineer certifying the location and elevation of improvements.
- B. Final Property Survey: Submit 10 copies of the final as-built survey.
- C. Project Record Documents: Submit a record of Work performed and record survey data as required under provisions of "Submittals" and "Project Closeout" Sections.

1.4 QUALITY ASSURANCE

- A. Surveyor Qualifications: Engage a land surveyor registered in the state where the Project is located, to perform required land-surveying services.
- B. Engineer Qualifications: Engage an engineer of the discipline required, licensed in the state where the Project is located, to perform required engineering services.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Identification: Identify existing control points and property line corner stakes.
- B. Verify layout information shown on the Drawings, in relation to the property survey and existing benchmarks, before proceeding to lay out the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.
 1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points or requirements to relocate reference points because of necessary changes in grades or locations.
 2. Promptly replace lost or destroyed Project control points. Base replacements on the original survey control points.
- C. Establish and maintain a minimum of 2 permanent benchmarks on the site, referenced to data established by survey control points.
 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

- D. Existing Utilities and Equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction.
 - 1. Prior to construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping.

3.2 PERFORMANCE

- A. Work from lines and levels established by the property survey. Establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.
 - 1. Advise entities engaged in construction activities of marked lines and levels provided for their use.
 - 2. As construction proceeds, check every major element for line, level, and plumb.
- B. Surveyor's Log: Maintain a surveyor's log of control and other survey work. Make this log available for reference.
 - 1. Record deviations from required lines and levels, and advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.
 - 2. On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- C. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes, and invert elevations.
- D. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels, and control lines and levels required for mechanical and electrical work.
- E. Existing Utilities: Furnish information necessary to adjust, move, or relocate existing structures, utility poles, lines, services, or other appurtenances located in or affected by construction. Coordinate with local authorities having jurisdiction.
- F. Final Property Survey: Prepare a final property survey showing significant features (real property) for the Project. Include on the survey a certification, signed by the surveyor, that principal metes, bounds, lines, and levels of the Project are accurately positioned as shown on the survey.
 - 1. Recording: At Substantial Completion, have the final property survey recorded by or with local governing authorities as the official "property survey."

END OF SECTION

SECTION 01060 - CODES AND STANDARDS

PART 1 - GENERAL

- A. This Section provides a listing of the Codes and Standards which are referenced in the project specifications. It is the responsibility of the Contractor and Vendor to comply with the latest Codes and other legal requirements applicable to the materials, equipment and services provided in accordance with the Contract, even if an applicable code or legal requirement is not referenced in the project specifications. In the event of conflict between the codes and the project specifications, the more stringent requirement shall apply.
- B. All materials, fasteners, piping systems and equipment shall conform to ANSI and other U.S. standard dimensional requirements unless otherwise specifically required by the Specifications.
- C. References are made to specific sections of the Codes and Standards in the text of the Divisional sections. Listing of each such referenced item at the start of each Divisional section is not provided as is done in some specifications.
- D. Contractor and Vendor shall promptly submit written notice to Construction Manager of any observed variance of Contract Documents from legal requirements.
- E. The following listing is merely provided as a convenience for identification of acronyms used and to provide the mailing address of the referenced associations and agencies.

AA	Aluminum Association 818 Connecticut Avenue, N.W. Washington, DC 20006
AAMA	American Architectural Manufacturers Association 2700 River Road, Suite 118 Des Plaines, IL 60018
ANSI	American National Standards Institute 1430 Broadway New York, NY 10018
ARI	Air-Conditioning and Refrigeration Institute 1501 Wilson Blvd., Suite 600 Arlington, VA 22209
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers 1791 Tullie Circle, N.E. Atlanta, GA 30329
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017
ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103
AWI	Architectural Woodwork Institute 2310 South Walter Reed Drive Arlington, VA 22206
BHMA	Builders Hardware Manufacturers Association 60 East 42nd Street New York, NY 10017
DOC	Department of Commerce U.S. Department of Commerce National Bureau of Standards Washington, DC 20234

DHI	Door and Hardware Institute 7711 Old Springhouse Road McClean, VA 22102
FM	Factory Mutual System 1151 Boston-Providence Turnpike Norwood, MA 02062
FTMS	Federal Test Method Standards General Services Administration General Services Building Eighteenth & E Streets, N.W. Washington, DC 20405
GA	Gypsum Association 1603 Orrington Avenue Evanston, IL 60201
HI	Hydronics Institute P. O. Box 218 35 Russo Place Berkeley Heights, NJ 07922
NAAMM	National Association of Architectural Metal Manufacturers 221 North LaSalle Street Chicago, IL 60601
	National Bureau of Standards 28 Belcaro Circle Burton Hills Nashville, TN 37215
	National Electric Code Battery March Park Quincy, MA 02269
	National Electrical Manufacturers' Association 2101 L Street, N.W. Washington, DC 20037
	National Fire Protection Association Battery March Park Quincy, MA 02269
	National Sanitation Foundation P. O. Box 1468 3475 Plymouth Road Ann Arbor, MI 48106
	Product Standard U.S. Department of Commerce Washington, DC 20203
TIMA	Thermal Insulation Manufacturers Association 7 Kirby Plaza Mt. Kisco, NY 10549
UL	Underwriters' Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062

END OF SECTION

SECTION 01061 - ACCESSIBILITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes requirements for complying with applicable accessibility regulations and requirements.

1.3 QUALITY ASSURANCE

- A. Regulations: Comply with applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
 - 1. Compliance with Federal regulations including The Americans with Disabilities Act (ADA 1990) and its amendments.
 - 2. Compliance with State regulations including The Texas Accessibility Standards (TAS).
 - 3. Compliance with City Building Code Accessibility Standards.
- B. Inspections: Arrange for authorities having jurisdiction to inspect and approve each item of work governed by Accessibility Regulations. Obtain required certifications and permits.

PART 2 - PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

- A. Comply with the more stringent of the applicable codes and the requirements of this section.

3.2 SPACE ALLOWANCE AND REACH RANGES

- A. Highest operable object: 48 Inches.
- B. Lowest operable object: 15 inches.

3.3 ACCESSIBLE ROUTES

- A. Changes in elevation.
 - 1. Maximum bump: $\frac{1}{4}$ inch. vertical or $\frac{1}{2}$ inch with a 1:2 slope.
 - 2. Maximum cross slope: $1:50 \cong 2\% \cong \frac{1}{4}$ inch per ft.
 - 3. Maximum slope for walk without handrails: $1:20 \cong 5\% \cong \frac{5}{8}$ inch per ft.
 - 4. Maximum slope for ramp with handrails: $1:12 \cong 8.33\% \cong 1$ inch per ft.

3.4 PROTRUDING OBJECTS

- A. Objects protruding from walls with their leading edges between 27 inches and 80 inches above the finished floor shall protrude no more than 4 inches into walks, halls, corridors, passageways or aisles.
- B. Free standing objects mounted on posts or pylons may overhang 12 inches maximum from 27 inches to 80 inches above the ground or finished floor.
- C. Head room: Walks, halls, corridors, passageways, asiles or other circulation spaces shall have 80 inches \cong 6'-8" clear head room.

3.5 GROUND FLOOR AND SURFACES

- A. Ground and floor surfaces along accessible routes shall be firm and slip resistant.
- B. Carpet shall be securely attached and have a maximum pile thickness of $\frac{1}{2}$ inch. Carpet cushions, if any, shall be firm.
- C. Carpet shall be fastened to the floor surfaces and have trim along the entire length of any exposed edge complying with the requirements for bumps allowed in accessible routes.
- D. Gratings: When gratings are located in walking surfaces or along accessible routes, then they shall have spaces no greater than $\frac{1}{2}$ inch wide in one direction. If gratings have elongated

openings, then they shall be placed so that the long dimension is perpendicular to the direction of travel.

3.6 PARKING AND PASSENGER LOADING ZONES

- A. Accessible parking spaces and aisles shall be level with surfaces sloped for drainage not exceeding $1:50 \cong 2\% \cong \frac{1}{4}$ inch per ft. in any direction.
- B. Accessible loading zones shall be level with surfaces sloped for drainage not exceeding $1:50 \cong 2\% \cong \frac{1}{4}$ inch per ft. in any direction.
- C. Clearance: Provide minimum vertical clearance of 98 inches (8'-2") at accessible parking spaces and routes from parking spaces.
- D. Clearance at loading zones: Provide minimum vertical clearance of 114 inches (9'-6") at accessible passenger loading zones.

3.7 CURB RAMPS

- A. Curb ramps shall be less than six inches high and have a slope of less than $1:12 \cong 8.33\% \cong 1$ inch per ft.
- B. Flared side on curb ramps maximum slope $1:10 \cong 10\% \cong 1.2$ inches per ft.
- C. Curb ramps and flared sides shall have tooled joints $\frac{1}{8}$ " deep, $\frac{1}{4}$ " wide and 2" on center, arranged at 45 degree so that water will not accumulate.
- D. Curb ramps and flared sides shall have permanent coloring applied, as selected by the Architect, which contrasts to the color of the adjoining pedestrian routes.
- E. Curb ramps shall be a minimum of 36" wide exclusive of flared sides.
- F. Maximum slope of adjoining gutters, road surface immediately adjacent to the curb ramp or accessible route shall not exceed $1:20 \cong 5\% \cong \frac{5}{8}$ inch per ft.

3.8 RAMPS

- A. Any part of an accessible route which exceeds $1:20 \cong 5\% \cong \frac{5}{8}$ inch per ft. shall be constructed as a ramp.
- B. Maximum rise for a continuous run in any ramp shall be 30 inches.
- C. Minimum width for ramps shall be 36 inches if the total ramp is less than 30 feet.
- D. Minimum width for ramps shall be 44 inches if the total ramp exceeds 30 feet.
- E. Ramps shall have level landings at the top and bottom of each run.
 - 1. Exterior ramps and their approaches shall not have any portion that accumulates water.
 - 2. Exterior landings shall be sloped to drain, not to exceed $1:20 \cong 5\% \cong \frac{5}{8}$ inch per ft. in any direction.
- F. Ramps shall have continuous handrails on each side.
 - 1. Each freestanding hand rail shall have a top rail at 34 inches above the finished floor and a secondary rail at 27 inches above the finished floor.
 - 2. Each freestanding hand rail shall have a radiused end connecting the bottom and top rails.
 - 3. Each freestanding handrail shall have a 2 inch (minimum) high toe guard.
 - 4. Each hand rail shall have an extension 12 inches past the top and bottom break points of the ramp.

3.9 STAIRS

- A. On any given flight of stairs, all steps shall have uniform riser heights and uniform tread widths.
 - 1. Stair treads shall be not less than 11 inches wide measured from the leading edge of one riser to the leading edge of the next riser.
 - 2. Stair risers shall not exceed 7 inches high.
 - 3. No two risers or treads in any flight of stairs shall vary more than $\frac{1}{4}$ inch.
- B. Nosings: The undersides of nosings, if provided, shall not be abrupt. Risers shall be sloped or the underside of the nosings shall have an angle not less than 60 degrees from the horizontal.
 - 1. Nosings shall project no more than $1 \frac{1}{2}$ inch.
- C. The radius of curvature on the leading edge of a stair tread shall be no greater than $\frac{1}{2}$ inch.
- D. Stairs shall have continuous handrails on each side or extensions.
- E. Stairs more than 88 inches shall have intermediate handrails at equal distances not exceeding 88 inches.

3.10 HANDRAILS

- A. If handrails are not continuous they shall have extensions at the top and bottom of the stair or ramp.
- B. Handrail extensions shall be 12 inches beyond the break point of the landing and parallel to the landing at the top of stairs and ramps.
- C. Handrail extensions shall be 12 inches and parallel to the landing at the bottoms of stairs and ramps. The break point at the bottom of stairs shall be one tread width past the first riser.
- D. The clear space between handrails and wall shall be 1 ½ inches.
- E. Gripping surfaces shall be uninterrupted by newel posts , other construction elements or obstructions.
- F. The top of handrail gripping surfaces shall be mounted at a uniform height between 34 and 38 inches above the walking surface or stair nosing.
- G. Ends of handrails shall be either rounded or returned smoothly to the floor, wall or post.
- H. Handrails shall not rotate in their fittings.

3.11 MANEUVERING CLEARANCES AT DOORS

- A. Clearance on the pull side of a door between the strike and the wall shall be at least 18 inches.
- B. Clearance on the push side of a door between the strike and the latch shall be at least 12 inches if the door has both a closer and a latch.

END OF SECTION

SECTION 01200 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project meetings, including, but not limited to, the following:
 - 1. Preconstruction conferences.
 - 2. Preinstallation conferences.
 - 3. Progress meetings.
 - 4. Coordination meetings.

1.3 PRECONSTRUCTION CONFERENCE

- A. Schedule a preconstruction conference before starting construction, at a time convenient to the Owner and the Architect, but no later than 15 days after execution of the Agreement. Hold the conference at the Project Site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
- B. Attendees: Authorized representatives of the Owner, Architect, and their consultants; the Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
- C. Agenda: Discuss items of significance that could affect progress, including the following:
 - 1. Tentative construction schedule.
 - 2. Critical work sequencing.
 - 3. Designation of responsible personnel.
 - 4. Procedures for processing field decisions and Change Orders.
 - 5. Procedures for processing Applications for Payment.
 - 6. Distribution of Contract Documents.
 - 7. Submittal of Shop Drawings, Product Data, and Samples.
 - 8. Preparation of record documents.
 - 9. Use of the premises.
 - 10. Parking availability.
 - 11. Office, work, and storage areas.
 - 12. Equipment deliveries and priorities.
 - 13. Safety procedures.
 - 14. First aid.
 - 15. Security.
 - 16. Housekeeping.
 - 17. Working hours.

1.4 PREINSTALLATION CONFERENCES

- A. Conduct a preinstallation conference at the Project Site before each construction activity that requires coordination with other construction.
- B. Attendees: The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Architect of scheduled meeting dates.

1. Review the progress of other construction activities and preparations for the particular activity under consideration at each preinstallation conference, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related Change Orders.
 - d. Purchases.
 - e. Deliveries.
 - f. Shop Drawings, Product Data, and quality-control samples.
 - g. Review of mockups (if any).
 - h. Possible conflicts.
 - i. Compatibility problems.
 - j. Time schedules.
 - k. Weather limitations.
 - l. Manufacturer's recommendations.
 - m. Warranty requirements.
 - n. Compatibility of materials.
 - o. Acceptability of substrates.
 - p. Temporary facilities.
 - q. Space and access limitations.
 - r. Governing regulations.
 - s. Safety.
 - t. Inspecting and testing requirements.
 - u. Required performance results.
 - v. Recording requirements.
 - w. Protection.
2. Record significant discussions and agreements and disagreements of each conference, and the approved schedule. Promptly distribute the record of the meeting to everyone concerned, including the Owner and the Architect.
3. Do not proceed with the installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.5 PROGRESS MEETINGS

- A. Conduct progress meetings at the Project Site at regular intervals. Notify the Owner and the Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.
- B. Attendees: In addition to representatives of the Owner and the Architect, each subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the status of the Project.
 1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to insure that current and subsequent activities will be completed within the Contract Time.
 2. Review the present and future needs of each entity present, including the following:
 - a. Interface requirements.
 - b. Time.

- c. Sequences.
 - d. Status of submittals.
 - e. Deliveries.
 - f. Off-site fabrication problems.
 - g. Access.
 - h. Site utilization.
 - i. Temporary facilities and services.
 - j. Hours of work.
 - k. Hazards and risks.
 - l. Housekeeping.
 - m. Quality and work standards.
 - n. Change Orders.
 - o. Documentation of information for payment requests.
- D. Reporting: No later than 3 days after each meeting, distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
- 1. Schedule Updating: Revise the Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01330 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.
- B. Related Sections include the following:
 - 1. Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule and construction photographs.
 - 2. Division 1 Section "Quality Requirements" for submitting test and inspection reports and Delegated-Design Submittals and for erecting mockups.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Architect's responsive action.
- B. Informational Submittals: Written information that does not require Architect's approval. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

- A. General: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal.
 - 1. Initial Review: Allow 10 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Concurrent Review: Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow 15 days for initial review of each submittal.

3. If intermediate submittal is necessary, process it in same manner as initial submittal.
 4. Allow 10 days for processing each resubmittal.
 5. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
- E. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 4 by 5 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
 3. Include the following information on label for processing and recording action taken:
 - a. Project Name: St. Luke's Sugar Land Hospital & Medical Plaza, M.O.B. and Site Package
 - b. Date:
 - c. Name and address of Architect: PageSoutherlandPage, 1100 Louisiana Suite One, Houston, TX 77002.
 - d. Name and address of Contractor:
 - e. Name and address of subcontractor:
 - f. Name and address of supplier:
 - g. Name of manufacturer:
 - h. Other necessary identification:
- F. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.
- G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.
1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
 2. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.
- H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.
1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.
 2. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.
 3. Transmittal Form: Use AIA Document G810.
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- J. Use for Construction: Use only final submittals with mark indicating action taken by Architect in connection with construction.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
1. Number of Copies: Submit four copies of each submittal, unless otherwise indicated. Architect will return two copies. Mark up and retain one returned copy as a Project Record Document. Submit one copy to Owner for review.
 2. Number of Copies: Submit copies of each submittal, as follows, unless otherwise indicated:
 - a. Initial Submittal: Submit a preliminary single copy of each submittal where selection of options, color, pattern, texture, or similar characteristics is required. Architect will return submittal with options selected.
 - b. Final Submittal: Submit three copies, unless copies are required for operation and maintenance manuals. Mark up and retain one returned copy as a Project Record Document.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Standard color charts.
 - e. Manufacturer's catalog cuts.
 - f. Wiring diagrams showing factory-installed wiring.
 - g. Printed performance curves.
 - h. Operational range diagrams.
 - i. Mill reports.
 - j. Standard product operating and maintenance manuals.
 - k. Compliance with recognized trade association standards.
 - l. Compliance with recognized testing agency standards.
 - m. Application of testing agency labels and seals.
 - n. Notation of coordination requirements.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.
 - i. Design calculations.
 - j. Compliance with specified standards.
 - k. Notation of coordination requirements.
 - l. Notation of dimensions established by field measurement.

2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 24 by 36 inches.
 4. Number of Copies: Submit copies of each submittal, as follows:
 - a. Initial Submittal: Submit one correctable, translucent, reproducible print and one blue- or black-line print. Architect will return the reproducible print.
- D. Samples: Prepare physical units of materials or products, including the following:
1. Comply with requirements in Division 1 Section "Quality Requirements" for mockups.
 2. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 3. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 4. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's sample where so indicated. Attach label on unexposed side that includes the following:
 - a. Generic description of Sample.
 - b. Product name or name of manufacturer.
 - c. Sample source.
 5. Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, provide the following:
 - a. Size limitations.
 - b. Compliance with recognized standards.
 - c. Availability.
 - d. Delivery time.
 6. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
 - a. If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit at least three sets of paired units that show approximate limits of the variations.
 - b. Refer to individual Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
 7. Number of Samples for Initial Selection: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
 8. Number of Samples for Verification: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.

- a. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
- 9. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
- E. Delegated-Design Submittal: Comply with requirements in Division 1 Section "Quality Requirements."
- F. Contractor's Construction Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for Construction Manager's action.
- G. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."
- H. Application for Payment: Comply with requirements in Division 1 Section "Payment Procedures."
- I. Schedule of Values: Comply with requirements in Division 1 Section "Payment Procedures."
- J. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.

2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
 - 1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Architect will not return copies.
 - 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - 3. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Requirements."
- B. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- C. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.
- D. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- E. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.

- F. **Manufacturer Certificates:** Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.
- G. **Material Certificates:** Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.
- H. **Material Test Reports:** Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
- I. **Preconstruction Test Reports:** Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements.
- J. **Compatibility Test Reports:** Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- K. **Field Test Reports:** Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.
- L. **Product Test Reports:** Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- M. **Maintenance Data:** Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section "Closeout Procedures Operation and Maintenance Data".
- N. **Design Data:** Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- O. **Manufacturer's Instructions:** Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
 - 1. Preparation of substrates.
 - 2. Required substrate tolerances.
 - 3. Sequence of installation or erection.
 - 4. Required installation tolerances.
 - 5. Required adjustments.
 - 6. Recommendations for cleaning and protection.
- P. **Manufacturer's Field Reports:** Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
 - 1. Name, address, and telephone number of factory-authorized service representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Statement that products at Project site comply with requirements.
 - 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.

5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- Q. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.
- C. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF SECTION

SECTION 01400 - QUALITY CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for quality-control services.
- B. Quality-control services include inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by Architect.
- C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.
- D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.
 - 1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified inspections, tests, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 RESPONSIBILITIES

- A. Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction. Costs for these services are included in the Contract Sum.
 - 1. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the not specifically identified as the Owner's responsibility, the Contractor shall employ and pay a qualified independent testing agency to perform quality-control services. Costs for these services are included in the Contract Sum.
 - 2. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Owner's responsibility, the Owner will engage the services of a qualified independent testing agency to perform those services. Payment for these services will be made by the Owner.
 - a. Where the Owner has engaged a testing agency for testing and inspecting part of the Work, and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Owner, unless agreed to in writing by the Owner.
- B. Retesting: The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.
 - 1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated noncompliance with Contract Document requirements.
- C. Associated Services: Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency

sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:

1. Provide access to the Work.
 2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
 3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
 4. Provide facilities for storage and curing of test samples.
 5. Deliver samples to testing laboratories.
 6. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
 7. Provide security and protection of samples and test equipment at the Project Site.
- D. Duties of the Testing Agency: The independent agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual Sections shall cooperate with the Architect and the Contractor in performance of the agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.
1. The agency shall notify the Architect and the Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.
 3. The agency shall not perform any duties of the Contractor.
- E. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

1.4 SUBMITTALS

- A. Unless the Contractor is responsible for this service, the independent testing agency shall submit a certified written report, in duplicate, of each inspection, test, or similar service to the Architect. If the Contractor is responsible for the service, submit a certified written report, in duplicate, of each inspection, test, or similar service through the Contractor.
1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
 2. Report Data: Written reports of each inspection, test, or similar service include, but are not limited to, the following:
 - a. Date of issue.
 - b. Project title and number.
 - c. Name, address, and telephone number of testing agency.
 - d. Dates and locations of samples and tests or inspections.
 - e. Names of individuals making the inspection or test.
 - f. Designation of the Work and test method.
 - g. Identification of product and Specification Section.
 - h. Complete inspection or test data.
 - i. Test results and an interpretation of test results.
 - j. Ambient conditions at the time of sample taking and testing.
 - k. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.
 - l. Name and signature of laboratory inspector.
 - m. Recommendations on retesting.

1.5 QUALITY ASSURANCE

- A. Qualifications for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, that are prequalified as complying with the American Council

of Independent Laboratories' "Recommended Requirements for Independent Laboratory Qualification" and that specialize in the types of inspections and tests to be performed.

1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Comply with Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities, and protect repaired construction.
- C. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

END OF SECTION

SECTION 01410 - TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Provisions established within the General and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.2 SECTION INCLUDES

- A. Owner provided testing laboratory services.
- B. Selection and payment.
- C. Laboratory responsibilities.
- D. Laboratory reports.
- E. Limits on testing laboratory authority.
- F. Contractor responsibilities.
- G. Schedule of inspections and tests.

1.3 REFERENCES

- A. ASTM C29 - Unit Weight and Voids in Aggregate.
- B. ASTM C31 - Making and Curing Concrete Test Specimens in the Field.
- C. ASTM C39 - Compressive Strength of Cylindrical Concrete Specimens.
- D. ASTM C109 - Compressive Strength of Hydraulic Cement Mortars.
- E. ASTM C127 - Specific Gravity and Absorption of Course Aggregate.
- F. ASTM C128 - Specific Gravity and Absorption of Fine Aggregate.
- G. ASTM C136 - Sieve Analysis of Fine and Course Aggregate.
- H. ASTM C138 - Unit Weight, Yield, and Air Content of Concrete.
- I. ASTM C231 - Air Content of Freshly Mixed Concrete by the Pressure Method.
- J. ASTM C143 - Slump of Portland Cement Concrete.
- K. ASTM C172 - Sampling Freshly Mixed Concrete
- L. ASTM C496 - Splitting Tensile Strength of Cylindrical Concrete Specimens.
- M. ASTM C780 - Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
- N. ASTM C1019 - Sampling and Testing Grout.
- O. ASTM D1188 - Bulk Specific Gravity and Density of Compacted Bituminous Materials.
- P. ASTM D698 - Moisture Density Relations of Soils and Soil Aggregate Mixture Using 5.5 lb. Rammer and 12" Drop.
- Q. ASTM D2167 - Density and Unit Weight of Soil in Place by Rubber Balloon Method.
- R. ASTM D2172 - Quantitative Extraction of Bituminous Paving Mixtures.

- S. ASTM D1560 - Resistance to Deformation and Cohesion of Bituminous Mixtures by Means of Hveem Apparatus.
- T. ASTM D2922 - Density of Soil and Soil Aggregate in Place by Nuclear Methods.
- U. ANSI/ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- V. ANSI/ASTM E329 - Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.
- W. AWS - American Welding Society, Document D1.1 and D1.3, Structural Welding Codes.
- X. ACI - American Concrete Institute, Document 315 (Details and Detailing of Concrete Reinforcement) and 347 (Recommended Practice for Concrete Formwork).

1.4 SELECTION AND PAYMENT

- A. Owner will employ services of an independent testing laboratory to perform specified inspection and testing.
- B. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents. Contractor will pay all testing required by local authorities having jurisdiction.

1.5 QUALITY ASSURANCE

- A. Laboratory shall comply with requirements of ANSI/ASTM E329 and ANSI/ASTM D3740.
- B. Laboratory shall maintain a full-time registered Engineer on staff to review services.
- C. Laboratory authorized to operate in State in which Project is located.
- D. Testing equipment shall be calibrated once each year with devices of an accuracy traceable to either NBS Standards or accepted values of natural physical constants.

1.6 LABORATORY RESPONSIBILITIES

- A. Test samples of mixes submitted by Contractor.
- B. Provide qualified personnel at site. Cooperate with Contractor and Architect in performance of services.
- C. Perform specified inspection, sampling, and testing of products in accordance with specified standards.
- D. Ascertain compliance of materials and mixes with requirements of Contract Documents.
- E. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
- F. Perform additional inspections and tests required by Architect.
- G. Attend preconstruction conference.

1.7 LABORATORY REPORTS

- A. After each inspection and test, promptly submit two copies of laboratory report to Architect and one to the applicable consultant and to Contractor. Include: Date issued, Project title and number, name of inspector, date and time of sampling or inspection, identification of product and Specifications section, location in the Project, type of inspection or test, date of test, results of tests, and conformance with Contract Documents. When requested by Architect/Engineer, provide interpretation of test results.

1.8 LIMITS ON TESTING LABORATORY AUTHORITY

- A. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
- B. Laboratory may not approve or accept any portion of the Work.
- C. Laboratory may not assume any duties of Contractor.
- D. Laboratory has no authority to stop Work.

1.9 CONTRACTOR RESPONSIBILITIES

- A. Deliver to laboratory at designated location adequate samples of materials proposed to be used which require testing, together with proposed mix designs.
- B. Cooperate with laboratory personnel, and provide access to Work and to manufacturer's facilities.
- C. Provide incidental labor and facilities to provide access to work to be tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, and for storage and curing of test samples.
- D. Notify laboratory of material sources and furnish necessary quantities of representative samples of materials proposed for use which are required to be tested.
- E. Notify Architect and laboratory 24 hours prior to expected time for operations requiring inspection and testing services.
- F. Advise laboratory in a timely fashion to complete required inspection and testing prior to subsequent work being performed.
- G. Pay for all subsequent re-testing of products or systems found to be defective or otherwise not in accordance with specification requirements. Remove rejected products and replace with products of specified quality.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EARTHWORK (SITE GENERAL)

- A. Make necessary soil tests (Atterberg Limit Series and ASTM D698 Standard Proctor) to determine moisture content and density of existing subgrade. Perform necessary soil tests (Atterberg Limit Series and ASTM D698 Standard Proctor for each type of fill specified) to determine the moisture content of existing subgrade and to inspect and test the placement of additional fill lifts to verify that all fill materials used are in accordance with the specifications for that use. Perform one field density test (ASTM D2922) per 10,000 S.F. of site area in the area affected on each lift prior to placement of additional fill material.

3.2 BUILDING SUBGRADE STABILIZATION

- A. Make necessary soil tests (Atterberg Limit Series and ASTM D698 Standard Proctor for each type of fill specified) to determine the moisture content and density of existing subgrade and inspect and test the placement of additional fill lifts to verify that all fill materials used are in accordance with the specifications for that use. Perform one field density test (ASTM D2922) for each 5,000 S.F. of area within the building footprint on each lift prior to placement of additional fill material.

3.3 CAST-IN-PLACE CONCRETE

- A. Design Mixes

1. All concrete mixtures to be reviewed by the testing laboratory.
 2. At the beginning of the work, Contractor shall submit proposed concrete mixes for review by the Architect and testing laboratory, including the sieve analysis of fine and coarse aggregate ASTM C-136, dry rodded weight of coarse aggregate - ASTM C-29, and the specific gravity (bulk saturated surface dry), of fine and coarse aggregates ASTM C127 and C128. Laboratory will review and make mix modification recommendations.
 3. Do not mix concrete for placing in the work until after laboratory reports reflect that each proposed mix will develop the strength required.
- B. Test Cylinders: Make at least one (1) test of each day's pouring or each fifty (50) cu. yards, whichever comes first, on each different portion or section of the work. Mold and cure specimens in accordance with ASTM C31, and test in accordance with ASTM C39. Test cylinders shall be made and tested by the laboratory in accordance with ASTM C 172. Footings, walls, and floor systems constitute different sections. Each test shall consist of five (5) specimens, two (2) of which shall be broken at seven (7) days, two (2) at twenty-eight (28) days and one held in reserve. Determine temperature and air content for each set of test cylinders in accordance with ASTM C231.
- C. Field Quality Control
1. Determine slump for each strength test and whenever consistency of concrete appears to vary, in accordance with ASTM C143.
 2. Monitor addition of water to concrete and length of time concrete is allowed to remain in truck.
 3. Certify delivery tickets indicating class of concrete, amount of water added during initial batching, and time initial batching occurred.
 4. Monitor work being performed in accordance with ACI (American Concrete Institute) recommendations as a standard of quality.
- D. Source Quality Control: Periodically inspect and control concrete mixing and loading of transit mix trucks at batch plant at intervals as agreed to by Architect and laboratory personnel.
- 3.4 WATERPROOFING
- A. Visually inspect installation of dampproofing for compliance with specifications.
- 3.5 ROOFING (MODIFIED BITUMEN) TESTING AND INSPECTION
- A. Make daily inspections while roofing installation is underway basing frequency on status of work being done and quality control problems being encountered.
 - B. Verify type of asphalt being used and temperature of asphalt at kettle and at point of discharge on roof. Verify proper spreading of asphalt.
 - C. Verify that type and manufacturer of roofing felts is in accordance with the Contract Documents. Verify that felts have been properly stored and protected and are dry at time of installation.
 - D. Verify type and manufacturer of insulation and installation is according to the Contract Documents. Verify proper storage of insulation and dryness at time of installation.
 - E. Verify status and conditions of metal deck prior to roof insulation installation.
 - F. Verify installation of asphalt and roofing felts are according to the Contract Documents and roofing manufacturer's recommendations.
 - G. Inspect roofing installation prior to flood coating and mark and report all fish mouths, felt to felt conditions and other departures from good roofing practices.
 - H. Verify size, cleanliness and moisture content of aggregate is according to specifications.

- I. Verify installation of flashings, water cut-offs and other methods to protect in-place roofing from the elements.
- J. Monitor Contractor in making 12" x 12" test cuts of the completed felt installation prior to flood coating and graveling. Check number of plies, amount and character of bitumen, adhesion of – plies and presence of moisture or foreign material. One test cut per 100 squares of roofing should be anticipated.
- K. Notify Roofing Contractor, General Contractor, Architect and Owner of the results of all tests.

3.7 TESTING NON-SHRINK GROUT

- A. Make one strength test for every 10 base plates grouted and for every 10 bags of grout used in joints between members.
- B. Each test shall consist of four cubes, two to be tested at seven days and two at 28 days, made and tested in accordance with ASTM C 109, with the exception that the grout shall be restrained from expansion by a top plate.

3.8 ARCHITECTURAL PRECAST CONCRETE

- A. Throughout the progress of mixing, placing and erecting precast concrete, the testing laboratory shall perform the following tests and inspections:
 - 1. Inspection of Precast Concrete During Fabrication:
 - a. Review and report on manufacturer's quality assurance program at beginning of fabrication.
 - b. Inspect fabrication and manufacture of precast concrete for conformance with Contract Documents and shop drawings.
 - c. Review fabricator's certificates and reports of concrete compression test confirmation cylinders for each day's casting.
 - d. Review fabricator's certificates and reports of stress and release readings of prestressing strands.
 - 2. Inspection of Precast Concrete During Erection:
 - a. Inspect members for cracks, spalls and other deficiencies which occur during transportation and erection.
 - b. Inspect erection of precast members for placement tolerances and to ensure that connections, bearing lengths, welding and grouting conform to the Contract Documents.
 - c. Every bearing condition must be inspected and approved prior to topping being placed.

3.9 MECHANICAL AND ELECTRICAL

- A. Testing for MEP work is specified in Divisions 15 and 16.

END OF SECTION

SECTION 01571 - NPDES REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This Section describes the required documentation to be prepared and signed by the Contractor before conducting construction operations, in accordance with the terms and conditions of the National Pollutant Discharge Elimination System (NPDES) Permit, as stated in the Federal Register Vol. 57 No. 175, issued by the Environmental Protection Agency on September 9, 1992.
- B. The Contractor shall be responsible for implementation, maintenance, and inspection of storm water pollution prevention control measures including, but not limited to, erosion and sediment controls, storm water management plans, waste collection and disposal, off-site vehicle tracking, and other practices shown on the Drawings or specified elsewhere in this or other Specifications.
- C. Contractor shall review implementation of the Storm Water Pollution Prevention Plan (SWPPP) in a meeting with the City Engineer prior to start of construction.

1.2 UNIT PRICES

- A. Unless indicated in the Unit Price Schedule as a pay item, no separate payment will be made for work performed under this Section. Include cost of work performed under this Section in pay items of which this work is a component.

1.3 REFERENCES

- A. ASTM D3786 - Standard Test Method for Hydraulic Bursting Strength for Knitted Goods and Nonwoven Fabrics
- B. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

PART 2 - PRODUCTS – (Not Used)

PART 3 - EXECUTION

3.1 NOTICE OF INTENT

- A. The Contractor shall fill out, sign, and date the Contractor's Notice of Intent (NOI) attached as Figure 01571 1 at the end of this Section. The signed copy of the Contractor's NOI shall be returned to the City. The City will complete the Owner's Notice of Intent attached as Figure 01571 2 and will submit both notices to the EPA. Submission of the NOI is required by both the City and the Contractor before construction operations start.

3.2 CERTIFICATION REQUIREMENTS

- A. On the Operator's Information form attached as Figure 01571 3, the Contractor shall fill out name, address, and telephone number for the Contractor; the names of persons or firms responsible for maintenance and inspection of erosion and sediment control measures and all Subcontractors.
- B. The City will complete and sign the City of Webster Certification and return a copy to the Contractor for inclusion with other project certification forms.
- C. The Contractor and Subcontractors named in the Operator's Information form shall read, sign, and date the Contractor's/Subcontractor's Certification form, attached as Figure 01571-5.

- D. The persons or firms responsible for maintenance and inspection of erosion and sediment control measures shall read, sign, and date the Contractor's Inspection and Maintenance Certification form, attached as Figure 01571-6.
- E. The Operator's Information form and all certification forms shall be submitted to the City before beginning construction.

3.3 RETENTION OF RECORDS

- A. The Contractor shall keep a copy of the Storm Water Pollution Prevention Plan at the construction site or at the Contractor's office from the date that it became effective to the date of project completion.
- B. At project closeout, the Contractor shall submit to the City all NPDES forms and certifications, as well as a copy of the SWPPP. Storm water pollution prevention records and data will be retained by City for a period of 3 years from the date of project completion.

3.4 REQUIRED NOTICES

- A. The following notices shall be posted from the date that this SWPPP goes into effect until the date of final site stabilization:
 - 1. Copies of the Notices of Intent submitted by the City and Contractor and a brief project description, as given in Paragraph 1.1 of the SWPPP, shall be posted at the construction site or at Contractor's office in a prominent place for public viewing.
 - 2. Notice to drivers of equipment and vehicles, instructing them to stop, check, and clean tires of debris and mud before driving onto traffic lanes. Post such notices at every stabilized construction exit area.
 - 3. In an easily visible location on site, post a notice of waste disposal procedures.
 - 4. Notice of hazardous material handling and emergency procedures shall be posted with the NOI on site. Keep copies of Material Safety Data Sheets at a location on site that is known to all personnel.
 - 5. Keep a copy of each signed certification at the construction site or at Contractor's office.

END OF SECTION

SECTION 01576 - WASTE MATERIAL DISPOSAL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Disposal of waste material and salvageable material.

1.2 SUBMITTALS

- A. Submittals shall conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit a copy of an approved "Development Permit" prior to disposal of excess material in areas designated as being in a "100-year Flood Hazard Area" within the City. Contact the City Storm Sewer Engineering Section for flood plain information.
- C. Obtain and submit disposal permits for proposed disposal sites if required by local ordinances.
- D. Submit a copy of written permission from property owner, along with description of property, prior to disposal of excess material adjacent to the Project. Submit a written and signed release from property owner upon completion of disposal work.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION

3.1 SALVAGEABLE MATERIAL

- A. Excavated Material: When indicated on Drawings, load, haul, and deposit excavated material at a location or locations shown on Drawings outside the limits of Project.
- B. Base, Surface, and Bedding Material: Load shell, gravel, bituminous, or other base and surfacing material designated for salvage into City of Clear Lake trucks.
- C. Pipe Culvert: Load culverts designated for salvage into City of Sugar Land trucks.
- D. Other Salvageable Materials: Conform to requirements of individual Specification Sections.
- E. Coordinate loading of salvageable material on City of Clear Lake trucks with City Engineer.

3.2 EXCESS MATERIAL

- A. Vegetation, rubble, broken concrete, debris, asphaltic concrete pavement, excess soil, and other materials not designated for salvage, shall become the property of Contractor and shall be removed from the job site and legally disposed of.
- B. Excess soil may be deposited on private property adjacent to the Project when written permission is obtained from property owner. See Paragraph 1.03 D above.
- C. Verify the flood plain status of any proposed disposal site. Do not dispose of excavated materials in an area designated as within the 100-year Flood Hazard Area unless a "Development Permit" has been obtained. Excess material placed in a "100-year Flood Hazard Area" within the City, without a "Development Permit", shall be removed by Contractor at no additional cost to the City.
- D. Waste materials shall be removed from the site on a daily basis, such that the site is maintained in a neat and orderly condition.

END OF SECTION

SECTION 01600 - MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements governing the Contractor's selection of products for use in the Project.

1.3 DEFINITIONS

- A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry.
 - 1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - a. "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
 - b. "Foreign Products," as distinguished from "domestic products," are items substantially manufactured (50 percent or more of value) outside the United States and its possessions. Products produced or supplied by entities substantially owned (more than 50 percent) by persons who are not citizens of, nor living within, the United States and its possessions are also considered to be foreign products.
 - 2. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
 - 3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.4 SUBMITTALS

- A. Product List: Prepare a list showing products specified in tabular form acceptable to the Architect. Include generic names of products required. Include the manufacturer's name and proprietary product names for each item listed.
 - 1. Coordinate product list with the Contractor's Construction Schedule and the Schedule of Submittals.
 - 2. Form: Prepare product list with information on each item tabulated under the following column headings:
 - a. Related Specification Section number.
 - b. Generic name used in Contract Documents.
 - c. Proprietary name, model number, and similar designations.
 - d. Manufacturer's name and address.
 - e. Supplier's name and address.
 - f. Installer's name and address.
 - g. Projected delivery date or time span of delivery period.
 - 3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of an initial product list. Provide a written explanation for omissions of data and for known variations from Contract requirements.

- a. At the Contractor's option, the initial submittal may be limited to product selections and designations that must be established early in the Contract period.
4. Completed List: Within 60 days after date of commencement of the Work, submit 4 copies of the completed product list. Submit one copy to Owner. Provide a written explanation for omissions of data and for known variations from Contract requirements.
5. Architect's Action: The Architect will respond in writing to Contractor within 2 weeks of receipt of the completed product list. No response within this period constitutes no objection to listed manufacturers or products but does not constitute a waiver of the requirement that products comply with Contract Documents. The Architect's response will include a list of unacceptable product selections, containing a brief explanation of reasons for this action.

1.5 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.
- B. Compatibility of Options: When the Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
- C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products that will be exposed to view in occupied spaces or on the exterior.
 1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
 2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
 1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to the site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
 5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
 6. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
 7. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.
1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. Product Selection Procedures: The Contract Documents and governing regulations govern product selection. Procedures governing product selection include the following:
1. Proprietary Specification Requirements: Where Specifications name only a single product or manufacturer, provide the product indicated. No substitutions will be permitted.
 2. Semiproprietary Specification Requirements: Where Specifications name 2 or more products or manufacturers, provide 1 of the products indicated. No substitutions will be permitted.
 - a. Where Specifications specify products or manufacturers by name, accompanied by the term "or equal" or "or approved equal," comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
 3. Nonproprietary Specifications: When Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
 4. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
 5. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by the manufacturer for the application indicated.
 - a. Manufacturer's recommendations may be contained in published product literature or by the manufacturer's certification of performance.
 6. Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.
 7. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily. Owner must review before final decision is made.
 - a. Where no product available within the specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category.
 8. Visual Selection: Where specified product requirements include the phrase "... as selected from manufacturer's standard colors, patterns, textures ..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern, and texture from the product line selected. Owner must review before final selection is made.
 9. Allowances: Refer to individual Specification Sections and "Allowance" provisions in Division 1 for allowances that control product selection and for procedures required for processing such selections.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
 - 1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION

SECTION 01631 - SUBSTITUTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for handling requests for substitutions made after award of the Contract.

1.3 DEFINITIONS

- A. Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after award of the Contract are considered to be requests for substitutions. The following are not considered to be requests for substitutions:
 - 1. Substitutions requested during the bidding period, and accepted by Addendum prior to award of the Contract, are included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.
 - 2. Revisions to the Contract Documents requested by the Owner or Architect.
 - 3. Specified options of products and construction methods included in the Contract Documents.
 - 4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBMITTALS

- A. Substitution Request Submittal: The Architect will consider requests for substitution if received within 30 days after commencement of the Work. Requests received more than 30 days after commencement of the Work may be considered or rejected at the discretion of the Architect.
 - 1. Submit 3 copies of each request for substitution for consideration on the form at the end of this section.
 - 2. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers.
 - 3. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
 - a. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate contractors, that will be necessary to accommodate the proposed substitution.
 - b. Review the proposed substitution with each authority having jurisdiction for acceptability under the applicable codes and ordinances.
 - c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.
 - d. Product Data, including Drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
 - g. Cost information, including a proposal of the net change, if any in the Contract Sum.

SUBSTITUTION REQUEST

DATE: _____
 Architect's Project No: _____

Project: _____

To: _____

PageSoutherlandPage
 1100 Louisiana, Suite One
 Houston, TX 77002

From: _____

=====
 ==

Contractor (Bidder) hereby request acceptance of the following product or system as substitution in accordance with provisions of Division 1 of the Specifications:

3.1 SPECIFIED PRODUCT OR SYSTEM:
 Substitution request for :

Specification Section No : _____ Article: _____

3.2 SUPPORTING DATA:
 _____ Product data adequate for evaluation of the request for proposed substitution is attached (description of product, reference standard, performance and test data, specifications, drawings, photographs).
 _____ Sample is attached.
 _____ Sample will be sent if requested.

3.3 QUALITY COMPARISON

	SPECIFIED PRODUCT	SUBSTITUTION
Name, Brand:	_____	_____
Catalog No.:	_____	_____
Manufacturer:	_____	_____
Vendor:	_____	_____
Significant Variations:	_____	_____

(Add Additional Sheets If Necessary)

Maintenance Service Available: Yes _____ No _____

Spare Parts Source: _____

Warranty Provided: Yes _____ No _____ Years _____

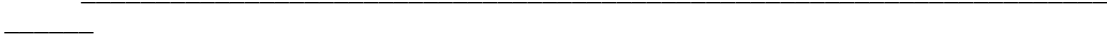
By Whom: _____

3.4 PREVIOUS INSTALLATIONS:
 Identification of similar projects on which proposed substitution was used:
 Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

3.5 REASON FOR NOT GIVING PRIORITY TO SPECIFIED ITEMS:



3.6 EFFECT OF SUBSTITUTION:

Does the proposed substitution affect other work (adverse or otherwise):

No _____ Yes _____ (if yes, explain)

Substitution Changes Contract Time: No Yes

Add/Deduct _____ Days

Substitution requires dimensional revisions or redesign of the work: No _____ Yes _____
Yes (if yes, attach explanation data)

Saving of credit to Owner: \$ _____

Extra Cost to Owner: \$ _____

3.7 CONTRACTOR'S (BIDDER'S) STATEMENT OF CONFORMANCE OF PROPOSED SUBSTITUTION TO CONTRACT DOCUMENTS:

I/we have investigated the proposed substitution. I/we:

- believe that it is equal or superior in all respects including function, appearance and quality to specified product, except as stated above;
- will provide same warranty and servicing requirements as specified for specified product;
- have included complete cost data and implications of the substitution;
- will pay for changes to the building design and special inspection costs caused by the use of this product;
- will coordinate the incorporation of the proposed substitution in the work;
- waive future claims for added cost to Contract caused by the substitution.
- have reviewed the substitution with the Authorities Having Jurisdiction and are in compliance with all applicable codes and ordinances.

Contractor _____

(Bidder): _____

Date: _____

By: _____

Answer all questions and complete all blanks - use "NA" if not applicable. Unresponsive or incomplete request will be rejected.

=====

=

ARCHITECT'S REVIEW AND ACTION

_____ Resubmit substitution request

_____ Provide more information in the following areas:

_____ Sign Contractor's (Bidder's) Statement of Conformance

_____ Substitution is accepted.

_____ Substitution is accepted, with the following comments:

—

— Substitution rejected.
— Substitution Request received too late.

Architect _____ Date: _____

END OF SECTION

SECTION 01670 - SYSTEMS DEMONSTRATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Provisions established within the General and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.2 SECTION INCLUDES

- A. Procedures for demonstration of equipment operation and instruction of Owner's personnel.

1.3 QUALITY ASSURANCE

- A. When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Owner's personnel, and provide written report that demonstrations and instructions have been completed.
- B. Owner will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

1.4 SUBMITTALS

- A. Submit preliminary schedule for Owner's approval, listing times and dates for demonstration of each item of equipment and each system, two weeks prior to proposed dates.
- B. Submit reports within one week after completion of demonstrations, that demonstrations and instructions have been satisfactorily completed. Give time and date of each demonstration, with a list of persons present.

PART 2 - PRODUCTS (Not Used.)

PART 3 - PART 3 EXECUTION

3.1 PREPARATION

- A. Verify equipment has been inspected and put into operation in accordance with Section 01650; testing, adjusting, and balancing has been performed in accordance with Division 15 and 16, and equipment and systems are fully operational.
- B. Have copies of completed operation and maintenance manuals at hand for use in demonstrations and instructions.

3.2 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of final inspection. For equipment requiring seasonal operation, perform instructions for other seasons within six months.
- B. Use operation and maintenance manuals as basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at designated location.
- D. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instructions.

3.3 TIME ALLOCATED FOR INSTRUCTIONS

- A. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

END OF SECTION

SECTION 01700 - CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Project record document submittal.
 - 3. Operation and maintenance manual submittal.
 - 4. Submittal of warranties.
 - 5. Final cleaning.
- B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 16.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
 - 1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete.
 - a. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 - b. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
 - 2. Advise the Owner of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
 - 4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 5. **Submit the final accessibility inspection report from the Independent Provider or the Texas Department of Licensing and Regulation as applicable. Verify with the Architect the entity that is responsible for this inspection.**
 - 6. Submit record drawings, maintenance manuals, final project photographs, damage or settlement surveys, property surveys, and similar final record information.
 - 7. Deliver tools, spare parts, extra stock, and similar items.
 - 8. Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.
 - 9. Complete startup testing of systems and instruction of the Owner's operation and maintenance personnel. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements.
 - 10. Complete final cleanup requirements, including touchup painting.
 - 11. Touch up and otherwise repair and restore marred, exposed finishes.
- B. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the

Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. The Architect will repeat inspection when requested and assured that the Work is substantially complete.
2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.4 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required.
 2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
 3. Submit a certified copy of the Architect's final inspection list of items to be completed or corrected, endorsed and dated by the Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by the Architect.
 4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when the Owner took possession of and assumed responsibility for corresponding elements of the Work.
 5. Submit consent of surety to final payment.
 6. Submit a final liquidated damages settlement statement.
 7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Reinspection Procedure: The Architect will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the Architect.
1. Upon completion of reinspection, the Architect will prepare a certificate of final acceptance. If the Work is incomplete, the Architect will advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
 2. If necessary, reinspection will be repeated.

1.5 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for the Architect's reference during normal working hours.
- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work.
 2. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.
 3. Note related change-order numbers where applicable.
 4. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.

- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda. Include with the Project Manual one copy of other written construction documents, such as Change Orders and modifications issued in printed form during construction.
 - 1. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.
 - 2. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.
 - 3. Note related record drawing information and Product Data.
 - 4. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.
- D. Record Product Data: Maintain one copy of each Product Data submittal. Note related Change Orders and markup of record drawings and Specifications.
 - 1. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site and from the manufacturer's installation instructions and recommendations.
 - 2. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation.
 - 3. Upon completion of markup, submit complete set of record Product Data to the Architect for the Owner's records.
- E. Record Sample Submitted: Immediately prior to Substantial Completion, the Contractor shall meet with the Architect and the Owner's personnel at the Project Site to determine which Samples are to be transmitted to the Owner for record purposes. Comply with the Owner's instructions regarding delivery to the Owner's Sample storage area.
- F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to the Architect for the Owner's records.
- G. Maintenance Manuals: Organize operation and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual, heavy-duty, 2-inch, 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:
 - 1. Emergency instructions.
 - 2. Spare parts list.
 - 3. Copies of warranties.
 - 4. Wiring diagrams.
 - 5. Recommended "turn-around" cycles.
 - 6. Inspection procedures.
 - 7. Shop Drawings and Product Data.
 - 8. Fixture lamping schedule.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

- A. Operation and Maintenance Instructions: Arrange for each Installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:
 - 1. Maintenance manuals.

2. Record documents.
 3. Spare parts and materials.
 4. Tools.
 5. Lubricants.
 6. Fuels.
 7. Identification systems.
 8. Control sequences.
 9. Hazards.
 10. Cleaning.
 11. Warranties and bonds.
 12. Maintenance agreements and similar continuing commitments.
- B. As part of instruction for operating equipment, demonstrate the following procedures:
1. Startup.
 2. Shutdown.
 3. Emergency operations.
 4. Noise and vibration adjustments.
 5. Safety procedures.
 6. Economy and efficiency adjustments.
 7. Effective energy utilization.

3.2 FINAL CLEANING

- A. General: The General Conditions require general cleaning during construction. Regular site cleaning is included in Division 1 Section "Construction Facilities and Temporary Controls."
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion.
 - a. Remove labels that are not permanent labels.
 - b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
 - c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
 - d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
 - e. Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests.
- D. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.
- E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.
1. Where extra materials of value remain after completion of associated Work, they become the Owner's property. Dispose of these materials as directed by the Owner.

END OF SECTION

SECTION 01710 - CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Bidding Requirements, the General and Supplementary General Conditions and Division 1, General Requirements, of this project manual apply to all work required for this Section.

1.2 DESCRIPTION:

- A. Execute cleaning during progress of the work.
- B. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations and anti-pollution laws.

PART 2 - PRODUCTS

- A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.
- B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.
- C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.1 DURING CONSTRUCTION:

- A. Execute periodic cleaning to keep the Work, the site and adjacent properties free from accumulations of waste materials, rubbish and windblown debris, resulting from construction operations. Wet dry materials and rubbish to lay dust and prevent blowing dust.
- B. Provide on-site containers for collection of waste materials, debris and rubbish.
- C. Remove waste materials, debris and rubbish from the site periodically (no more than weekly) and dispose at legal disposal areas away from the site, off Owner's property.
- D. Store volatile wastes in covered metal containers, and remove from premises daily. Prevent accumulation of wastes which create hazardous conditions. Provide adequate ventilation during use of volatile or noxious substances.
- E. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws. Do not burn or bury rubbish and waste materials on the project site. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains. Do not dispose of wastes into streams or waterways.
- F. Vacuum clean interior building areas when ready to receive finish painting, and continue vacuum cleaning on an as-needed basis until building is ready for substantial completion or occupancy. Schedule cleaning operations so dust and other contaminants resulting from cleaning process will not fall on wet, newly coated surfaces.

3.2 FINAL CLEANING:

- A. Employ experienced workmen, or professional cleaners, for final cleaning. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces. Remove grease, oil, dust, dirt, stains, labels, fingerprints and other foreign materials from sight-exposed interior and exterior finished surfaces, including fixtures, equipment, floors, walls, ceilings, glass and hardware; polish surfaces so designated to a shine finish, Repair, patch and touch-up marred surfaces to specified finish to match adjacent surfaces.

- B. Wash and shine glazing and mirrors.
- C. Polish glossy surfaces to a clear shine.
- D. Ventilating Systems:
 - 1. Clean permanent filters and replace disposable filters if units were operated during construction.
 - 2. Clean ducts, blowers and coils if units were operated non-conformance with specification without filters during construction. Service machinery and equipment, and leave ready for Owner's use.
- E. Prior to final completion, or Owner occupancy, conduct an inspection of sight-exposed interior surfaces, and all work areas, to verify the entire work is clean.
- F. Maintain cleaning until project, or portion thereof, is occupied by Owner. Owner will assume responsibility for cleaning as of time designated on Certificate of Substantial Completion for Owner's acceptance of project or portion thereof.

END OF SECTION

SECTION 01730 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for operation and maintenance manuals, including the following:
 1. Preparing and submitting operation and maintenance manuals for building operating systems and equipment.
 2. Preparing and submitting instruction manuals covering the care, preservation, and maintenance of architectural products and finishes.
 3. Instruction of the Owner's operating personnel in the operation and maintenance of building systems and equipment.

1.3 QUALITY ASSURANCE

- A. Maintenance Manual Preparation: In preparation of maintenance manuals, use personnel thoroughly trained and experienced in operation and maintenance of equipment or system involved.
 1. Where maintenance manuals require written instructions, use personnel skilled in technical writing where necessary for communication of essential data.
 2. Where maintenance manuals require drawings or diagrams, use draftsmen capable of preparing drawings clearly in an understandable format.
- B. Instructions for the Owner's Personnel: Use experienced instructors thoroughly trained and experienced in operation and maintenance of equipment or system involved to instruct the Owner's operation and maintenance personnel.

1.4 SUBMITTALS

- A. Submittal Schedule: Comply with the following schedule for submitting operation and maintenance manuals:
 1. Before Substantial Completion, when each installation that requires operation and maintenance manuals is nominally complete, submit 2 draft copies of each manual to the Architect for review. Include a complete index or table of contents of each manual.
 - a. The Architect will return 1 copy of the draft with comments within 15 days of receipt.
 2. Submit 1 copy of data in final form at least 15 days before final inspection. The Architect will return this copy within 15 days after final inspection, with comments.
 3. After final inspection, make corrections or modifications to comply with the Architect's comments. Submit the specified number of copies of each approved manual to the Architect within 15 days of receipt of the Architect's comments.
- B. Form of Submittal: Prepare operation and maintenance manuals in the form of an instructional manual for use by the Owner's operating personnel. Organize into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder.
 1. Binders: For each manual, provide heavy-duty, commercial-quality, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to receive 8-1/2-by-11- inch paper. Provide a clear plastic sleeve on the spine to hold labels describing contents. Provide pockets in the covers to receive folded sheets.
 - a. Where 2 or more binders are necessary to accommodate data, correlate data in each binder into related groupings according to the Project Manual table of

- contents. Cross-reference other binders where necessary to provide essential information for proper operation or maintenance of the piece of equipment or system.
- b. Identify each binder on front and spine, with the printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter covered. Indicate volume number for multiple volume sets of manuals.
2. Dividers: Provide heavy paper dividers with celluloid-covered tabs for each separate Section. Mark each tab to indicate contents. Provide a typed description of the product and major parts of equipment included in the Section on each divider.
 3. Protective Plastic Jackets: Provide protective, transparent, plastic jackets designed to enclose diagnostic software for computerized electronic equipment.
 4. Text Material: Where maintenance manuals require written material, use the manufacturer's standard printed material. If manufacturer's standard printed material is not available, provide specially prepared data, neatly typewritten, on 8-1/2-by-11-inch, 20-lb/sq. ft. white bond paper.
 5. Drawings: Where maintenance manuals require drawings or diagrams, provide reinforced, punched binder tabs on drawings and bind in with text.
 - a. Where oversize drawings are necessary, fold drawings to the same size as text pages and use as a foldout.
 - b. If drawings are too large to be used practically as a foldout, place the drawing, neatly folded, in front or rear pocket of binder. Insert a typewritten page indicating drawing title, description of contents, and drawing location at the appropriate location in the manual.

1.5 MANUAL CONTENT

- A. In each manual include information specified in the individual Specification Section and the following information for each major component of building equipment and its controls:
 1. General system or equipment description.
 2. Design factors and assumptions.
 3. Copies of applicable Shop Drawings and Product Data.
 4. System or equipment identification, including:
 - a. Name of manufacturer.
 - b. Model number.
 - c. Serial number of each component.
 5. Operating instructions.
 6. Emergency instructions.
 7. Wiring diagrams.
 8. Inspection and test procedures.
 9. Maintenance procedures and schedules.
 10. 1Precautions against improper use and maintenance.
 11. 1Copies of warranties.
 12. 1Repair instructions including spare parts listing.
 13. 1Sources of required maintenance materials and related services.
 14. 1Manual index.
- B. Organize each manual into separate Sections for each piece of related equipment. As a minimum, each manual shall contain a title page; a table of contents; copies of Product Data, supplemented by Drawings and written text; and copies of each warranty, bond, and service contract issued.
 1. Title Page: Provide a title page in a transparent, plastic envelope as the first sheet of each manual. Provide the following information:
 - a. Subject matter covered by the manual.
 - b. Name and address of the Project.
 - c. Date of submittal.
 - d. Name, address, and telephone number of the Contractor.
 - e. Name and address of the Architect.

- f. Cross-reference to related systems in other operation and maintenance manuals.
2. Table of Contents: After title page, include a typewritten table of contents for each volume, arranged systematically according to the Project Manual format. Include a list of each product included, identified by product name or other appropriate identifying symbol and indexed to the content of the volume.
 - a. Where a system requires more than one volume to accommodate data, provide a comprehensive table of contents for all volumes in each volume of the set.
3. General Information: Provide a general information Section immediately following table of contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the subcontractor or Installer and the maintenance contractor. Clearly delineate the extent of responsibility of each of these entities. Include a local source for replacement parts and equipment.
4. Product Data: Where the manuals include manufacturer's standard printed data, include only sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where the Project includes more than one item in a tabular format, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation, and delete references to information that is not applicable.
5. Written Text: Prepare written text to provide necessary information where manufacturer's standard printed data is not available, and the information is necessary for proper operation and maintenance of equipment or systems. Prepare written text where it is necessary to provide additional information or to supplement data included in the manual. Organize text in a consistent format under separate headings for different procedures. Where necessary, provide a logical sequence of instruction for each operation or maintenance procedure.
6. Drawings: Provide specially prepared drawings where necessary to supplement manufacturer's printed data to illustrate the relationship of component parts of equipment or systems or to provide control or flow diagrams. Coordinate these drawings with information contained in project record drawings to assure correct illustration of the completed installation.
 - a. Do not use original project record documents as part of operation and maintenance manuals.
7. Warranties, Bonds, and Service Contracts: Provide a copy of each warranty, bond, or service contract in the appropriate manual for the information of the Owner's operating personnel. Provide written data outlining procedures to follow in the event of product failure. List circumstances and conditions that would affect validity of warranty or bond.

1.6 MATERIAL AND FINISHES MAINTENANCE MANUAL

- A. Submit 3 copies of each manual, in final form, on material and finishes to the Architect for distribution. Provide one section for architectural products, including applied materials and finishes. Provide a second section for products designed for moisture protection and products exposed to the weather.
 1. Refer to individual Specification Sections for additional requirements on care and maintenance of materials and finishes.
- B. Architectural Products: Provide manufacturer's data and instructions on care and maintenance of architectural products, including applied materials and finishes.
 1. Manufacturer's Data: Provide complete information on architectural products, including the following, as applicable:
 - a. Manufacturer's catalog number.
 - b. Size.
 - c. Material composition.
 - d. Color.
 - e. Texture.
 - f. Reordering information for specially manufactured products.

2. Care and Maintenance Instructions: Provide information on care and maintenance, including manufacturer's recommendations for types of cleaning agents to be used and methods of cleaning. Provide information on cleaning agents and methods that could prove detrimental to the product. Include manufacturer's recommended schedule for cleaning and maintenance.
- C. Moisture Protection and Products Exposed to the Weather: Provide complete manufacturer's data with instructions on inspection, maintenance, and repair of products exposed to the weather or designed for moisture-protection purposes.
1. Manufacturer's Data: Provide manufacturer's data giving detailed information, including the following, as applicable:
 - a. Applicable standards.
 - b. Chemical composition.
 - c. Installation details.
 - d. Inspection procedures.
 - e. Maintenance information.
 - f. Repair procedures.

1.7 EQUIPMENT AND SYSTEMS MAINTENANCE MANUAL

- A. Submit 6 copies of each manual, in final form, on equipment and systems to the Architect for distribution. Provide separate manuals for each unit of equipment, each operating system, and each electric and electronic system.
1. Refer to individual Specification Sections for additional requirements on operation and maintenance of the various pieces of equipment and operating systems.
- B. Equipment and Systems: Provide the following information for each piece of equipment, each building operating system, and each electric or electronic system.
1. Description: Provide a complete description of each unit and related component parts, including the following:
 - a. Equipment or system function.
 - b. Operating characteristics.
 - c. Limiting conditions.
 - d. Performance curves.
 - e. Engineering data and tests.
 - f. Complete nomenclature and number of replacement parts.
 2. Manufacturer's Information: For each manufacturer of a component part or piece of equipment, provide the following:
 - a. Printed operation and maintenance instructions.
 - b. Assembly drawings and diagrams required for maintenance.
 - c. List of items recommended to be stocked as spare parts.
 3. Maintenance Procedures: Provide information detailing essential maintenance procedures, including the following:
 - a. Routine operations.
 - b. Troubleshooting guide.
 - c. Disassembly, repair, and reassembly.
 - d. Alignment, adjusting, and checking.
 4. Operating Procedures: Provide information on equipment and system operating procedures, including the following:
 - a. Startup procedures.
 - b. Equipment or system break-in.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Instructions on stopping.
 - f. Shutdown and emergency instructions.
 - g. Summer and winter operating instructions.
 - h. Required sequences for electric or electronic systems.

- i. Special operating instructions.
- 5. Servicing Schedule: Provide a schedule of routine servicing and lubrication requirements, including a list of required lubricants for equipment with moving parts.
- 6. Controls: Provide a description of the sequence of operation and as-installed control diagrams by the control manufacturer for systems requiring controls.
- 7. Coordination Drawings: Provide each Contractor's Coordination Drawings.
 - a. Provide as-installed, color-coded, piping diagrams, where required for identification.
- 8. Valve Tags: Provide charts of valve-tag numbers, with the location and function of each valve.
- 9. Circuit Directories: For electric and electronic systems, provide complete circuit directories of panelboards, including the following:
 - a. Electric service.
 - b. Controls.
 - c. Communication.

1.8 INSTRUCTIONS FOR THE OWNER'S PERSONNEL

- A. Prior to final inspection, instruct the Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Provide instruction at mutually agreed upon times.
 - 1. For equipment that requires seasonal operation, provide similar instruction during other seasons.
 - 2. Use operation and maintenance manuals for each piece of equipment or system as the basis of instruction. Review contents in detail to explain all aspects of operation and maintenance.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01741 - WARRANTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturers standard warranties on products and special warranties.
 - 1. Refer to the General Conditions for terms of the Contractor's period for correction of the Work.
- B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.3 WARRANTY REQUIREMENTS

- A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
- D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.
 - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
- E. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.4 SUBMITTALS

- A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.

1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within 15 days of completion of that designated portion of the Work.
- B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Architect, for approval prior to final execution.
- C. Form of Submittal: At Final Completion compile 2 copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- D. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.
 2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of the Contractor.
 3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 02220 - EARTHWORK UNDER BUILDING

PART 1. GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. Extent of earthwork is indicated on drawings.
- B. Preparation of subgrade for building slabs is included as part of this work.
- C. Drainage fill course for support of building slabs is included as part of this work.
- D. Backfilling of trenches within building lines is included as part of this work.
- E. Excavation for Mechanical/Electrical Work: Excavation and backfill required in conjunction with underground mechanical and electrical utilities, and buried mechanical and electrical appurtenances is included as work of this section.
- F. Definition: "Excavation" consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.

1.3 QUALITY ASSURANCE

- A. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.
- B. Testing and Inspection Service:
 - 1. Owner will engage soil testing and inspection service for quality control testing during earthwork operations.

1.4 JOB CONDITIONS

- A. Site Information: Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn there from by Contractor. Data are made available for convenience of Contractor.
- B. Additional test borings and other exploratory operations may be made by Contractor at no cost to Owner.
- C. Existing Utilities: Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
- D. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.
1. Operate warning lights as recommended by authorities having jurisdiction.

PART 2. PRODUCTS

2.1 SOIL MATERIALS

A. Backfill/Drainage Fill:

1. Material for backfill immediately under slabs on grade shall be sound and free-draining, such as sand, gravel or crushed stone with less than 10% passing the #200 sieve. Maximum diameter shall be 1-1/2 inches. The Testing Agency shall examine and approve the material prior to backfilling.

PART 3. EXECUTION

3.1 EXCAVATION

- A. Excavation is Unclassified, and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.
- B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Architect/Engineer. Unauthorized excavation, as well as remedial work directed by Architect, shall be at Contractor's expense.
1. Under footings, foundation bases, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation.
 2. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Architect/Engineer.
- C. Additional Excavation: When excavation has reached required subgrade elevation, notify Testing Agency who will make an inspection of conditions.
1. If unsuitable bearing materials such as loose soils are encountered at required subgrade elevations, carry excavations deeper until competent soils are observed, and replace excavated material as directed by Testing Agency, at no extra cost to the owner.

- D. **Stability of Excavations:** Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
1. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- E. **Dewatering:** Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
 2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.
 3. Water must not be allowed to stand on the building pad and excavations should be concreted as soon as possible. Slabs-on-grade shall be placed as soon as possible after the building pad is prepared. If the building pad is left exposed to rainfall, perched groundwater conditions may develop which will undermine the integrity of the floor slab.
 4. Foundation concrete shall not be placed on soils that have been disturbed by rainfall or seepage. If the bearing soils are softened by surface water intrusion during exposure or by desiccation, the unsuitable soils must be removed from the foundation excavation and replaced with compacted structural fill prior to placement of concrete.
 5. Bearing surfaces for spread footings shall be protected against disturbance and deterioration. Any bearing area not concreted within the day it is exposed should be covered with a thin seal slab.
- F. **Material Storage:** Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.
1. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.
 2. Dispose of excess soil material and waste materials as herein specified.
- G. **Excavation for Structures:** Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10', and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
1. In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

- H. Excavation for Pavements: Cut surface under pavements to comply with cross-sections, elevations and grades as shown.
- I. Excavation for Trenches: Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide 6" to 9" clearance on both sides of pipe or conduit.
 - 1. Excavate trenches to depth indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.
 - 2. Where rock is encountered, carry excavation 6" below required elevation.
 - 3. For pipes or conduit 5" or less in nominal size and for flat-bottomed multiple-duct conduit units, do not excavate beyond indicated depths. Hand excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.
 - 4. For pipes or conduit 6" or larger in nominal size, tanks and other mechanical/electrical work indicated to receive subbase, excavate to subbase depth or, if not otherwise indicated, to 6" below bottom of work to be supported.
 - 5. Except as otherwise indicated, excavate for exterior water-bearing piping (water, steam, condensate, drainage) so top of piping is not less than 3'-6" below finished grade.
 - 6. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe.
 - 7. Backfill trenches with concrete where trench excavations pass within 18" of column or wall footings and which are carried below bottom of such footings, or which pass under wall footings. Place concrete to level of bottom of adjacent footing.
 - 8. Concrete is specified in Division 3.
 - 9. Do not backfill trenches until tests and inspections have been made and backfilling authorized by Architect/Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.
 - 10. For piping or conduit less than 2'-6" below surface of roadways, provide 4" thick concrete base slab support. After installation and testing of piping or conduit, provide minimum 4" thick encasement (sides and top) of concrete prior to backfilling or placement of roadway subbase.
- J. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35° F. (1°C).

3.2 PROOFROLLING

- A. After excavation and before any fill placement, fill areas shall be proofrolled with five coverages of a loaded dump truck or scraper. Areas found to be soft or

pumping shall have the soft soil removed and replaced with compacted/conditioned fill. Subsequent to proofrolling, and just prior to the placement of fill, the exposed subgrade should be moisture conditioned to within 2 percent of the optimum moisture content and compacted to at least 98 percent of the Standard Proctor (ASTM D698) maximum dry density.

3.3 BACKFILL AND FILL

- A. General: Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.
 - 1. Under building, use structural fill, and drainage fill material directly under slab. See plans for required structural fill and drainage fill heights. The structural fill thickness shall extend at least 5 feet outside of building limits.
 - 2. Under mat spread footing foundation use structural fill. The construction of spread footings should be completed in a manner that allows for the bearing surface to be exposed and the footing cast during a single workday.
 - 3. Under piping and conduit, use fill soils under piping or conduit; shape to fit bottom 90° of cylinder. All trenches should be properly backfilled and compacted to 95% of the maximum dry densities. Sand or permeable materials should not be used as backfill.

- B. Backfill excavations as promptly as work permits, but not until completion of the following:
 - 1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
 - 2. Inspection, testing, approval, and recording locations of underground utilities.
 - 3. Removal of concrete formwork.
 - 4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
 - 5. Removal of trash and debris.
 - 6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

- C. Ground Surface Preparation
 - 1. Soft soils should be removed until firm soil is reached. The soft soils can be aerated and placed back in eight-inch loose lifts and compacted to 95% as specified by ASTM D-698.

2. The building and pavement areas should be stripped of all vegetation including roots and stumps, loose or soft topsoil, and any other debris. Care should be taken to replace or recompact all soil removed or loosened by removal of tree roots and stumps. It is recommended to fill voids created by the removal of root systems with structural fill or cement-stabilized sand. The loosened soils should be moisture conditioned to within 2 percent of the optimum moisture content and compacted to at least 95 percent of the Standard Proctor (ASTM D 698) maximum dry density.
 3. Depending on the virgin site conditions, organic is found at depths of 2 to 3 feet below the existing grades. All organic materials should be scarified and removed prior to subgrade preparation.
 4. Any low-lying areas including ravines, ditches, swamps, etc. should be filled with structural fill and placed in 8-inch lifts. Each lift should be compacted to 95% of the maximum dry density as specified by ASTM D-698.
 5. The exposed subgrade should be scarified to a minimum depth of six inches in the slab areas. The subgrade should then be compacted to 95% of the maximum density as determined by ASTM D-698. A sheep-foot roller should be utilized to compact the fill soils. A smooth-drum compaction equipment should then be utilized to seal the compacted fill. In the event that the upper six inches cannot be compacted do to excessive moisture conditions, see remedial procedures below.
 6. The site shall be proof-rolled as described above.
 7. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to within 2 percent optimum moisture content, and compact to required depth and percentage of maximum density.
- D. Place backfill and fill materials evenly adjacent to structures, piping or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift.

3.4 COMPACTION

- A. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.
- B. Placement and Compaction: Unless described otherwise, place backfill and fill materials in layers not more than 8" loose depth with compacted thickness not to exceed 6" for material compacted by heavy compaction equipment, and not more than 4" in loose depth for material compacted by hand-operated tampers.
 1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

- C. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture density relationship (cohesive soils) determined in accordance with ASTM D698 (Standard Proctor); and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).
 - 1. Areas to receive Structural Fill: Place in loose lifts not to exceed 8 inches and compacted to at least 95 percent of the standard Proctor maximum dry density. The moisture content should be within +2% of optimum as established by ASTM D-698. Under no circumstances shall any material containing organics and roots be used as backfill.
 - 2. Walls: Compact backfill behind walls not supporting building structures or paved areas in layers to provide 90% maximum density for cohesive material or 90% relative density for cohesionless material.
- D. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material. Apply water in manner to prevent free water appearing on surface during or subsequent to compaction operations.
 - 1. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
 - 2. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

3.5 GRADING

- A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.
- B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding.
- C. Finish surfaces free from irregular surface changes, and as follows:
- D. Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2" when tested with a 10' straightedge.
- E. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

3.6 BUILDING SLAB DRAINAGE COURSE

- A. General: Drainage course consists of placement of drainage fill material, in layers of indicated thickness, over subgrade surface to support concrete building slabs.
- B. Placing: Place drainage fill material on prepared subgrade in layers of uniform thickness, conforming to indicated cross- section and thickness. Maintain optimum moisture content for compacting material during placement operations.
- C. When a compacted drainage course is shown to be 6" thick or less, place material in a single layer. When shown to be more than 6" thick, place material in equal layers, except no single layer more than 6" or less than 3" in thickness when compacted.

3.7 FIELD QUALITY CONTROL

- A. Quality Control Testing During Construction: Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed.
 - 1. A qualified soil technician should monitor all earthwork operations.
 - 2. Field density test shall be performed in sufficient number to insure that the specified density is being obtained. Tests shall be in accordance with ASTM D1556 (sand cone method) and ASTM D2167 (rubber balloon method). ASTM D2922 (nuclear probe method) may be used for up to 75% of the field density tests provided it is calibrated against one of the other methods specified herein.
 - 3. Paved Areas and Building Slab Subgrade: Make at least one field density test of subgrade for every 2,500 sq. ft. of paved area or building slab, but in no case less than 3 tests. In each compacted fill layer, make one field density test for every 2,500 sq. ft. of overlying building slab or paved area, but in no case less than 3 tests per fill layer.
 - 4. Spread Footing Excavations: A geotechnical engineer shall observe spread footing excavations and verify the required design bearing capacity.
 - 5. If in opinion of Architect/Engineer, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional expense.
- B. Laboratory Tests:
 - 1. Perform the following laboratory tests:
 - (a) Determine particle size of each type of soil per ASTM D422.
 - (b) Determine Liquid Limit, Plastic Limit, and Plasticity Index of each type of soil by ASTM D4318, Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils (Method A - Multipoint Test).
 - 2. Determine maximum density of each type of soil by ASTM D698.

3.8 MAINTENANCE

- A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
 - 1. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.
- C. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.9 WET WEATHER CONSIDERATIONS

- A. If the subgrade cannot be adequately compacted to minimum densities as described above, one of the following measures will be required:
 - 1. Removal and replacement with structural fill.
 - 2. Chemical treatment of the soil to dry and improve the stability of the subgrade. Chemical treatment may be necessary to depths of 12 to 24 inches or greater depending on the condition of the soil at the time of construction.
 - 3. Drying by natural means.

3.10 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash and debris, and dispose of it off Owner's property.

END OF SECTION 02220

SECTION 02361 - TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes soil treatment for termite control.

1.3 SUBMITTALS

- A. Product data and application instructions.
- B. Certification that products used comply with U.S. Environmental Protection Agency (EPA) regulations for termiticides.

1.4 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for preparing substrate and application.
- B. Engage a professional pest control operator who is licensed according to regulations of governing authorities to apply soil treatment solution.
- C. Use only termiticides that bear a federal registration number of the EPA and are approved by local authorities having jurisdiction.

1.5 JOB CONDITIONS

- A. Restrictions: Do not apply soil treatment solution until excavating, filling, and grading operations are completed, except as otherwise required in construction operations.
- B. To ensure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

1.6 WARRANTY

- A. Warranty: Furnish written warranty, executed by Applicator and Contractor, certifying that applied soil termiticide treatment will prevent infestation of subterranean termites. If subterranean termite activity is discovered during warranty period, Contractor will re-treat soil and repair or replace damage caused by termite infestation.
- B. Warranty Period: 5 years from date of Substantial Completion.
- C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT SOLUTION

- A. General: Use an emulsible, concentrated termiticide that dilutes with water, specially formulated to prevent termites infestation. Fuel oil will not be permitted as a diluent. Provide a solution consisting of one of following chemical elements.

- B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Chloropyrifos:
 - a. Dursban TC, Dow Chemical Co.
- C. Dilute with water to concentration level recommended by manufacturer.
- D. Other solutions may be used as recommended by Applicator if approved for intended application by local authorities having jurisdiction. Use only soil treatment solutions that are not harmful to plants.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Surface Preparation: Remove foreign matter that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicants may be applied before placing compacted fill under slabs if recommended by toxicant manufacturer.
- B. Application Rates: Apply soil treatment solution as follows:
 - 1. Under slab-on-grade structures, treat soil before concrete slabs are placed, using the following application rates:
 - a. Apply 4 gallons of chemical solution per 10 linear feet to soil in critical areas under slab, including entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers.
 - b. Apply 1 gallon of chemical solution per 10 sq. ft. as an overall treatment under slab and attached slab areas where fill is soil or unwashed gravel. Apply 1-1/2 gallon of chemical solution per 10 sq. ft. to areas where fill is washed gravel or other coarse absorbent material.
 - c. Apply 4 gallons of chemical solution per 10 linear feet of trench for each 12 inches of depth from grade to footing, along outside edge of building. Dig a trench 6 to 8 inches wide along outside of foundation to a depth of not less than 12 inches. Punch holes to top of footing at not more than 12 inches o.c. and apply chemical solution. Mix chemical solution with the soil as it is being replaced in the trench.
- C. Post signs in areas of application to warn workers that soil termiticide treatment has been applied. Remove signs after areas are covered by other construction.
- D. Reapply soil treatment solution to areas disturbed by subsequent excavation, landscape grading, or other construction activities following application.

END OF SECTION

SECTION 02577 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Pavement-marking paint.
- B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate dedicated handicapped spaces with international graphics symbol.
- C. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

1.3 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings" Review methods and procedures related to asphalt paving including, but not limited to, the following:
 - 1. Review condition of substrate and preparatory work performed by other trades.
 - 2. Review requirements for protecting pavement markings work, including restriction of traffic during installation period and for remainder of construction period.
 - 3. Review forecasted weather conditions and procedures for coping with unfavorable conditions.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location and within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.5 PROJECT CONDITIONS

- A. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

- A. Pavement-Marking Paint: Alkyd-resin type, ready-mixed, complying with FS TT-P-115, Type I, or AASHTO M-248, Type N.
 - 1. Color: White.
- B. Glass Beads: AASHTO M-247.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to for pavement marking.
- B. Notify Architect in writing of any unsatisfactory conditions. Do not begin paving installation until these conditions have been satisfactorily corrected.

3.2 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to cure for 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.

- D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
 - 1. Broadcast glass spheres uniformly into wet pavement markings at a rate of 6 lb/gal.

3.3 SCHEDULE

- A. Parking stall striping, directional emblems, restricted parking zone striping, disabled accessibility paths: White.
- B. Disabled parking emblems: Blue with white copy.
- C. Fire lanes: Red with white copy.

END OF SECTION

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with fly ash.

1.4 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mix water to be withheld for later addition at Project site.
- C. Steel Reinforcing Placement Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
- D. Welding Certificates: Copies of certificates for welding procedures and personnel.
- E. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Cementitious materials and aggregates.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Admixtures.
 - 4. Curing materials.
 - 5. Bonding agents.
 - 6. Vapor retarders.
 - 7. Joint-filler strips.
 - 8. Repair materials.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
 - 1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.
- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

- D. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code-Reinforcing Steel."
- E. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
 - 1. ACI 301, "Specification for Structural Concrete" and "Lightweight Concrete".
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 - 3.

1.6 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer and Rustication Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
- D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of the exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter in concrete surface.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.
- B. Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60 (Grade 420). Cut bars true to length with ends square and free of burrs.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I/II.
- B. Fly Ash: ASTM C 618, Class C.
- C. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
 - 1. Class: Negligible weathering region, but not less than 1N.
 - 2. Nominal Maximum Aggregate Size: 1-1/2 inches (38 mm).
 - 3. Nominal Maximum Aggregate Size: 3/4 inch (19 mm) where indicated.
- D. Water: Potable and complying with ASTM C 94.
- E. Lightweight Aggregate: ASTM C 330, 1-inch (25 mm), 3/8-inch (10 mm) where indicated.

2.5 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
- D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
- E. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.6 VAPOR RETARDERS

- A. Vapor Retarder: ASTM E 1745, Class C, of one of the following materials; or polyethylene sheet, ASTM D 4397, not less than 15 mils thick:
 - 1. Nonwoven, polyester-reinforced, polyethylene coated sheet; 15 mils thick. (Note: This thickness exceeds the requirements given in the Soils Report, is the same as given in the Structural Drawings and this thickness should be the one which governs.)
- B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a No. 4 (4.75-mm) sieve and 10 to 30 percent passing a No. 100 (0.15-mm) sieve; meeting deleterious substance limits of ASTM C 33 for fine aggregates.
- C. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (38-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 22 percent solids.
- G. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Evaporation Retarder:

- a. Cimfilm; Axim Concrete Technologies.
 - b. Finishing Aid Concentrate; Burke Group, LLC (The).
 - c. Spray-Film; ChemMasters.
 - d. Aquafilm; Conspec Marketing & Manufacturing Co., Inc.
 - e. Sure Film; Dayton Superior Corporation.
 - f. Eucobar; Euclid Chemical Co.
 - g. Vapor Aid; Kaufman Products, Inc.
 - h. Lambco Skin; Lambert Corporation.
 - i. E-Con; L&M Construction Chemicals, Inc.
 - j. Confilm; Master Builders, Inc.
 - k. Waterhold; Metalcrete Industries.
 - l. Rich Film; Richmond Screw Anchor Co.
 - m. SikaFilm; Sika Corporation.
 - n. Finishing Aid; Symons Corporation.
 - o. Certi-Vex EnvioAssist; Vexcon Chemicals, Inc.
2. Clear, Waterborne, Membrane-Forming Curing Compound:
- a. AH Clear Cure WB; Anti-Hydro International, Inc.
 - b. Klear Kote WB II Regular; Burke Chemicals.
 - c. Safe-Cure & Seal 20; ChemMasters.
 - d. High Seal; Conspec Marketing & Manufacturing Co., Inc.
 - e. Safe Cure and Seal; Dayton Superior Corporation.
 - f. Aqua Cure VOX; Euclid Chemical Co.
 - g. Cure & Seal 309 Emulsion; Kaufman Products Inc.
 - h. Glazecote Sealer-20; Lambert Corporation.
 - i. Dress & Seal WB; L&M Construction Chemicals, Inc.
 - j. Vocomp-20; W. R. Meadows, Inc.
 - k. Metcure; Metalcrete Industries.
 - l. Cure & Seal 150E; Nox-Crete Products Group, Kinsman Corporation.
 - m. Rich Seal 14 percent E; Richmond Screw Anchor Co.
 - n. Kure-N-Seal WB; Sonneborn, Div. of ChemRex, Inc.
 - o. Florseal W.B.; Sternson Group.
 - p. Cure & Seal 14 percent E; Symons Corporation.
 - q. Seal Cure WB 150; Tamms Industries Co., Div. of LaPorte Construction Chemicals of North America, Inc.
 - r. Hydro Seal; Unitex.
 - s. Starseal 309; Vexcon Chemicals, Inc.

2.8 RELATED MATERIALS

- A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

2.9 REPAIR MATERIALS

- A. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6 mm).
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5700 psi (39 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
 - 1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.
- C. Grade Beams: Proportion normal-weight concrete mix as follows:
 - 1. Compressive Strength (28 Days): 4000 psi (27.6 MPa).
 - 2. Maximum Slump: 4 inches (100 mm).
 - 3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches (200 mm) after admixture is added to concrete with 2- to 4-inch (50- to 100-mm) slump.
- D. Slab-on-Grade and Cement Concrete Pavement: Proportion normal-weight concrete mix as follows:
 - 1. Compressive Strength (28 Days): 3000 psi (20.7 MPa).
 - 2. Minimum Cementitious Materials Content: 470 lb/cu. yd. (279 kg/cu. m).
 - 3. Maximum Slump: 5 inches (125 mm).
 - 5. Maximum Water-Cementitious Materials Ratio: 0.50 for concrete required to have low water permeability.
- E. Topping Slabs and Suspended Slabs: Proportion normal-weight concrete mix as follows:
 - 1. Compressive Strength (28 Days): 4000 psi (27.6 MPa).
 - 2. Maximum Slump: 5 inches (125 mm).
 - 3. Maximum Water-Cementitious Materials Ratio: 0.45 for concrete required to have low water permeability.
- F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 20 percent.
- G. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 2 to 4 percent, unless otherwise indicated.
- H. Air Content for Topping Slabs and Suspended Slabs: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1.5 percent, unless otherwise indicated:
 - 1. Air Content: 5 percent for 3/4-inch- (19-mm-) nominal maximum aggregate size.
- I. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- J. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete for parking structure slabs.
- K. Suspended Slabs: Proportion structural lightweight concrete mixture as follows:
 - 1. Compressive strength (28 days): 3000 psi (20.7 Mpa).
 - 2. Maximum slump: 4 1/2 inches (100 mm).
 - 3. Maximum Water-Cementitious Materials Ratio: 0.45.

2.11 FABRICATING REINFORCEMENT

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

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch (3 mm) where exposed to public view.
 - 2. Class B, 1/4 inch (6 mm) where not exposed in the completed construction.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
 - 1. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Install horizontal rustications at the intersection of vertical concrete surfaces in different placements and elsewhere as shown.
- J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- M. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

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

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork, for sides of beams, walls, plinths, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.
- B. Leave formwork, for slab soffits and other structural elements, that supports weight of concrete in place until concrete has achieved the following:
 - 1. 28-day design compressive strength.
- C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

- A. Comply with ACI 318 (ACI 318M), ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.
- B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

- A. Vapor Retarder: Where indicated, place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.

3.6 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
- C. Accurately position, support and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.

2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 4. Locate horizontal joints in walls and plinths at underside of floors, slabs, beams, and girders and at the top of pile caps or floor slabs.
 5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 2. Terminate full-width joint-filler strips not less than 1/2 inch (12 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.
1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
- F. Contraction Joints in Topping Slabs-on-Precast Double Tees: Form weakened-plane contraction joints aligning with the joint between double tees, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
- G. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- H. Before placing concrete, water may be added at Project site, subject to limitations of ACI 301 and as indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mix.
- I. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

- J. Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints. Do not drop concrete more than 60 inches (1500 mm) in forms.
1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.
- K. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- L. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- M. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch (3 mm) in height.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
 2. Do not apply rubbed finish to smooth-formed finish.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with recommendations in ACI 302.1R for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces indicated and to surfaces to receive trowel finish.
- C. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with paint, or another thin film-finish coating system
 2. Finish and measure surface so gap at any point between concrete surface and an unlevelled freestanding 10-foot- (3.05-m-) long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed the following:
 - a. 1/4 inch (6.4 mm).
- D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
- E. Slip-Resistive Aggregate Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
1. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
 2. After broadcasting and tamping, apply trowel finish.
 3. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose slip-resistive aggregate.

3.10 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.11 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - 2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.12 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least three months. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid epoxy joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.2-mm) sieve, using only enough water for handling and placing.

- C. Repairing Formed Surfaces: Surface defects include texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 - 2. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - 4. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch (19 mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 - 5. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

- a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.
 7. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
- C. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
- D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

END OF SECTION

SECTION 03410 - STRUCTURAL PRECAST CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. Extent of structural precast concrete work is shown on drawings and in schedules.
- B. Structural precast concrete includes the following:
 - 1. Long-span (double-T) units.
 - 2. Structural framing units.
 - a. Interior girder units.
 - b. Column units.

1.3 RELATED WORK

- A. Cast-in-place concrete is specified in another Division-3 section.
- B. Joint sealants and backing are specified in Division 7.
- C. Applied finishes are specified in Division 9.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except as otherwise indicated:
 - 1. ACI 301 "Specifications for Structural Concrete for Buildings".
 - 2. ACI 318 "Building Code Requirements for Reinforced Concrete".
 - 3. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".
 - 4. Prestressed Concrete Institute MNL 116, "Manual for Quality Control for Plants and Production of Precast Concrete Products".
- B. Fabricator Qualifications: Firms which have 5 or more years successful experience in fabrication of precast concrete units similar to units required for this project will be acceptable. Fabricator must have sufficient production capacity to produce required units without causing delay in work.
 - 1. Fabricator must be producer member of the Prestressed Concrete Institute (PCI) and/or participate in its Plant Certification Program.
- C. Fabrication Qualifications: Produce precast concrete units at fabricating plant engaged primarily in manufacturing of similar units, unless plant fabrication or delivery to project site is impractical.
- D. Fire-resistance Rated Precast Units: Where precast concrete units are shown or scheduled as requiring a fire-resistance classification, provide units tested and listed by UL in "Fire Resistance Directory", or with each unit bearing UL label and marking.

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications and instructions for manufactured materials and products. Include manufacturer's certifications and laboratory test reports as required.
- B. Shop Drawings: Submit shop drawings consisting of 2 sets of prints and one set of reproducibles showing complete information for fabrication and installation of precast concrete

units. Indicate member dimensions and cross-section; location, size and type of reinforcement, including special reinforcement and lifting devices necessary for handling and erection.

- C. Indicate layout, dimensions, and identification of each precast unit corresponding to sequence and procedure of installation. Indicate welded connections by AWS standard symbols. Detail inserts, connections, and joints, including accessories and construction at openings in precast units.
- D. Provide location and details of anchorage devices that are to be embedded in other construction. Furnish templates if required for accurate placement.
- E. Include erection procedure for precast units and sequence of erection.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver precast concrete units to project site in such quantities and at such times to assure continuity of installation. Store units at project site to prevent cracking, distortion, staining, or other physical damage, and so that markings are visible. Lift and support units at designated lift points.
- B. Deliver anchorage items which are to be embedded in other construction before start of such work. Provide setting diagrams, templates, instructions and directions as required for installation.

PART 2 - PRODUCTS

2.1 FORMWORK

- A. Provide forms and, where required, form facing materials of metal, plastic, wood, or other acceptable material that is non-reactive with concrete and will produce required finish surfaces.
- B. Accurately construct forms, mortar-tight, of sufficient strength to withstand pressures due to concrete placing operations, temperature changes, and when prestressed, pretensioning and detensioning operations. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified in PCI MNL 116.
- C. Unless forms for plant-manufactured prestressed concrete units are stripped prior to detensioning, design forms so that stresses are not induced in precast units due to deformation of concrete under prestress or to movement during detensioning.

2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60, unless otherwise indicated.
- B. Welded Wire Fabric: ASTM A 185.
- C. Welded Deformed Steel Wire Fabric: ASTM A 497.
- D. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing, complying with CRSI recommendations.
- E. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).

2.3 PRESTRESSING TENDONS

- A. Uncoated, 7-wire stress-relieved strand complying with ASTM A 416. Use Grade 270.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type III.
- B. Use only one brand and type of cement throughout the project, unless otherwise acceptable to Architect.
- C. Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.
 - 1. Local aggregates not complying with ASTM C 33, but which have shown by special test or actual service to produce concrete of adequate strength and durability, may be used when acceptable to Architect.
- D. Lightweight Aggregate: ASTM C 330.
- E. Water: Drinkable and free from foreign materials in amounts harmful to concrete and embedded steel.
- F. Air-Entraining Admixture: ASTM C 260.
- G. Water-Reducing Admixture: ASTM C 494, Type A.

2.5 CONNECTION MATERIALS

- A. Steel Plates: Structural quality, hot-rolled carbon steel, ASTM A 283, Grade C.
- B. Steel Shapes: ASTM A 36.
- C. Anchor Bolts: ASTM A 307, low-carbon steel bolts, regular hexagon nuts and carbon steel washers.
- D. Finish of Steel Units: Exposed units galvanized per ASTM A 153; others painted with rust-inhibitive primer.
- E. Bearing Pads: Provide bearing pads for precast concrete units as required. Elastomeric Pads: Vulcanized, chloroprene elastomeric compound, molded to size or cut from a molded sheet, 50 - 60 shore A durometer.
- F. Laminated Fabric-Rubber Pads: Preformed, unused synthetic fibers and new, unvulcanized rubber. Surface hardness of 70 - 80 shore A durometer.
- G. Frictionless Pads: Tetrafluoroethylene (TFE), with glass fiber reinforcing as required for service load bearing stress.
- H. Tempered Hardboard Pads: PS 58, smooth both sides.
- I. Accessories: Provide clips, hangers, and other accessories required for installation of project units and for support of subsequent construction or finishes.

2.6 GROUT MATERIALS

- A. Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 404. Mix at ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum water required for placement and hydration.
- B. Metallic, Shrinkage-Resistant Grout: Premixed, factory-packaged ferrous aggregate grouting compound.
 - 1. Available Products: Subject to compliance with requirements, products may be incorporated in the work to include, but are not limited to, the following:
 - a. Firmix; Euclid Chemical Co.
 - b. Embeco 153; Master Builders.
 - c. Ferrolith G; Sonneborn/Contech.
 - d. Irontox; Toch Brothers.

- e. Kemox C; Sika Chemical.
 - f. Vibra-Foil; W.R. Grace.
- C. Non-Metallic Shrinkage-Resistant Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CRD-C621.
- 1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
 - a. Euco N.S.; Euclid Chemical Co.
 - b. Crystex; L&M Construction Chemicals.
 - c. Masterflow 713; Master Builders.
 - d. Five Star Grout; U.S. Grout Corp.
 - e. Upcon, Upco Chem. Div., USM Corp.
 - f. Propak; Protex Industries, Inc.

2.7 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes for each type of concrete required.
 - 1. Design mixes may be prepared by an independent testing facility or by qualified precast manufacturing plant personnel, at precast manufacturer's option.
- B. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project for each type of concrete required, complying with ACI 318.
- C. Produce standard-weight concrete consisting of specified portland cement, aggregates, admixtures, and water to produce the following properties:
 - 1. Compressive strength; 5,000 psi minimum at 28 days.
 - 2. Minimum release strength for prestressed units: 3,500 psi.
- D. Produce lightweight concrete consisting of specified portland cement, aggregates, admixtures, and water to produce the following properties:
 - 1. Compressive strength; 5,000 psi minimum at 28 days.
 - 2. Air-dry density; not less than 90 nor more than 115 lbs. per cu. ft.
 - 3. Minimum release strength for prestressed units: 3,500 psi.
- E. Cure compression test cylinders using same methods as used for precast concrete work.
- F. Submit written reports to Architect of proposed mix for each type of concrete at least 15 days prior to start of precast unit production. Do not begin concrete production until mixes and evaluations have been reviewed by Architect.
- G. Adjustment to Concrete Mixes: Mix design adjustments may be requested when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by Architect before using in the work.
- H. Admixtures:
 - 1. Use air-entraining admixture in concrete, unless otherwise indicated.
 - 2. Use water-reducing admixtures in strict compliance with manufacturer's directions. Admixtures to increase cement dispersion, or provide increased workability for low-slump concrete, may be used subject to Architect's acceptance.
 - 3. Use amounts as recommended by admixture manufacturer for climatic conditions prevailing at time of placing. Adjust quantities of admixtures as required to maintain quality control.

2.8 FABRICATION

- A. General: Fabricate precast concrete units complying with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances of PCI MNL-116, and as specified for types of units required.
- B. Ready-mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.
 - 1. Delete references for allowing additional water to be added to batch for material with insufficient slump. Addition of water to batch will not be permitted.
 - 2. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.
 - 3. When the air temperature is between 85°F (30°C) and 90°F (32°C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90°F (32°C), reduce mixing and delivery time to 60 minutes.
- C. Built-in Anchorages: Accurately position built-in anchorage devices and secure to formwork. Locate anchorages where they do not affect position of main reinforcement or placing of concrete. Do not relocate bearing plates in units unless acceptable to Architect.
- D. Cast holes for openings larger than 4" diameter or 4" square in accordance with final shop drawings. Other smaller holes will be field cut by trades requiring them, as acceptable to Architect.
- E. Coat surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's instructions.
- F. Clean reinforcement of loose rust and mill scale, earth and other materials which reduce or destroy bond with concrete.
- G. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.
- H. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- I. Pretensioning of tendons for prestressed concrete may be accomplished either by single strand tensioning method or multiple-strand tensioning method. Comply with PCI MNL-116 requirements.
- J. Place concrete in a continuous operation to prevent formation of seams or planes of weakness in precast units, complying with requirements of ACI 304. Thoroughly consolidate placed concrete by internal and external vibration without dislocation or damage to reinforcement and built-in items.
- K. Identification: Provide permanent markings to identify pick-up points and orientation in structure, complying with markings indicated on final shop drawings. Imprint date of casting on each precast unit on a surface which will not show in finished structure.
- L. Curing by low-pressure steam, by steam vapor, by radiant heat and moisture, or other similar process may be employed to accelerate concrete hardening and to reduce curing time.
- M. Delay detensioning of prestressed units until concrete has attained at least 70% of design stress, as established by test cylinders.
 - 1. If concrete has been heat-cured, perform detensioning while concrete is still warm and moist, to avoid dimensional changes which may cause cracking or undesirable stresses in concrete.

2. Detensioning of pretensioned tendons may be accomplished either by gradual release of tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
- N. Finish of Formed Surfaces: Provide finishes for formed surfaces of precast concrete as indicated for each type of unit as specified by the Architect, and as follows:
1. Standard Finish: Normal plant run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal form joint marks, and minor chips and spalls will be tolerated, but no major or unsightly imperfections, honeycomb, or structural defects will be permitted. Remove fins and large protrusions and fill large holes. Rub or grind ragged edges. Faces to be true, well-defined surfaces.
- O. Finish of Unformed Surfaces: Apply trowel finish to unformed surfaces unless otherwise indicated. Consolidate concrete, bring to proper level with a straightedge, float, and trowel to a smooth, uniform finish.
1. Apply scratch finish to precast units which will receive concrete topping after installation. Following initial strikeoff, transversely scarify surface to provide ridges approximately 1/4" deep.

2.9 PRECAST UNITS

- A. Type: Provide type of precast units as indicated on drawings and as follows:
1. Plant fabricated, precast prestressed long span concrete units, produced under rigid, factory-inspected process acceptable to Architect.
 2. Precast prestressed concrete structural framing units produced under a rigidly inspected process.
- B. Furnish units which are free of voids or honeycomb, with straight true edges and surfaces.
- C. Provide "Standard Finish" units unless otherwise indicated by Architect.
1. Where ends of strands will not be enclosed or covered, cut flush and cover with high strength mortar bonded to unit with epoxy resin bonding agent.
 2. Where used as floor members, provide broomed or raked top finish for bonding with concrete floor topping.
- D. Fabrication: Manufacturer units of concrete materials which will provide a minimum 3,500 psi compressive strength at time of initial prestress and a 28-day compressive strength of 5,000 psi.
- E. Adequately reinforce slab units to resist transporting and handling stresses.
- F. Include cast-in weld plates where required for anchorage or lateral bracing to other structural members.
- G. Cooperate with other trades for installation of items to be cast-in hollow slab units. Notify Contractor of items not received in ample time so as to not delay work.
- H. Provide headers of structural steel shapes for openings as indicated on drawings.
- I. Provide block-outs for openings in accordance with design drawings or precast unit manufacturer's recommendations.

2.10 LONG-SPAN UNITS

- A. Type: Plant fabricated, precast prestressed concrete units, produced under rigid, factory-inspected process acceptable to Architect.
- B. Furnish units which are free of voids or honeycomb, with straight true edges and surfaces.
- C. Provide "Standard Finish" units as specified.

- D. Where ends of strands will not be enclosed or covered, cut flush and cover with high strength mortar bonded to unit with epoxy resin bonding agent.
 - 1. Where used as floor members, provide broomed or raked top finish for bonding with concrete floor topping.
- E. Adequately reinforce units to resist transporting and handling stresses.
- F. Include cast-in weld plates where required for anchorage or lateral bracing to structural steel and adjacent precast members.
- G. Cooperate with other trades for installation of items to be cast in the long-span units. Notify Contractor of items not received in ample time so as to not delay work.
- H. Provide block-outs for openings in accordance with design drawings or precast unit manufacturer's recommendations.

2.11 STRUCTURAL FRAMING UNITS

- A. Type: Precast prestressed concrete units produced under a rigidly inspected process.
- B. Furnish units which are free of voids or honeycomb, with straight true edges and surfaces.
- C. Provide "Standard Finish" units as specified.
 - 1. Where ends of strands will not be enclosed or covered, cut flush and cover with a high strength mortar bonded with an epoxy resin bonding agent.
- D. Fabrication: Manufacture units of concrete materials which will provide a minimum 3,500 psi compressive strength at time of initial prestress and a 28-day strength of 5,000 psi.
- E. Adequately reinforce units to resist transporting and handling stresses.
- F. Include cast-in weld plates where required for anchorage or lateral bracing to other supporting members.
- G. Cooperate with other trades for the installation of items to be cast-in precast structural framing units. Notify Contractor of items not received in ample time so as to not delay work.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Bearing Pads: Install flexible bearing pads where indicated, as precast units are being erected. Set pads on level, uniform bearing surfaces and maintain in correct position until precast units are placed.
- B. Welding: Perform welding in compliance with AWS D 1.1, including qualification of welders.
- C. Protect units from damage by field welding or cutting operations and provide non-combustible shield as required.
- D. Repair damaged metal surfaces by cleaning and applying a coat of liquid galvanizing repair compound to galvanized surfaces and compatible primer to painted surfaces.
- E. Powder-Actuated Fasteners: Do not use powder-actuated fasteners for surface attachment of accessory items in precast, prestressed unit unless otherwise accepted by precast manufacturer.
- F. Installation Tolerances: Install precast units without exceeding following tolerance limits:
 - 1. Variations from Plumb: 1/4" in any 20' run or story height; 1/2" total in any 40' or longer run.
 - 2. Variations from Level or Elevation: 1/4" in any 20' run; 1/2" in any 40' run; total plus or minus 1/2" at any location.

3. Variation from Position in Plan: Plus or minus 1/2" maximum at any location.
 4. Offsets in Alignment of Adjacent Members at Any Joint: 1/16" in any 10' run; 1/4" maximum.
- G. Grouting Connections and Joints: After precast concrete units have been placed and secured, grout open spaces at connection and joints as follows:
1. Cement grout consisting of 1 part portland cement, 2-1/2 parts sand, and only enough water to properly mix and for hydration.
 2. Shrinkage-resistant grout consisting of premixed compound and water to provide a flowable mixture without segregation or bleeding.
 3. Provide forms or other acceptable method to retain grout in place until sufficiently hard to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, plumb, and level with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it hardens.

3.2 PLANT QUALITY CONTROL EVALUATIONS

- A. The Owner may employ a separate testing laboratory to evaluate precast manufacturer's quality control and testing methods.
- B. The precast manufacturer shall allow Owner's testing facility access to materials storage areas, concrete production equipment, and concrete placement and curing facilities. Cooperate with Owner's testing laboratory and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.
- C. Dimensional Tolerances: Units having dimensions smaller or greater than required, and outside specified tolerance limits, will be subject to additional testing as herein specified.
1. Precast units having dimensions greater than required will be rejected if appearance or function of the structure is adversely affected, or if larger dimensions interfere with other construction. Repair, or remove and replace rejected units as required to meet construction conditions.
- D. Strength of Units: The strength of precast concrete units will be considered potentially deficient if the manufacturing processes fail to comply with any of the requirements which may affect the strength of the precast units, including the following conditions:
1. Failure to meet compressive strength tests requirements.
 2. Reinforcement, and pretensioning and detensioning of tendons of prestressed concrete, not conforming to specified fabrication requirements.
 3. Concrete curing, and protection of precast units against extremes in temperature, not as specified.
 4. Precast units damaged during handling and erection.
- E. Testing Precast Units: When there is evidence that strength of precast concrete units does not meet specification requirements, the concrete testing service shall take cores drilled from hardened concrete for compressive strength determination, complying with ASTM C 42 and as follows:
1. Take at least 3 representative cores from precast units of suspect strength, from locations directed by Architect.
 2. Test cores in a saturated-surface-dry condition per ACI 318 if concrete will be wet during use of completed structure.
 3. Test cores in an air-dry condition per ACI 318 if concrete will be dry during use of completed structure.
 4. Strength of concrete for each series of cores will be considered satisfactory if their average compressive strength is at least 85% of 28-day design compressive strength.
 5. Tests results will be made in writing on same day that tests are made, with copies to Architect, Contractor, and precast manufacturer. Include in test reports the project

identification name and number, date, name of precast concrete manufacturer, name of concrete testing service, identification letter, number, and type of member or members represented by core tests, design compressive strength, compression breaking strength and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizontal plan of concrete as placed, and moisture condition of core at time of testing.

6. Patching: Where core test results are satisfactory and precast units are acceptable for use in work, fill core holes solid with patching mortar, and finish to match adjacent concrete surfaces.
7. Defective Work: Precast concrete units which do not conform to specified requirements, including strength, tolerances, and finishes, shall be replaced with precast concrete units that meet requirements of this section. Contractor shall also be responsible for cost of corrections to other work affected by or resulting from corrections to precast concrete work.

END OF SECTION

SECTION 04810 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes unit masonry assemblies consisting of the following:
 - 1. Concrete masonry units.
 - 2. Mortar and grout.
 - 3. Reinforcing steel.
 - 4. Masonry joint reinforcement.
 - 5. Ties and anchors.
 - 6. Miscellaneous masonry accessories.

1.3 DEFINITIONS

- A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops the following net-area compressive strengths (f'm) at 28 days. Determine compressive strength of masonry from net-area compressive strengths of masonry units and mortar types according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
- B. Provide unit masonry that develops the following net-area compressive strengths (f'm) at 28 days. Determine compressive strength of masonry by testing masonry prisms according to ASTM C 1314.
 - 1. For Concrete Unit Masonry: f'm = 2500 psi.

1.5 SUBMITTALS

- A. Product Data: For each different masonry unit, accessory, and other manufactured product specified.
- B. Samples for Verification: For the following:
 - 1. Full-size units for each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.
 - 2. Colored mortar Samples for each color required, showing the full range of colors expected in the finished construction. Make samples using the same sand and mortar ingredients to be used on Project.
 - 3. Weep holes/vents in color to match mortar color.
 - 4. Accessories embedded in the masonry.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- D. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
 - 1. Each type of masonry unit required.

- a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.
 - b. Include test results, measurements, and calculations establishing net-area compressive strength of masonry units.
- 2. Mortar complying with property requirements of ASTM C 270.
- 3. Grout mixes complying with compressive strength requirements of ASTM C 476. Include description of type and proportions of grout ingredients.
- E. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Each type of masonry unit required.
 - a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.
 - b. Include test data, measurements, and calculations establishing net-area compressive strength of masonry units.
 - 2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
 - 3. Each combination of masonry unit type and mortar type. Include statement of net-area compressive strength of masonry units, mortar type, and net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602. Each material and grade indicated for reinforcing bars.
 - 4. Each type and size of joint reinforcement.
 - 5. Each type and size of anchor, tie, and metal accessory.
- F. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.
- D. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by Owner. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
 - 1. Concrete Masonry Unit Test: For each concrete masonry unit indicated, per ASTM C 140.
 - 2. Prism Test: For each type of wall construction indicated, per ASTM C 1314.
 - 3. Mortar Test: For mortar properties per ASTM C 270.
 - 4. Grout Test: For compressive strength per ASTM C 1019.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
 - 1. Protect Type I concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of **24 inches** down both sides and hold cover securely in place.
 - 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of **24 inches** down face next to unconstructed wythe and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is **40 deg F** and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Concrete Masonry Units:
 2. Portland Cement, Mortar Cement, Masonry Cement, and Lime:
 - a. TXI (Texas Industries, Inc)
 - b. Lone Star Industries
 3. Mortar Pigments:
 - a. Lambert
 4. Joint Reinforcement, Ties, and Anchors:
 - a. Dur-O-Wal, Inc.
 - b. Heckman Building Products, Inc.
 - c. Hohmann & Barnard, Inc.
 - d. Masonry Reinforcing Corp. of America.
 - e. National Wire Products Industries.
 - f. Southern Construction Products.

2.2 CONCRETE MASONRY UNITS

- A. General: Provide shapes indicated and as follows:
 1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
 2. Provide bullnose units for outside corners, unless otherwise indicated.
 3. Provide square-edged units for outside corners, unless indicated as bullnose.
- B. Concrete Masonry Units: ASTM C 90 and as follows:
 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi.
 2. Weight Classification: Normal weight.
 3. Provide Type I, moisture-controlled units.
 4. Provide Type II, nonmoisture-controlled units.
 5. Size (Width): Manufactured to the following dimensions:
 - a. 6 inches nominal; 5-5/8 inches actual.
 - b. 8 inches nominal; 7-5/8 inches actual.
 6. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.
 - a. Where units are to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.
 - b. Where units are to be left exposed, provide color and texture matching the range represented by Architect's sample.

2.3 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.
- D. Mortar Cement: ASTM C 1329.
- E. Masonry Cement: ASTM C 91.
 - 1. For pigmented mortar, use a colored cement formulation as required to produce the color indicated or, if not indicated, as selected from manufacturer's standard formulations.
 - a. Pigments shall not exceed 10 percent of portland cement by weight for mineral oxides nor 2 percent for carbon black.
 - b. Pigments shall not exceed 5 percent of mortar cement by weight for mineral oxides nor 1 percent for carbon black.
 - 2. For colored-aggregate mortar, use natural color or white cement as necessary to produce required mortar color.
- F. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 - 1. White-Mortar Aggregates: Natural white sand or ground white stone.
 - 2. Colored-Mortar Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.
- G. Aggregate for Grout: ASTM C 404.
- H. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
- I. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units (and approved for such use by manufacturer of the units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.
- J. Refractory Mortar Mix: Ground fireclay or non-water-soluble, calcium aluminate, refractory mortar; complying with ASTM C 199, medium duty; or an equivalent product acceptable to authorities having jurisdiction.
- K. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.
- L. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
- M. Water: Potable.
- N. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Colored Masonry Cement:
 - a. Brixment-in-Color; Essroc Materials, Inc.
 - b. Centurion Colorbond; Lafarge Corporation.
 - c. Lehigh Custom Color Masonry Cement; Lehigh Portland Cement Co.
 - d. Flamingo Color Masonry Cement; Riverton Corporation (The).

2. Colored Portland Cement-Lime Mix:
 - a. Color Mortar Blend; Glen-Gery Corporation.
 - b. Centurion Colorbond PL; Lafarge Corporation.
 - c. Lehigh Custom Color Portland/Lime; Lehigh Portland Cement Co.
 - d. Riverton Portland Cement Lime Custom Color; Riverton Corporation (The).
 3. Mortar Pigments:
 - a. True Tone Mortar Colors; Davis Colors.
 - b. Centurion Pigments; Lafarge Corporation.
 - c. SGS Mortar Colors; Solomon Grind-Chem Services, Inc.
 4. Cold-Weather Admixture:
 - a. Accelguard 80; Euclid Chemical Co.
 - b. Morset; Grace: W.R. Grace & Co.
 5. Water-Repellent Admixture:
 - a. Dry-Block Mortar Admixture; Grace: W.R. Grace & Co.
- O. Products: Subject to compliance with requirements, provide one of the following:
1. Mortar Cement:
 - a. Magnolia Superbond Mortar Cement; Blue Circle Cement.
 - b. Lafarge Mortar Cement; Lafarge Corporation.

2.4 REINFORCING STEEL

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; ASTM A 616/A 616M, including Supplement 1; or ASTM A 617/A 617M, **Grade 60**.
- B. Epoxy-Coated Reinforcing Steel: ASTM A 615/A 615M, **Grade 60**; epoxy coated to comply with ASTM A 775/A 775M.

2.5 MASONRY JOINT REINFORCEMENT

- A. General: ASTM A 951 and as follows:
 1. Mill galvanized, carbon-steel wire for interior walls.
 2. Hot-dip galvanized, carbon-steel wire for exterior walls.
 3. Hot-dip galvanized, carbon-steel wire for both interior and exterior walls.
 4. Hot-dip galvanized, carbon-steel wire for interior walls.
 5. Stainless-steel wire for exterior walls.
 6. Wire Size for Side Rods: W2.8 or **0.188-inch** diameter.
 7. Wire Size for Cross Rods: W2.8 or **0.188-inch** diameter.
 8. Provide in lengths of not less than **10 feet**, with prefabricated corner and tee units where indicated.
- B. For single-wythe masonry, provide either ladder or truss type with single pair of side rods and cross rods spaced not more than **16 inches** o.c.
- C. For multiwythe masonry, provide types as follows:
 1. Ladder type with perpendicular cross rods spaced not more than **16 inches** o.c. and 1 side rod for each face shell of hollow masonry units more than **4 inches** in width, plus 1 side rod for each wythe of masonry **4 inches** or less in width.
 2. Tab type with single pair of side rods spaced for embedment within each face shell of backup wythe and rectangular box-type cross ties spaced not more than **16 inches** o.c. Size ties to extend at least halfway through outer wythe but with at least **5/8-inch** cover on outside face.
 3. Adjustable (2-piece) type with single pair of side rods and cross ties spaced not more than **16 inches** o.c. and with separate adjustable veneer ties engaging the cross ties.

Cross ties are either U-shaped with eyes or rectangular. Space side rods for embedment within each face shell of backup wythe and size adjustable ties to extend at least halfway through outer wythe but with at least **5/8-inch** cover on outside face.

- a. Use where indicated and where horizontal joints of facing wythe do not align with those of backup wythe.
- b. Use where facing wythe is of different material than backup wythe.

2.6 TIES AND ANCHORS, GENERAL

- A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless otherwise indicated.
- B. Mill Galvanized Carbon-Steel Wire: ASTM A 82; with **ASTM A 641**, Class 1 coating.
- C. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.
- D. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304 or 316.
- E. Galvanized Steel Sheet: ASTM A 653/A 653M, **G60**, commercial-quality, steel sheet zinc coated by hot-dip process on continuous lines before fabrication.
- F. Steel Sheet, Galvanized after Fabrication: ASTM A 366/A 366M cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153.
- G. Stainless-Steel Sheet: ASTM A 666, Type 304 or 316.
- H. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.7 BENT WIRE TIES

- A. General: Rectangular units with closed ends and not less than **4 inches** wide. Z-shaped ties with ends bent 90 degrees to provide hooks not less than **2 inches** long may be used for masonry constructed from solid units or hollow units laid with cells horizontal.
 1. Where coursing between wythes does not align, use adjustable ties composed of 2 parts; 1 with pintles, the other with eyes; with maximum misalignment of **1-1/4 inches**.
 2. Where wythes are of different materials, use adjustable ties composed of 2 parts; 1 with pintles, the other with eyes; with maximum misalignment of **1-1/4 inches**.
- B. Wire: Fabricate from **3/16-inch**-diameter, hot-dip galvanized steel.

2.8 MISCELLANEOUS ANCHORS

- A. Dovetail Slots: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.0336-inch, galvanized steel sheet.
- B. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:
 - a. Headed bolts.

2.9 RIGID ANCHORS

- A. General: Fabricate from steel bars as follows:
 1. **1-1/2 inches** wide by **1/4 inch** thick by **24 inches** long, with ends turned up **2 inches** or with cross pins.
 2. As indicated.
 3. Finish: Hot-dip galvanized to comply with ASTM A 153.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
 - 1. Styrene-Butadiene-Rubber Compound: ASTM D 2000, Designation M2AA-805.
 - 2. PVC: ASTM D 2287, Type PVC-65406.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch OD by 4 inches long.
- E. Rectangular Plastic Weep/Vent Tubing: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches.
- F. Wicking Material: Cotton or polyester rope, 1/4 to 3/8 inch in diameter, in length required to produce 2-inch exposure on exterior and 18 inches in cavity between wythes.
- G. Aluminum Weep Hole/Vent: One-piece, L-shaped units made from sheet aluminum, designed to fit into a head joint and consisting of a vertical channel with louvers stamped in web and with a top flap to keep mortar out of the head joint; painted to comply with Division 9 Section "Painting," before installation, in color approved by Architect to match that of mortar.
- H. Plastic Weep Hole/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, designed to fill head joint with outside face held back 1/8 inch from exterior face of masonry, in color selected from manufacturer's standard.
- I. Vinyl Weep Hole/Vent: One-piece, offset, T-shaped units made from flexible, injection-molded PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color approved by Architect to match that of mortar.
- J. Cavity Drainage Material: 3/4-inch-thick, free-draining mesh; made from polyethylene strands and shaped to avoid being clogged by mortar droppings.
- K. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.187-inch steel wire, hot-dip galvanized after fabrication.
 - 1. Provide units with either two loops or four loops as needed for number of bars indicated.
- L. Available Products: Subject to compliance with requirements, cavity drainage materials that may be incorporated into the Work include, but are not limited to, the following:

2.11 MASONRY-CELL INSULATION

- A. Loose-Granular Fill Insulation: Perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption).

2.12 MASONRY CLEANERS

- A. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.
- B. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
 - 1. Available Products: Subject to compliance with requirements, products that may be used to clean unit masonry surfaces include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cleaners for Red and Light-Colored Brick Not Subject to Metallic Staining with Mortar Not Subject to Bleaching:
 - 1) 202 New Masonry Detergent; Diedrich Technologies, Inc.
 - 2) Sure Klean No. 600 Detergent; ProSoCo, Inc.

2.13 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
 2. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification.
- D. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification.
 1. Extended-Life Mortar for Unit Masonry: Mortar complying with ASTM C 1142 may be used instead of mortar specified above, at Contractor's option.
 2. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
 3. Limit cementitious materials in mortar for exterior and reinforced masonry to portland cement, mortar cement, and lime.
 4. For reinforced masonry and where indicated, use Type S.
 5. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
 6. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- E. Grout for Unit Masonry: Comply with ASTM C 476.
 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 5 of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 2. Provide grout with a slump of **8 to 11 inches** as measured according to ASTM C 143.
- F. Epoxy Pointing Mortar: Mix epoxy pointing mortar to comply with mortar manufacturer's directions.

2.14 SOURCE QUALITY CONTROL

- A. Owner will engage a qualified independent testing agency to perform source quality-control testing indicated below:
 1. Payment for these services will be made by Owner.
 2. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
- B. Brick Tests: For each type and grade of brick indicated, units will be tested according to ASTM C 67.

- C. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
 4. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.
- D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
1. Mix units from several pallets or cubes as they are placed.

3.3 CONSTRUCTION TOLERANCES

- A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:
- B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than **1/4 inch in 20 feet**, nor **1/2 inch** maximum.
- C. For vertical alignment of exposed head joints, do not vary from plumb by more than **1/4 inch in 10 feet**, nor **1/2 inch** maximum.
- D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than **1/4 inch in 20 feet**, nor **1/2 inch** maximum.
- E. For exposed bed joints, do not vary from thickness indicated by more than plus or minus **1/8 inch**, with a maximum thickness limited to **1/2 inch**. Do not vary from bed-joint thickness of adjacent courses by more than **1/8 inch**.
- F. For exposed head joints, do not vary from thickness indicated by more than plus or minus **1/8 inch**. Do not vary from adjacent bed-joint and head-joint thicknesses by more than **1/8 inch**.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
 - 1. Running bond.
- C. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.
- E. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
- F. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- G. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 3. At fire-rated partitions, install firestopping in joint between top of partition and underside of structure above to comply with Division 7 Section "Firestopping."

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow concrete masonry units as follows:
 - 1. With full mortar coverage on horizontal and vertical face shells.
 - 2. Maintain joint widths indicated, except for minor variations required to maintain bond alignment. If not indicated, lay walls with 3/8-inch joints.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

3.6 CAVITIES

- A. Keep cavities clean of mortar droppings and other materials during construction. Strike joints facing cavities flush.

3.7 MORTAR BEDDING AND JOINTING

- A. Lay hollow masonry units as follows:
 - 1. With full mortar coverage on horizontal and vertical face shells.
 - 2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
 - 3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joints in unit masonry where indicated. Build-in related items as the masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.
- B. Form control joints in concrete masonry as follows:
 - 1. Fit bond-breaker strips into hollow contour in ends of block units on one side of control joint. Fill the resultant core with grout and rake joints in exposed faces.
 - 2. Install preformed control-joint gaskets designed to fit standard sash block.
 - 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake joint.
- C. Control joints:
 - 1. Install where intimated and at the following locations:
 - a. Changes in thickness height or direction.
 - b. Within 4'-0" of corners and offsets.
 - c. At control or expansion joints in structure.
 - d. At each side of opening greater than 24" wide.
 - e. At foundation walls, shelf angles, setbacks and materials expanding at different ratios.
 - f. At 30'-0" On center maximum in uninterrupted walls.
 - g. Offset control joints to ends of lintels.
- D. Build-in horizontal pressure-relieving joints where indicated; construct joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 7 Section "Joint Sealants."
 - 1. Locate horizontal pressure-relieving joints beneath shelf angles supporting masonry veneer and attached to structure behind masonry veneer.

3.9 MASONRY-CELL INSULATION

- A. Pour granular insulation into cavities as shown to fill void spaces completely. Maintain inspection ports to show the presence of insulation at the extremities of each pour area. Close the ports after complete coverage has been confirmed. Limit the fall of insulation to 1 story in height, but not to exceed **20 feet**.
- B. Install molded-polystyrene insulation units into masonry unit cells before laying units.

3.10 MASONRY JOINT REINFORCEMENT

- A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of **5/8 inch** on exterior side of walls, **1/2 inch** elsewhere. Lap reinforcement a minimum of **6 inches**.
 - 1. Space reinforcement not more than **16 inches** o.c.
 - 2. Space reinforcement not more than **8 inches** o.c. in foundation walls and parapet walls.
 - 3. Provide reinforcement not more than **8 inches** above and below wall openings and extending **12 inches** beyond openings.
 - a. Reinforcement above is in addition to continuous reinforcement.
- B. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- C. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.11 FLASHING, WEEP HOLES, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to the downward flow of water in the wall, and where indicated.
- B. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer before covering with mortar.
- C. Install flashing as follows:
 - 1. At composite masonry walls, including cavity walls, extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4 inches, and through the inner wythe to within 1/2 inch of the interior face of the wall in exposed masonry. Where interior surface of inner wythe is concealed by furring, carry flashing completely through the inner wythe and turn up approximately 2 inches, unless otherwise indicated.
 - 2. At masonry-veneer walls, extend flashing from exterior face of veneer, through the veneer, up face of sheathing at least 8 inches, and behind air-infiltration barrier/building paper.
 - 3. At lintels and shelf angles, extend flashing a minimum of 4 inches into masonry at each end. At heads and sills, extend flashing 4 inches at ends and turn up not less than 2 inches to form a pan.
 - 4. Interlock end joints of ribbed sheet-metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements of Division 7 Section "Joint Sealants" for application indicated.
 - 5. Extend sheet-metal flashing 1/2 inch beyond face of masonry at exterior and turn down to form a drip.
 - 6. Cut off flashing flush with face of wall after masonry wall construction is completed.
- D. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing and as follows:
 - 1. Form weep holes with product specified in Part 2 of this Section.
 - 2. Form weep holes by keeping head joints free and clear of mortar.
 - 3. Space weep holes 24 inches o.c.
 - 4. Space weep holes 16 inches o.c.
 - 5. In cavities, place pea gravel to a height equal to height of first course, but not less than 2 inches, immediately above top of flashing embedded in the wall, as masonry construction progresses, to splatter mortar droppings and to maintain drainage.
 - 6. Place cavity drainage material immediately above flashing in cavities.
 - 7. In insulated cavities, cover cavity side of open weep holes with copper or plastic insect screening before placing loose-fill masonry insulation in cavity.
- E. Install vents in vertical head joints at the top of each continuous cavity. Space vents and close off cavities vertically and horizontally with blocking in manner indicated.
 - 1. Install through-wall flashing and weep holes above horizontal blocking.
- F. Install reglets and nailers for flashing and other related construction where shown to be built into masonry.

3.12 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.
 - 1. Construct formwork to conform to shape, line, and dimensions shown. Make it sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements of ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
1. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.13 FIELD QUALITY CONTROL

- A. Owner will engage a qualified independent testing agency to perform field quality-control testing indicated below.
1. Payment for these services will be made by Owner.
 2. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
- B. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq. ft. of wall area or portion thereof.
- C. Mortar properties will be tested per ASTM C 780.
- D. Grout will be sampled and tested for compressive strength per ASTM C 1019.
- E. Brick Tests: For each type and grade of brick indicated, units will be tested according to ASTM C 67.
- F. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C 140.
- G. Prism-Test Method: For each type of wall construction indicated, masonry prisms will be tested per ASTM C 1314, and as follows:
1. Prepare 1 set of prisms for testing at 7 days and 1 set for testing at 28 days.

3.14 PARGING

- A. Parge predampened masonry walls, where indicated, with Type S or Type N mortar applied in 2 uniform coats to a total thickness of 3/4 inch. Scarify first parging coat to ensure full bond to subsequent coat.
- B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.
- C. Damp cure parging for at least 24 hours and protect until cured.

3.15 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
 5. Clean brick by the bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20, using job-mixed detergent solution.
 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
 7. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.
 8. Clean limestone units to comply with recommendations in the Indiana Limestone Institute of America's "Indiana Limestone Handbook."

3.16 MASONRY WASTE DISPOSAL

- A. Recycling: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Disposal as Fill Material: Dispose of clean masonry waste, including broken masonry units, waste mortar, and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.
1. Crush masonry waste to less than **4 inches** in each dimension.
 2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 2 Section "Earthwork."
 3. Do not dispose of masonry waste as fill within **18 inches** of finished grade.
- C. Excess Masonry Waste: Remove excess, clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following metal fabrications:
 - 1. Rough hardware.
 - 2. Ladders (including elevator pit ladders).
 - 3. Loose bearing and leveling plates.
 - 4. Miscellaneous framing and supports for the following:
 - a. Elevator hoisting machines and sheaves.
 - b. Elevator door sills.
 - c. Applications where framing and supports are not specified in other sections.
 - 5. Miscellaneous steel trim, including the following:
 - 6. Pipe bollards.

1.3 SUBMITTALS

- A. Product data for nonslip aggregates and nonslip aggregate surface finishes, prefabricated building columns, cast nosings, treads and thresholds, steel floor plate, paint products, and grout.
- B. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.
- C. Samples representative of materials and finished products as may be requested by Architect.
- D. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.
- E. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include a list of completed projects with project name, addresses, names of architects and owners, and other information specified.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the Work.
- B. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel," AWS D1.2 "Structural Welding Code--Aluminum," and AWS D1.3 "Structural Welding Code--Sheet Steel."
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

PART 2 - PRODUCTS

2.1 FERROUS METALS

- A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- B. Steel Plates, Shapes, and Bars: ASTM A 36.
- C. Rolled Steel Floor Plates: ASTM A 786.
- D. Steel Tubing: Product type (manufacturing method) and as follows:
 1. Cold-Formed Steel Tubing: ASTM A 500.
 2. Hot-Formed Steel Tubing: ASTM A 501.
 - a. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A 53.
- E. Steel Pipe: ASTM A 53, standard weight (schedule 40), unless otherwise indicated, or another weight required by structural loads.
 1. Black finish, unless otherwise indicated.
 2. Galvanized finish for exterior installations and where indicated.
- F. Gray-Iron Castings: ASTM A 48, Class 30.
- G. Malleable-Iron Castings: ASTM A 47, Grade 32510.
- H. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27 cast steel. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A 153.
- I. Welding Rods and Bare Electrodes: Select according to AWS specifications for the metal alloy to be welded.

2.2 ALUMINUM

- A. Aluminum Extrusions: ASTM B 221, alloy 6063-T6.
- B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632 Pattern 1, alloy 6061-T6.

2.3 PAINT

- A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements of FS TT-P-664, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

- C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

2.4 FASTENERS

- A. General: Provide plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating, for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A, with hex nuts, ASTM A 563, and, where indicated, flat washers.
- C. Machine Screws: ANSI B18.6.3.
- D. Lag Bolts: ANSI B18.2.1.
- E. Wood Screws: Flat head, carbon steel, ANSI B18.6.1.
- F. Plain Washers: Round, carbon steel, ANSI B18.22.1.
- G. Lock Washers: Helical, spring type, carbon steel, ANSI B18.21.1.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
 - 1. Material: Carbon steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material: Group 1 alloy 304 or 316 stainless-steel bolts and nuts complying with ASTM F 593 and ASTM F 594.
- I. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as required.

2.5 GROUT

- A. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
- B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- C. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Nonshrink, Metallic Grouts:
 - a. Hi Mod Grout; Euclid Chemical Co.
 - b. Embeco 885 and 636; Master Builders Technologies, Inc.
 - c. Ferrolith G Redi-Mix and G-NC; Sonneborn Building Products--ChemRex, Inc.
 - 2. Nonshrink, Nonmetallic Grouts:
 - a. Euco N-S Grout; Euclid Chemical Co.
 - b. Five Star Grout; Five Star Products.
 - c. Masterflow 928 and 713; Master Builders Technologies, Inc.
 - d. Sealtight 588 Grout; W. R. Meadows, Inc.

2.6 CONCRETE FILL

- A. Concrete Materials and Properties: Comply with requirements of Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless higher strengths are indicated.

2.7 FABRICATION, GENERAL

- A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.
- B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- C. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
 - 1. Temperature Change (Range): 120 deg F.
- D. Shear and punch metals cleanly and accurately. Remove burrs.
- E. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- F. Remove sharp or rough areas on exposed traffic surfaces.
- G. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.
- H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- K. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.8 ROUGH HARDWARE

- A. Furnish bent, or otherwise custom-fabricated, bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 Sections.
- B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts that bear on wood structural connections, and furnish steel washers elsewhere.

2.9 STEEL LADDERS

- A. General: Fabricate ladders for the locations shown, with dimensions, spacings, details, and anchorages as indicated. Comply with requirements of ANSI A14.3.
- B. Siderails: Continuous, steel, 1/2-by-2-1/2-inch flat bars, with eased edges, spaced 18 inches apart.
- C. Bar Rungs: 1-inch-diameter steel bars, spaced 12 inches o.c.
- D. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
- E. Support each ladder at top and bottom and at intermediate points spaced not more than 60 inches o.c. with welded or bolted steel brackets.
 - 1. Size brackets to support design dead and live loads indicated and to hold centerline of ladder rungs clear of the wall surface by not less than 7 inches.
 - 2. Extend side rails 42 inches above top rung, and return rails to wall or structure unless other secure handholds are provided. If the adjacent structure does not extend above the top rung, goose-neck the extended rails back to the structure to provide secure ladder access.
- F. Provide nonslip surfaces on top of each rung, either by coating the rung with aluminum-oxide granules set in epoxy-resin adhesive, or by using a type of manufactured rung that is filled with aluminum-oxide grout.
- G. Galvanize ladders, including brackets and fasteners, in the following locations:
 - 1. Exterior locations.
 - 2. Interior locations where indicated.

2.10 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.
- B. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
 - a. Except as otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4 inch thick by 8 inches long.
- C. Galvanize miscellaneous framing and supports in the following locations:
 - 1. Exterior locations.
 - 2. Interior locations where indicated.

2.11 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices wherever possible.
- B. Provide cutouts, fittings, and anchorages as required to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches from each end, 6 inches from corners, and 24 inches o.c., unless otherwise indicated.
- C. Galvanize miscellaneous steel trim in the following locations:
 - 1. Exterior locations.
 - 2. Interior locations where indicated.

2.12 STRUCTURAL STEEL DOOR FRAMES

- A. Fabricate steel door frames from structural shapes and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch steel bar stops, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than 10 inches o.c. Reinforce frames and drill and tap as required to accept finish hardware.
- B. Provide steel strap anchors for securing door frames into adjoining concrete or masonry, using 1/8-by-2-inch straps of the length required for a minimum 8-inch embedment, unless otherwise indicated. Weld anchors to frame jambs no more than 12 inches from both bottom and head of frame and space anchors not more than 30 inches apart.
- C. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.
- D. Galvanize frames and anchors in the following locations:
 - 1. Exterior locations.
 - 2. Interior locations where indicated.

2.13 CAST NOSINGS, TREADS, AND THRESHOLDS

- A. Fabricate units of material, sizes, and configurations indicated. If not indicated, provide cast-iron units with an integral abrasive finish. Furnish in lengths as required to accurately fit each opening or conditions.
 - 1. Cast units with an integral abrasive grit consisting of aluminum oxide, silicon carbide, or a combination of both.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. American Safety Tread Co., Inc.
 - 2. Balco/Metalines, Inc.
 - 3. Safe-T-Metal Co.
 - 4. Wooster Products Inc.
- C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with the manufacturer.
- D. Apply black asphaltic coating to concealed bottoms, sides, and edges of cast-iron units set into concrete.
- E. Provide a fluted or cross-hatched surface.

2.14 PIPE BOLLARDS

- A. Fabricate pipe bollards from Schedule 80 steel pipe. Cap bollards with 1/4-inch minimum steel plate.
- B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch-thick steel plate welded to bottom of sleeve.

2.15 FINISHES, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designing finishes.
- B. Finish metal fabrications after assembly.

2.16 STEEL AND IRON FINISHES

- A. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with the following requirements:

1. ASTM A 153 for galvanizing iron and steel hardware.
 2. ASTM A 123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick or thicker.
- B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
1. Exteriors (SSPC Zone 1B): SSPC-SP 6 "Commercial Blast Cleaning."
 2. Interiors (SSPC Zone 1A): SSPC-SP 3 "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA 1 "Paint Application Specification No. 1" for shop painting.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
- 2.17 ALUMINUM FINISHES
- A. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).
- C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I clear coating 0.7 mil or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.
- B. Center nosings on tread widths with noses flush with riser faces and tread surfaces.
- C. Set sleeves in concrete with tops flush with finish surface elevations. Protect sleeves from water and concrete entry.

3.2 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.
- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

- E. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.3 SETTING LOOSE PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
- B. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.
 - 1. Use nonshrink, metallic grout in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 INSTALLING SUPPORTS FOR TOILET PARTITIONS

- A. Anchor supports securely to and rigidly brace from overhead building structure.

3.5 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

- A. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solidly with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's directions.
- B. Fill bollards solidly with concrete, mounding top surface.
- C. Paint the bollard with aluminum paint.
- D. Paint a 12 inch high stripe around the bollard 12 inches from the top of the bollard with White reflective paint.

3.6 INSTALLING PIPE GUARDS

- A. Install pipe guards at exposed vertical pipes in parking garage where not protected by curbs or other barriers. Install by bolting to floor and wall or column with drilled-in expansion anchors.

3.7 INSTALLING WHEEL GUARDS

- A. Anchor wheel guards to concrete or masonry construction to comply with manufacturer's instructions. Fill cores solidly with concrete.

3.8 INSTALLING PIPE BOLLARDS

- A. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solidly with nonshrink, nonmetallic grout, mixed and placed to comply with grout manufacturer's directions.
- B. Fill bollards solidly with concrete, mounding top surface.

3.9 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a 2.0-mil minimum dry film thickness.
 - 2. Coordinate with additional requirements of DIVISION 9 Painting and Special Coatings.
- B. For galvanized surfaces, clean welds, bolted connections, and abraded areas, and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 05521 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Steel pipe and tube handrails and railings.

1.3 PERFORMANCE REQUIREMENTS

- A. General: In engineering handrails and railings to withstand structural loads indicated, determine allowable design working stresses of handrail and railing materials based on the following:
 - 1. Cold-Formed Structural Steel: AISI SG-673, Part I, "Specification for the Design of Cold-Formed Steel Structural Members."
- B. Structural Performance of Handrails and Railings: Provide handrails and railings complying with requirements of ASTM E 985 for structural performance, based on testing performed according to ASTM E 894 and ASTM E 935.
- C. Thermal Movements: Provide handrails and railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of mechanically connected handrails and railings.
 - 2. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Show fabrication and installation of handrails and railings. Include plans, elevations, sections, component details, and attachments to other Work.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for products with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required, prepared on components indicated below and of same thickness and metal indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
- E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

- F. Product Test Reports: From a qualified testing agency indicating products comply with requirements, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- B. Source Limitations: Obtain each type of handrail and railing through one source from a single manufacturer.

1.6 STORAGE

- A. Store handrails and railings in a dry, well-ventilated, weathertight place.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify handrail and railing dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8 COORDINATION

- A. Coordinate installation of anchorages for handrails and railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.9 SCHEDULING

- A. Schedule installation so handrails and railings are mounted only on completed walls. Do not support temporarily by any means that does not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Steel Pipe and Tube Railings:
 - a. Humane Equipment Co.
 - b. Wagner: R & B Wagner, Inc.

2.2 METALS

- A. General: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.
- B. Steel and Iron: Provide steel and iron in the form indicated, complying with the following requirements:
 - 1. Steel Pipe: ASTM A 53; finish, type, and weight class as follows:
 - a. Galvanized finish for exterior installations and where indicated.
 - b. Type F, or Type S, Grade A, standard weight (Schedule 40), unless another grade and weight are required by structural loads.
 - 2. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 3. Iron Castings: Malleable iron complying with ASTM A 47, Grade 32510 (ASTM A 47M, Grade 22010).

- C. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.3 WELDING MATERIALS, FASTENERS, AND ANCHORS

- A. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Fasteners for Anchoring Handrails and Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring handrails and railings to other types of construction indicated and capable of withstanding design loads.
 - 1. For steel handrails, railings, and fittings, use plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
- C. Fasteners for Interconnecting Handrail and Railing Components: Use fasteners fabricated from same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
 - 1. Provide concealed fasteners for interconnecting handrail and railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for handrails and railings indicated.
 - 2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
- D. Cast-in-Place and Postinstalled Anchors: Anchors of type indicated below, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
 - 1. Expansion anchors.

2.4 PAINT

- A. Shop Primers: Provide primers to comply with applicable requirements in Division 9 Section "Painting."
- B. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated, and complying with SSPC-Paint 5.
- C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

- A. General: Fabricate handrails and railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

- B. Assemble handrails and railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Form changes in direction of railing members as follows:
 - 1. By bending.
- D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
- E. Welded Connections: Fabricate handrails and railings for connecting members by welding. Cope components at perpendicular and skew connections to provide close fit, or use fittings designed for this purpose. Weld connections continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- F. Nonwelded Connections: Fabricate handrails and railings by connecting members with concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection using an epoxy structural adhesive where this is manufacturer's standard splicing method.
- G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing members to other work, unless otherwise indicated.
- H. Provide inserts and other anchorage devices for connecting handrails and railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railings. Coordinate anchorage devices with supporting structure.
- I. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.
- J. Ease exposed edges to a radius of approximately **1/32 inch (1 mm)**, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
- K. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.
- L. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members that are exposed to exterior or to moisture from condensation or other sources.
- M. Fabricate joints that will be exposed to weather in a watertight manner.
- N. Close exposed ends of handrail and railing members with prefabricated end fittings.
- O. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns, unless clearance between end of railing and wall is **1/4 inch (6 mm)** or less.

2.7 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Provide exposed fasteners with finish matching appearance, including color and texture, of handrails and railings.

2.8 STEEL FINISHES

- A. Galvanized Handrails and Railings: Hot-dip galvanize exterior steel and iron handrails and railings to comply with ASTM A 123. Hot-dip galvanize hardware for exterior steel and iron handrails and railings to comply with ASTM A 153/A 153M.
- B. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. For galvanized handrails and railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- D. Preparation for Shop Priming: After galvanizing, thoroughly clean handrails and railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.
 - 1. Exteriors (SSPC Zone 1B): SSPC-SP 6, "Commercial Blast Cleaning."
- E. Apply shop primer to prepared surfaces of handrail and railing components, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required to install handrails and railings. Set handrails and railings accurately in location, alignment, and elevation; measured from established lines and levels and free from rack.
 - 1. Do not weld, cut, or abrade surfaces of handrail and railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Align rails so variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed **1/4 inch in 12 feet (5 mm in 3 m)**.
- C. Adjust handrails and railings before anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated, but not less than that required by structural loads.

3.2 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.3 ANCHORING RAILING ENDS

- A. Anchor railing ends into concrete and masonry with round flanges connected to railing ends and anchored into wall construction with postinstalled anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces.
 - 1. Connect flanges to railing ends using nonwelded connections.

3.4 ATTACHING HANDRAILS TO WALLS

- A. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface.
- B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.

3.5 CLEANING

- A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.6 PROTECTION

- A. Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at the time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

SECTION 07133 - THERMOPLASTIC SHEET WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. PVC sheet waterproofing.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 5 Section "Architectural Joint Systems" for expansion-joint systems.
 - 2. Division 7 Section "Joint Sealants" for joint-sealant materials and installation.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide waterproofing membrane below concrete slab that prevents the passage of water.

1.4 SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.
- B. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
- C. Product Test Reports: From a qualified independent testing agency indicating and interpreting test results of waterproofing for compliance with requirements, based on comprehensive testing of current waterproofing formulations.
- D. Sample Warranty: Copy of special waterproofing manufacturer's warranty stating obligations, remedies, limitations, and exclusions before starting waterproofing.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who is authorized and approved by waterproofing manufacturer to install manufacturer's products; and who is eligible to receive waterproofing warranty specified.
- B. Source Limitations: Obtain waterproofing materials through one source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store rolls according to manufacturer's written instructions.
- C. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Apply waterproofing within range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.

1.8 WARRANTY

- A. Special Manufacturer's Warranty: Written warranty, signed by waterproofing manufacturer agreeing to repair or replace waterproofing that does not comply with requirements or that does not remain watertight within specified warranty period.
 - 1. Warranty Period: 10 years after date of Substantial Completion.
- B. Special Installer's Warranty: Written waterproofing Installer's warranty, signed by Installer, covering Work of this Section, for warranty period of two years.
 - 1. Warranty includes removing and reinstalling protection board, drainage panels, insulation, pedestals, and pavers on plaza decks.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
- B. Products: Subject to compliance with requirements, provide one of the following products:
 - 1. Sarnafil Waterproofing Systems, Inc.; System 1000.

2.2 SHEET WATERPROOFING

- A. PVC Sheet: 60-mil thick flexible sheet compounded from PVC resin, plasticizers, stabilizers, fillers, and pigments and reinforced with nonwoven fiberglass with the following properties measured per standard test methods referenced:
 - 1. Tensile Strength: 1600 psi minimum; ASTM D 638.
 - 2. Elongation at Break: 300 percent minimum, machine direction; ASTM D 638.
 - 3. Seam Strength: 90 percent minimum of tensile strength; ASTM D 638.
 - 4. Retention of Properties after Heat Aging: 95 percent minimum retention of tensile strength and elongation; ASTM D 638 after 168 hours at 194 deg F; ASTM D 3045.
 - 5. Tear Resistance: 17 lbf minimum; ASTM D 1004.
 - 6. Low-Temperature Bend: Pass at minus 40 deg F; ASTM D 2136.
 - 7. Linear Dimension Change: 0.01 percent maximum after 6 hours at 176 deg F; ASTM D 1204.
 - 8. Water Absorption: 2 percent maximum weight gain after 168 hours' immersion at 158 deg F; ASTM D 570.

2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
- B. Concealed Sheet Flashing: Sheet flashing of same material, construction, and thickness as sheet waterproofing.
- C. Exposed Sheet Flashing: 60-mil-thick, coated PVC; reinforced with nonwoven fiberglass.
- D. Bonding Adhesives: Adhesive for bonding polymeric sheets and sheet flashings to substrates and projections.
- E. Containment Strip: Manufacturer's standard asphalt-resistant, 60-mil- thick PVC strip; reinforced with nonwoven fiberglass; 12 inches wide.
- F. Waterproofing and Sheet Flashing Accessories: Provide PVC discs, sealants, pourable sealers, cone and vent flashings, inside and outside corner flashings, termination reglets, clamps, compression bars, tapes, and other accessories recommended by waterproofing manufacturer for intended use.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
 - 1. Verify that substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 2. Notify Architect in writing of anticipated problems using waterproofing over substrate.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions.

3.3 LOOSELY LAID SHEET INSTALLATION

- A. General: Install loosely laid sheets over entire slab area to receive waterproofing according to manufacturer's written instructions.
 - 1. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required. Stagger end laps.
 - 2. Install loosely laid sheets and auxiliary materials to tie into adjoining waterproofing.
 - 3. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending beyond repaired areas in all directions.
- B. Horizontal Applications: Secure terminations and perimeter of sheet waterproofing with PVC cord and metal termination bars anchored **12 inches** o.c.
 - 1. Apply sheets with side laps shingled with slope of deck where possible.
 - 2. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal sheet in place with clamping ring.

3.4 PROTECTION AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.

END OF SECTION

SECTION 07135 – SHEET MEMBRANE WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this section.

1.2 SUMMARY

- A. The work of this section includes, but is not limited to, the following:
 - 1. Rubberized asphalt sheet membrane waterproofing system
 - 2. Prefabricated drainage composite
 - 3. Protection board
- B. Related Sections: Other specification sections which directly relate to the work of this section include, but are not limited to, the following:
 - 1. Section 03300 – Cast-In-Place Concrete
 - 2. Section 04200 – Unit Masonry
 - 3. Section 07150 – Dampproofing
 - 4. Section 07600 – Flashing and Sheet Metal
 - 5. Section 07900 – Joint Sealers

1.3 REFERENCE STANDARDS

- A. The following standards and publications are applicable to the extent referenced in the text.
- B. American Society for Testing and Materials (ASTM)
 - D 412 Standard Test Methods for Rubber Properties in Tension
 - D 882 Standard Test Methods for Tensile Properties of Thin Plastic Sheeting
 - D 903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
 - D 1876 Standard Test Method for Peel Release of Adhesives (T-Peel)
 - D 3767 Standard Practice for Rubber - Measurements of Dimensions
 - D 5385 Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes
 - E 96 Standard Test Methods for Water Vapor Transmission of Materials
 - E 154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations. Include certification of data indicating VOC (Volatile Organic Compound) content of all components of waterproofing system.
- B. Samples: Submit representative samples of the following for approval:
 - 1. Sheet membrane

1.5 QUALITY ASSURANCE

- A. Manufacturer: Sheet membrane waterproofing system shall be manufactured and marketed by a firm with a minimum of 20 years experience in the production and sales of self-adhesive sheet membrane waterproofing. Manufacturers proposed for use but not named in these specifications shall submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past 5 years.

- B. Installer: A firm which has at least 3 years experience in work of the type required by this section.
- C. Materials: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer.
- D. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashing.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.
 - 1. Do not double-stack pallets of membrane on the job site. Provide cover on top and all sides, allowing for adequate ventilation.
 - 2. Protect mastic and adhesive from moisture and potential sources of ignition.
 - 3. Store drainage composite or protection board flat and off the ground. Provide cover on top and all sides.
 - 4. Protect surface conditioner from freezing.
- B. Sequence deliveries to avoid delays, but minimize on-site storage.

1.7 PROJECT CONDITIONS

- A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.
- B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive sheet membrane waterproofing.

1.8 WARRANTY

- A. Sheet Membrane Waterproofing: Provide written 5 year material warranty issued by the membrane manufacturer upon completion of the work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Sheet Membrane Waterproofing System: Bituthene® System 4000 Membrane by Grace Construction Products; a self-adhesive, cold-applied composite sheet consisting of a thickness of 1.4 mm (0.056 in.) of rubberized asphalt and 0.1 mm (0.004 in.) of cross-laminated, high density polyethylene film specially formulated for use with water-based surface conditioner. Provide rubberized asphalt membrane covered with a release sheet which is removed during installation. No special adhesive or heat shall be required to form laps.
- B. Sheet Membrane Waterproofing

PHYSICAL PROPERTIES FOR BITUTHENE SYSTEM 4000 MEMBRANE:

Property	Test Method	Typical Value
Color		Dark gray-black
Thickness	ASTM D 3767 Method A	1.5 mm (0.060 in.) nominal
Flexibility, 180° bend over 25 mm (1 in.) mandrel at -43°C (-45°F)	ASTM D 1970	Unaffected
Tensile Strength, Membrane Die C	ASTM D 412 Modified ¹	2240 kPa (325 lbs/in. ²) minimum
Tensile Strength, Film	ASTM D 882 Modified ¹	34.5 MPa (5,000 lbs/in. ²) minimum
Elongation, Ultimate Failure of Rubberized Asphalt	ASTM D 412 Modified ¹	300% minimum
Crack Cycling at -32°C (-25°F), 100 Cycles	ASTM C 836	Unaffected
Lap Adhesion at Minimum Application Temperature	ASTM D 1876 Modified ²	880 N/m (5 lbs/in.)
Peel Strength	ASTM D 903 Modified ³	1576 N/m (9 lbs/in.)
Puncture Resistance, Membrane	ASTM E 154	222 N (50 lbs) minimum
Resistance to Hydrostatic Head	ASTM D 5385	70 m (231 ft) of water
Permeance	ASTM E 96, Section 12 – Water Method	2.9 ng/m ² sPa (0.05 perms) maximum
Water Absorption	ASTM D 570	0.1% maximum

Footnotes:

1. The test is run at a rate of 50 mm (2 in.) per minute.
2. The test is conducted 15 minutes after the lap is formed and run at a rate of 50 mm (2 in.) per minute at -4°C (25°F).
3. The 180° peel strength is run at a rate of 300 mm (12 in.) per minute.

- C. Prefabricated Drainage Composite: (Hydroduct[®] 220) Drainage Composite by Grace Construction Products. Drainage Composite shall be designed to promote positive drainage while serving as a protection course.
- D. Protection Board:
1. Expanded Polystyrene Protection Board: 25 mm (1 in.) thick for vertical applications with the following characteristics. Adhere to waterproofing membrane with Bituthene Protection Board Adhesive.
Normal Density: 16 kg/m³ (1.0 lb/ft³)
Thermal Conductivity, K factor: 0.24 at 5°C (40°F), 0.26 at 24°C (75°F)
Thermal Resistance, R-Value: 4 per 25 mm (1 in.) of thickness.
 2. Asphalt Hardboard: A premolded semi-rigid protection board consisting of bitumen, mineral core and reinforcement. Provide 3 mm (0.125 in.) thick hardboard on horizontal surfaces not receiving steel reinforced slab. Where steel reinforcing bars are to be used, apply two layers of 3 mm (0.125 in.) thick hardboard or one layer of 6 mm (0.25 in.) thick hardboard.
- E. Miscellaneous Materials: Surface conditioner, mastic, liquid membrane, tape and accessories specified or acceptable to manufacturer of sheet membrane waterproofing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.2 PREPARATION OF SUBSTRATES

- A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods which are acceptable to manufacturer of sheet membrane waterproofing.
- B. Cast-In-Place Concrete Substrates:
 - 1. Do not proceed with installation until concrete has properly cured and dried (minimum 7 days for normal structural concrete and minimum 14 days for lightweight structural concrete).
 - a. Bituthene® Primer B2 may be used to allow priming and installation of membrane sooner than 7 days. Priming may begin in this case as soon as the concrete will maintain structural integrity.
 - 2. Fill form tie rod holes with concrete and finish flush with surrounding surface.
 - 3. Repair bugholes over 13 mm (0.5 in.) in length and 6 mm (0.25 in.) deep and finish flush with surrounding surface.
 - 4. Remove scaling to sound, unaffected concrete and repair exposed area.
 - 5. Grind irregular construction joints to suitable flush surface.
- C. Related Materials: Treat joints and install flashing as recommended by waterproofing manufacturer.

3.3 INSTALLATION

- A. Refer to manufacturer's literature for recommendations on installation, including but not limited to, the following:
 - 1. Apply surface conditioner at rate recommended by manufacturer. Recoat areas not waterproofed if contaminated by dust. Mask and protect adjoining exposed finish surfaces to protect those surfaces from excessive application of surface conditioner.
 - 2. Delay application of membrane until surface conditioner is completely dry. Dry time will vary with weather conditions.
 - 3. Seal daily terminations with troweled bead of mastic.
 - 4. Apply protection board and related materials in accordance with manufacturer's recommendations.

3.4 CLEANING AND PROTECTION

- A. Remove any masking materials after installation. Clean any stains on materials which would be exposed in the completed work.
- B. Protect completed membrane waterproofing from subsequent construction activities as recommended by manufacturer.

END OF SECTION

SECTION 07160 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Cold-applied, asphalt emulsion dampproofing.
- B. Bituminous sheet waterproofing is specified in Division 7 Section "Sheet Membrane Waterproofing."

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each type of product specified, including data substantiating that materials comply with requirements for each dampproofing material specified. Include recommended method of application, recommended primer, number of coats, coverage or thickness, and recommended protection course.
 - 1. Certification by dampproofing manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed bituminous dampproofing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Single-Source Responsibility: Obtain primary dampproofing materials and primers from one source and by a single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1.5 PROJECT CONDITIONS

- A. Substrate: Proceed with dampproofing only after substrate construction and penetrating work have been completed.
- B. Weather Limitations: Proceed with dampproofing only when existing and forecasted weather conditions will permit work to be performed according to manufacturer's recommendations and warranty requirements.
- C. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has thoroughly cured.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cold-Applied, Asphalt Emulsion Dampproofing:
 - a. ChemRex, Inc.; Sonneborn Building Products Div.
 - b. Euclid Chemical Co.
 - c. Karnak Chemical Corporation.
 - d. Koppers Industries, Inc.
 - e. Meadows: W.R. Meadows, Inc.

2.2 BITUMINOUS DAMPPROOFING

- A. General: Provide products recommended by manufacturer for designated application.
 1. Odor Elimination: For interior and concealed-in-wall uses, provide type of bituminous dampproofing material warranted by manufacturer to be substantially odor free after drying for 24 hours under normal conditions.
- B. Cold-Applied, Asphalt Emulsion Dampproofing: Asphalt-based emulsions recommended by the manufacturer for dampproofing use when applied according to the manufacturer's instructions.
 1. Trowel Grade: Emulsified asphalt mastic, prepared with mineral- colloid emulsifying agents suitable for application in a relatively thick film, complying with ASTM D 1187, Type I.
 2. Trowel Grade: Emulsified asphalt mastic, prepared with mineral- colloid emulsifying agents and containing fibers other than asbestos, complying with ASTM D 1227, Type III or IV.
 3. Semimastic Grade: Emulsified asphalt semimastic, prepared with mineral-colloid emulsifying agents and containing fibers other than asbestos, complying with ASTM D 1227, Type III or IV.
 4. Spray Grade: Emulsified asphalt, prepared with mineral-colloid emulsifying agents without fibrous reinforcement, complying with ASTM D 1227, Type III.

2.3 MISCELLANEOUS MATERIALS

- A. Primer: Asphalt primer complying with ASTM D 41, for asphalt-based dampproofing.
- B. Glass Fabric: Woven glass fabric, treated with asphalt, complying with ASTM D 1668, Type I.
- C. Protection Course, Board Type: Premolded, 1/8-inch- (3-mm-) thick, multi-ply, semi-rigid board, consisting of a mineral-stabilized asphalt core sandwiched between layers of asphalt-saturated felt, and faced on one side with polyethylene film.
 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Protection Course II; ChemRex, Inc.; Sonneborn Building Products Div.
 - b. Bituthene Asphaltic Hardboard; Grace: W.R. Grace & Co.
 - c. PC-2 Protection Course; Meadows: W.R. Meadows, Inc.
- D. Protection Course, Roll Roofing Type: Smooth-surfaced roll roofing, complying with ASTM D 224, Type II.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrate of projections and substances detrimental to work; comply with recommendations of prime materials manufacturer.

- B. Install cant strips and similar accessories as shown and as recommended by prime materials manufacturer even though not shown.
- C. Fill voids, seal joints, and apply bond breakers, if any, as recommended by prime materials manufacturer, with particular attention at construction joints.
- D. Install separate flashings and corner protection stripping, as recommended by prime materials manufacturer, where indicated to precede application of dampproofing. Comply with details shown and with manufacturer's recommendations. Pay particular attention to requirements at building expansion joints, if any.
- E. Prime substrate as recommended by prime materials manufacturer.
- F. Protection of Other Work: Do not allow liquid and mastic compounds to enter and clog drains and conductors. Prevent spillage and migration onto other surfaces of work by masking or otherwise protecting adjoining work.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's recommendations except where more stringent requirements are indicated and where Project conditions require extra precautions to ensure satisfactory performance of work.
- B. Application: Apply dampproofing to the following surfaces.
 - 1. Exterior, below-grade surfaces of exterior concrete or masonry walls in contact with earth or other backfill and where space is enclosed on opposite side.
 - 2. Back side of concrete or masonry retaining walls and stone facing to prevent percolating of water through the wall or facing.
- C. Cold-Applied Asphalt Dampproofing: For exterior surfaces, provide either emulsified or cut-back, asphalt dampproofing materials, at Contractor's option. For interior surfaces, provide only emulsified asphalt materials.
- D. Reinforcement: At changes in plane or where otherwise shown as "reinforced," install lapped course of glass fabric in first coat of dampproofing compound before it thickens.
- E. Bituminous Cant Strips: Install 2-by-2-inch (50-by-50-mm) cant strip of bituminous grout at base of vertical dampproofing where it meets horizontal surface.
- F. Apply vertical dampproofing down walls from finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inches (150 mm) over outside face of footing. Extend 12 inches (300 mm) onto intersecting walls and footings, but do not extend onto surfaces exposed to view when the Project is completed.

3.3 COLD-APPLIED, ASPHALT EMULSION DAMPPROOFING

- A. Spray Grade: Brush or spray apply a coat of asphalt emulsion dampproofing at a rate of 1.5 to 2.5 gal./100 sq. ft. (0.6 to 1 L/sq. m), depending on substrate texture, to produce a uniform, dry-film thickness of not less than 15 mils (0.4 mm). Apply in 2 coats, if necessary, to obtain required thickness, allowing time for complete drying between coats.
- B. Semimastic Grade: Brush or spray apply a coat of asphalt emulsion dampproofing at a rate of 5 gal./100 sq. ft. (2 L/sq. m), to produce a uniform, dry-film thickness of not less than 30 mils (0.8 mm).
- C. Trowel Grade: Trowel apply a coat of mastic asphalt emulsion dampproofing onto substrate at a minimum rate of 7 gal./100 sq. ft., to produce an average, dry-film thickness of 60 mils but not less than 30 mils at any point.

3.4 PROTECTION AND CLEANING

- A. Protect exterior, below-grade dampproofing membrane from damage until backfill is completed. Remove overspray and spilled materials from surfaces not intended to receive dampproofing.

3.5 INSTALLATION OF PROTECTION COURSE

- A. General: Where indicated, install protection course of type indicated over completed-and-cured dampproofing treatment. Comply with dampproofing materials manufacturer's recommendations for method of support or attaching of protection materials. Support with spot application of trowel-grade mastic where not otherwise indicated.

END OF SECTION

SECTION 07551 - APP-MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. APP-modified bituminous membrane roofing.
 - 2. Vapor retarder.
- B. This Section includes the installation of acoustical roof deck rib insulation strips furnished under Division 5 Section "Steel Deck."
- C. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry " for wood nailers, cants, curbs, and blocking and for wood-based, structural-use roof deck panels.
 - 2. Division 7 Section "Sheet Metal Flashing and Trim" for roof penetration flashings, flashings, and counterflashings.
 - 3. Division 15 Section "Plumbing Specialties" for roof drains.

1.3 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.
- B. Hot Roofing Asphalt: Roofing asphalt heated to its equiviscous temperature, the temperature at which its viscosity is 125 centipoise for mop-applied roofing asphalt and 75 centipoise for mechanical spreader-applied roofing asphalt, within a range of plus or minus 25 deg F (14 deg C), measured at the mop cart or mechanical spreader immediately before application.
- C. Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," before multiplication by a safety factor.
- D. Factored Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," after multiplication by a safety factor.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- C. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
 - 1. Fire/Windstorm Classification: Class 1A-120.

- D. Roofing System Design: Provide a roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist the factored design uplift pressures calculated according to SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems."

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
 - 1. Base flashings, cants, and membrane terminations.
 - 2. Crickets, saddles, and tapered edge strips, including slopes.
- C. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- D. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of meeting performance requirements.
- E. Qualification Data: For Installer and manufacturer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.
- G. Research/Evaluation Reports: For components of roofing system.
- H. Maintenance Data: For roofing system to include in maintenance manuals.
- I. Warranties: Special warranties specified in this Section.
- J. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.
- B. Manufacturer Qualifications: A qualified manufacturer that has UL listing for roofing system identical to that used for this Project.
- C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- D. Source Limitations: Obtain components for roofing system approved by roofing system manufacturer.
- E. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
 - 1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.
 - 2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

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

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

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

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
1. Special warranty includes roofing membrane, base flashings, roofing membrane accessories walkway products and other components of roofing system.
 2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. APP-Modified Bituminous Membrane Roofing:
 - a. CertainTeed Corporation.
 - b. Firestone Building Products Company.
 - c. GAF Materials Corporation.
 - d. Hickman, W. P. Systems Inc.
 - e. Johns Manville International, Inc.
 - f. Koppers Industries, Inc.

2.2 APP-MODIFIED ASPHALT-SHEET MATERIALS

- A. Roofing Membrane Cap Sheet: ASTM D 6223, Grade G, Type I or II, composite polyester- and glass-fiber-reinforced, APP-modified asphalt sheet; granular surfaced; suitable for application method specified, and as follows:
 - 1. Granule Material: Mineral ceramic coated.
 - 2. Granule Color: White.

2.3 BASE-SHEET MATERIALS

- A. Sheathing Paper: Red-rosin type, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).
- B. Base Sheet: ASTM D 4601, Type I, nonperforated, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.

2.4 BASE FLASHING SHEET MATERIALS

- A. Backer Sheet: ASTM D 4601, Type I, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.
- B. Flashing Sheet: ASTM D 6223, Grade G, Type I or II, composite polyester- and glass-fiber-reinforced, APP-modified asphalt sheet; granular surfaced; suitable for application method specified, and as follows:
 - 1. Granule Color: White.
- C. Glass-Fiber Fabric: Woven glass-fiber cloth, treated with asphalt, complying with ASTM D 1668, Type I.

2.5 AUXILIARY ROOFING MEMBRANE MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane.
- B. Asphalt Primer: ASTM D 41.
- C. Roofing Asphalt: ASTM D 312, Type III or IV as recommended by roofing system manufacturer for application.
- D. Cold-Applied Adhesive: Roofing system manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with roofing membrane and base flashings.
- E. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application.

- F. Mastic Sealant: Polyisobutylene, plain or modified bitumen, nonhardening, nonmigrating, nonskinning, and nondrying.
- G. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roofing membrane components to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.
- H. Metal Flashing Sheet: Metal flashing sheet is specified in Division 7 Section "Sheet Metal Flashing and Trim."
- I. Roofing Granules: Ceramic-coated roofing granules, No. 11 screen size with 100 percent passing No. 8 (2.36-mm) sieve and 98 percent of mass retained on No. 40 (0.425-mm) sieve, color to match roofing membrane.
- J. Separator Sheet: Polyethylene sheet, 4 mils (0.1 mm) thick, minimum.
- K. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.

2.6 VAPOR RETARDER

- A. Polyethylene-Sheet Vapor Retarder: ASTM D 4397, 6 mils (0.15 mm) thick, minimum, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
 - 1. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
 - 2. Adhesive: Manufacturer's standard lap adhesive, FMG approved for vapor-retarder application.

2.7 WALKWAYS

- A. Walkway Pads: Mineral-granule-surfaced, reinforced asphaltic composition, slip-resisting pads, manufactured as a traffic pad for foot traffic and acceptable to roofing system manufacturer, 1/2 inch (13 mm) thick, minimum.
 - 1. Granule Material: Mineral ceramic coated.
 - 2. Granule Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
 - 2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 5 Section "Steel Deck."
 - 4. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
 - 5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - a. Test for moisture by pouring 1 pint (0.5 L) of hot roofing asphalt on deck at start of each day's work and at start of each roof area or plane. Do not proceed with

roofing work if test sample foams or can be easily and cleanly stripped after cooling.

6. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of **1/16 inch (1.6 mm)** out of plane relative to adjoining deck.
7. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Prime surface of concrete deck with asphalt primer at a rate of **3/4 gal./100 sq. ft. (0.3 L/sq. m)** and allow primer to dry.
- D. Install acoustical roof deck rib insulation strips, specified in Division 5 Section "Steel Deck," according to acoustical roof deck manufacturer's written instructions.

3.3 VAPOR-RETARDER INSTALLATION

- A. Loosely lay polyethylene-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of **2 inches (50 mm)** and **6 inches (150 mm)**, respectively.
 1. Seal side and end laps with adhesive.
- B. Install laminated-sheet vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of **2 inches (50 mm)** and **6 inches (150 mm)**, respectively. Bond vapor retarder to deck as follows:
 1. Apply adhesive at rate recommended by vapor-retarder manufacturer. Seal laps with adhesive.
 2. Apply ribbons of hot roofing asphalt at spacing, temperature, and rate recommended by vapor-retarder manufacturer. Seal laps with hot roofing asphalt.
- C. Self-Adhering Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of **3-1/2 inches (90 mm)** and **6 inches (150 mm)**, respectively. Seal laps by rolling.
- D. Install 2 glass-fiber felt plies lapping each sheet **19 inches (483 mm)** over preceding sheet. Embed each sheet in a solid mopping of hot roofing asphalt. Glaze-coat completed surface with hot roofing asphalt. Apply hot roofing asphalt at a rate of **20 lb/100 sq. ft. (1 kg/sq. m)**, plus or minus 25 percent.
- E. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.4 ROOFING MEMBRANE INSTALLATION, GENERAL

- A. Install roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations of ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
- B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

- C. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.
- D. Coordinate installing roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
 - 1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.
 - 2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
 - 3. Remove and discard temporary seals before beginning work on adjoining roofing.
- E. Asphalt Heating: Heat and apply SEBS-modified roofing asphalt according to roofing system manufacturer's written instructions.
- F. Substrate-Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.5 BASE-SHEET INSTALLATION

- A. Loosely lay one course of sheathing paper, lapping edges and ends a minimum of **2 inches (50 mm)** and **6 inches (150 mm)**, respectively.
- B. Install lapped base sheet course, extending sheet over and terminating beyond cants. Attach base sheet as follows:
 - 1. Adhere to substrate in a solid mopping of hot roofing asphalt.
- C. Install a second lapped base sheet course, extending sheet over and terminating beyond cants. Attach base sheet as follows:
 - 1. Adhere to substrate in a solid mopping of hot roofing asphalt.

3.6 BASE-PLY SHEET INSTALLATION

- A. Install two glass-fiber base-ply sheets according to roofing system manufacturer's written instructions starting at low point of roofing system. Align glass-fiber base-ply sheets without stretching. Shingle side laps of glass-fiber base-ply sheets uniformly to ensure required number of glass-fiber base-ply sheets covers substrate at any point. Shingle in direction to shed water. Extend glass-fiber base-ply sheets over and terminate beyond cants.
 - 1. Embed each glass-fiber base-ply sheet in a continuous mopping of hot roofing asphalt, to form a uniform membrane without glass-fiber base-ply sheets touching.

3.7 APP-MODIFIED BITUMINOUS MEMBRANE INSTALLATION

- A. Install modified bituminous roofing membrane sheet and cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:
 - 1. Adhere to substrate in cold-applied adhesive.
 - 2. Torch apply to substrate.
 - 3. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.
- B. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
 - 1. Repair tears and voids in laps and lapped seams not completely sealed.
 - 2. Apply roofing granules to cover exuded bead at laps while bead is hot.

- C. Install roofing membrane sheets so side and end laps shed water.

3.8 FLASHING AND STRIPPING INSTALLATION

- A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:
 - 1. Prime substrates with asphalt primer if required by roofing system manufacturer.
 - 2. Backer Sheet Application: Install backer sheet and adhere to substrate in a solid mopping of hot roofing asphalt.
- B. Extend base flashing up walls or parapets a minimum of **8 inches (200 mm)** above roofing membrane and **4 inches (100 mm)** onto field of roofing membrane.
- C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
 - 1. Seal top termination of base flashing with a strip of glass-fiber fabric set in asphalt roofing cement.
- D. Roof Drains: Set **30-by-30-inch (760-by-760-mm)** metal flashing in bed of roofing-manufacturer-approved asphaltic adhesive on completed roofing membrane. Cover metal flashing with roofing membrane cap-sheet stripping and extend a minimum of **6 inches (150 mm)** beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
 - 1. Install stripping according to roofing system manufacturer's written instructions.

3.9 COATING INSTALLATION

- A. Apply coatings to roofing membrane and base flashings according to manufacturer's written instructions, by spray, roller, or other suitable application method.

3.10 WALKWAY INSTALLATION

- A. Walkway Pads: Install walkway pads in cold-applied adhesive, using units of size indicated or, if not indicated, of manufacturer's standard size according to walkway pad manufacturer's written instructions.
- B. Walkway Strips: Install walkway cap sheet strips over roofing membrane.
 - 1. Install walkway strips in cold-applied adhesive.

3.11 PROTECTED MEMBRANE ROOFING INSULATION AND BALLAST INSTALLATION

- A. Loosely lay separator sheet over cooled roofing membrane, with minimum **2-inch (50-mm)** side laps and **4-inch (150-mm)** end laps.
- B. Insulation: Loosely lay board insulation units over roofing membrane, with long joints of insulation in a continuous straight line and with end joints staggered between rows. Abut edges and ends between units. Install to achieve required insulation thickness over roofing membrane. Cut and fit to within **3/4 inch (19 mm)** of projections and penetrations.
 - 1. Where overall insulation thickness is **2 inches (50 mm)** or more, install required thickness in 2 or more layers with joints of each succeeding layer staggered over joints of previous layer a minimum of **6 inches (150 mm)** in each direction.
 - 2. Install protection mat over insulation, overlapping edges and ends at least **12 inches (300 mm)**. Do not lap ends of fabric sheets within **72 inches (1800 mm)** of roof perimeter. Extend fabric **2 to 3 inches (50 to 75 mm)** above ballast at perimeter and penetrations. Apply additional protection mat layer around penetrations to prevent aggregate from getting between penetrations and insulation. Do not cover drains or restrict water flow to drains.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.
- B. Test Cuts: Test specimens will be removed to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:
 - 1. Approximate quantities of components within roofing membrane will be determined according to ASTM D 3617.
 - 2. Test specimens will be examined for interply voids according to ASTM D 3617 and to comply with criteria established in Appendix 3 of ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
 - 1. Notify Architect or Owner 48 hours in advance of date and time of inspection.
- D. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.13 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07620 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes sheet metal flashing and trim in the following categories:
 - 1. Exposed trim, gravel stops, and fasciae.
 - 2. Metal flashing.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 7 Section "Joint Sealants" for elastomeric sealants.
 - 2. Division 7 Roofing Sections for flashing and roofing accessories installed integral with roofing membrane as part of roofing-system work.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing.
- B. Fabricate and install flashings at roof edges to comply with recommendations of FM Loss Prevention standards.

1.4 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data including manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.
- C. Shop Drawings of each item specified showing layout, profiles, methods of joining, and anchorage details.
- D. Samples of sheet metal flashing, trim, and accessory items, in the specified finish. Where finish involves normal color and texture variations, include Sample sets composed of 2 or more units showing the full range of variations expected.
 - 1. **8-inch- (200-mm-)** square Samples of specified sheet materials to be exposed as finished surfaces.
 - 2. **12-inch- (300-mm-)** long Samples of factory-fabricated products exposed as finished Work. Provide complete with specified factory finish.
- E. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

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

1.6 PROJECT CONDITIONS

- A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

PART 2 - PRODUCTS

2.1 METALS

- A. Galvanized Steel Sheet: **ASTM A 526, G 90 (ASTM A 526M, Z 275)**, commercial quality, or **ASTM A 527, G 90 (ASTM A 527M, Z 275)**, lock-forming quality, hot-dip galvanized steel sheet with 0.20 percent copper, mill phosphatized where indicated for painting; not less than **0.0396 inch (1.0 mm)** thick, unless otherwise indicated.

2.2 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Burning Rod for Lead: Same composition as lead sheet.
- B. Solder: ASTM B 32, Grade Sn50, used with rosin flux.
- C. Solder for Stainless Steel: ASTM B 32, Grade Sn60, used with an acid flux of type recommended by stainless-steel sheet manufacturer; use a noncorrosive rosin flux over tinned surfaces.
- D. Stainless-Steel Welding Rods: Type recommended by stainless-steel sheet manufacturer for type of metal sheets furnished.
- E. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.
- F. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
- G. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealants."
- H. Epoxy Seam Sealer: 2-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior and interior nonmoving joints, including riveted joints.
- I. Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.
- J. Paper Slip Sheet: **5-lb/square (0.244 kg/sq. m)** red rosin, sized building paper conforming to FS UU-B-790, Type I, Style 1b.
- K. Polyethylene Underlayment: ASTM D 4397, minimum **6-mil- (0.15-mm-)** thick black polyethylene film, resistant to decay when tested according to ASTM E 154.
- L. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

2.3 FABRICATION, GENERAL

- A. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.

- B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- C. Form exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.
- D. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- E. Expansion Provisions: Space movement joints at maximum of **10 feet (3 m)** with no joints allowed within **24 inches (610 mm)** of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with mastic sealant (concealed within joints).
- F. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
- G. Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.
- H. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.
- I. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.
 - 1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

2.4 SHEET METAL FABRICATIONS

- A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.
- B. Exposed Trim, Gravel Stops, and Fasciae: Fabricate from the following material:
 - 1. Galvanized Steel: **0.0276 inch (0.7 mm)** thick.
- C. Copings: Fabricate from the following material:
 - 1. Galvanized Steel: **0.0396 inch (1.0 mm)** thick..
- D. Base Flashing: Fabricate from the following material:
 - 1. Galvanized Steel: **0.0276 inch (0.7 mm)** thick.
- E. Counterflashing: Fabricate from the following material:
 - 1. Galvanized Steel: **0.0217 inch (0.55 mm)** thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Anchor units of Work securely in place by methods

indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.

- B. Install exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- C. Roof-Edge Flashings: Secure metal flashings at roof edges according to FM Loss Prevention Data Sheet 1-49 for specified wind zone.
- D. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of **10 feet (3 m)** with no joints allowed within **24 inches (610 mm)** of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than **1 inch (25 mm)** deep, filled with mastic sealant (concealed within joints).
- E. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of **1-1/2 inches (38 mm)**, except where pre-tinned surface would show in finished Work.
 - 1. Do not solder the following metals:
 - a. Aluminum.
 - b. Coil-coated galvanized steel sheet.
 - 2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
- F. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant.
 - 1. Use joint adhesive for nonmoving joints specified not to be soldered.
- G. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- H. Separations: Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.
 - 1. Underlayment: Where installing stainless steel or aluminum directly on cementitious or wood substrates, install a slip sheet of red-rosin paper and a course of polyethylene underlayment.
 - 2. Bed flanges of Work in a thick coat of roofing cement where required for waterproof performance.
- I. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of **2 inches (50 mm)** and bed with sealant.
- J. Install continuous gutter screens on gutters with noncorrosive fasteners, arranged as hinged units to swing open for cleaning gutters.

3.3 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
- B. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

END OF SECTION

SECTION 07920 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Uniform General and Supplementary General Conditions for State of Texas Building Construction Contracts, Special Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes joint sealants for the following locations:
 - 1. Exterior joints in vertical surfaces and no traffic horizontal surfaces as indicated below:
 - a. Control and expansion joints in cast-in-place concrete.
 - b. Joints between architectural precast concrete units.
 - c. Control and expansion joints in unit masonry.
 - d. Joints between different materials listed above.
 - e. Perimeter joints between materials listed above and frames of doors and windows.
 - f. Control and expansion joints in ceiling and overhead surfaces.
 - g. Other joints as indicated.
 - 2. Exterior joints in horizontal traffic surfaces as indicated below:
 - a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
 - b. Joints between different materials listed above.
 - c. Other joints as indicated.
 - 3. Interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Joints between tops of non-load-bearing unit masonry walls and underside of cast-in-place concrete slabs and beams.
 - d. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
 - e. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
 - f. Other joints as indicated.
 - 4. Interior joints in horizontal traffic surfaces as indicated below:
 - a. Control and expansion joints in cast-in-place concrete slabs.
 - b. Other joints as indicated.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.
- B. Provide joint sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water resistant and cause no staining or deterioration of joint substrates.

1.4 SUBMITTALS

- A. Product data from manufacturers for each joint sealant product required.
 - 1. Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.
- B. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.

- C. Samples for verification purposes of each type and color of joint sealant required. Install joint sealant samples in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.
- E. Certification from the manufacturer's representative that the installation is complete and complies with all manufacturer's requirements. Certification is to be based upon 30 day test results and field inspection.
- F. Qualification data complying with requirements specified in "Quality Assurance" article. Include list of completed projects with project names addresses, names of Architects and Owners, plus other information specified.
- G. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.
- H. Product test reports for each type of joint sealants indicated, evidencing compliance with requirements specified.
- I. Preconstruction field test reports indicating which products and joint preparation methods demonstrate acceptable adhesion to joint substrates.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.
- B. Testing Laboratory Qualifications: To qualify for acceptance, an independent testing laboratory must demonstrate to Architect's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct satisfactorily the testing indicated without delaying progress of the Work.
- C. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.
- D. Preconstruction Compatibility and Adhesion Testing: Submit to joint sealant manufacturers samples of materials that will contact or affect joint sealants for compatibility and adhesion testing as indicated below:
 1. Use test methods standard with manufacturer to determine if priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - a. Perform tests under normal environmental conditions that will exist during actual installation.
 2. Submit not less than 9 pieces of each type of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.
 3. Schedule sufficient time for testing and analysis of results to prevent delay in the progress of the Work.
 4. Investigate materials failing compatibility or adhesion tests and obtain joint sealant manufacturer's written recommendations for corrective measures, including use of specially formulated primers.
 5. Testing will not be required when joint sealant manufacturer is able to submit joint preparation data required above that are acceptable to Architect and are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

- E. Product Testing: Provide comprehensive test data for each type of joint sealant based on tests conducted by a qualified independent testing laboratory on current product formulations within a 24-month period preceding date of Contractor's submittal of test results to Architect.
 - 1. Test elastomeric sealants for compliance with requirements specified by reference to ASTM C 920. Include test results for hardness, stain resistance, adhesion and cohesion under cyclic movement (per ASTM C 719), low-temperature flexibility, modulus of elasticity at 100 percent strain, effects of heat aging, and effects of accelerated weathering.
 - 2. Include test results performed on joint sealants after they have cured for 1 year.
 - F. Preconstruction Field Testing: Prior to installation of joint sealants, field-test their adhesion to joint substrates as follows:
 - 1. Locate test joints where indicated or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each application indicated below:
 - a. Each type of elastomeric sealant and joint substrate indicated.
 - b. Each type of non-elastomeric sealant and joint substrate indicated.
 - c. Weather conditions and temperature range of the actual installation including the required curing time.
 - 3. Notify Architect one week in advance of the dates and times when mock-ups will be erected.
 - 4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.
 - 5. Test Method: Test joint sealants by hand pull method described below:
 - a. Install joint sealants in 60 inches joint lengths using same materials and methods for joint preparation and joint sealant installation required for completed Work. Allow sealants to cure fully before testing.
 - b. Make knife cuts horizontally from one side of joint to the other followed by 2 vertical cuts approximately 2 inches long at side of joint and meeting horizontal cut at top of 2-inch cuts. Place a mark 1 inch from top of 2-inch piece.
 - c. Use fingers to grasp 2-inch piece of sealant just above 1-inch mark; pull firmly down at a 90-degree angle or more while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
 - 6. Report whether or not sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
 - 7. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.
 - G. Field-Constructed Mock-Ups: Prior to installation of joint sealants, apply elastomeric sealants as follows to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution:
 - 1. Joints in field-constructed mock-ups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants specified in this Section.
 - H. Pre-Installation Conference: Conduct conference at Project site to comply with requirements of the Division 1 Section covering this activity.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer for installation and curing time.
 - 2. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40 deg F.
 - 3. When joint substrates are wet.
- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.8 SEQUENCING AND SCHEDULING

- A. Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors: Provide color of exposed joint sealants to comply with the following:
 - 1. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.
- C. When one-part products are specified and the scheduling of the installation cannot be done at a time when the material can cure to the optimum performance substitute an acceptable multipart fast curing material subject to the approval of the Architect.
- D. Materials
 - 1. Modified Polyurethane (type 1 Sealant)
 - a. Two or three part conforming to FS TT-S-00227E, class A, type II (nonsag) and ASTM C-920.
 - b. Acceptable products:
 - 1) Dynatrol II, Pecora
 - 2) NP2, Sonneborn-Contech, Inc.
 - 3) Dymeric, Tremco.
 - 2. Polyurethane (Type 2 Sealant)
 - a. Two part conforming to FS TT-S-00227E, class A, type I (self leveling) and ASTM-920.
 - b. Acceptable products:
 - 1) Dynatrated, Pecora.
 - 2) Sonalastic Paving joint sealant, Sonneborn-Contech.
 - 3) THC 900 (Self leveling) or 901 (low sag), Tremco.
 - 3. Silicone, General purpose (Type 3 Sealant):
 - a. One part rubber based silicone conforming to FS-TT-S-001543, class A, Type II and ASTM C-920.
 - b. Acceptable products:

- 1) 790 building sealant, Dow Corning.
- 2) Silproof, General Electric.
- 3) Spetrum 1, Tremco.
4. Silicone, Sanitary (Type 4 Sealant)
 - a. One-part conforming to FS TT-S-001543, FDA Regulation 21 CFR 177.2600 and FDA Food Additive Regulation 121.2514.
 - b. Color: Clear.
 - c. Acceptable products:
 - 1) No. 786 Silicone Rubber Sealnt, Dow Corning.
 - 2) SCS 1702, General Electric.
5. Acrylic Latex (Type 5 Sealant)
 - a. One part, non-sag acrylic latex, meeting ASTM C834.
 - b. Acceptable products:
 - 1) AC-20, Pecora.
 - 2) Sonalac, Sonneborn-Contech.
 - 3) Acrylic Latex 834 caulk, Tremco.
6. Acoustical sealant (Type 6 Sealant)
 - a. Butyl rubber for concealed locations.
 - b. Acceptable products:
 - 1) AC-20, Pecora.
 - 2) Acoustical sealant, Tremco.
7. Joint fillers and Accessories as part of waterproofing installation (Type 10)
 - a. Emseal 20 H system, Code EH 12560.
 - b. Emseal expanding foam sealant (1" wide x 2.5" deep)
 - c. Emseal Poymer topcoat 200 (1/32" thick x 1.5" wide)
 - d. Emseal Epoxy Edging Adhesive, series 600 and 700 (depending on application temperatures)

2.2 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 1. Open-cell polyurethane foam.
 2. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.
 3. Proprietary, reticulated, closed-cell polymeric foam, nonoutgassing, with a density of 2.5 pcf and tensile strength of 35 psi per ASTM D 1623, and with water absorption less than 0.02 g/cc per ASTM C 1083.
 4. Any material indicated above.
- C. Elastomeric Tubing Joint Fillers: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, capable of remaining resilient at temperatures down to -26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.3 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:
 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 3. Remove laitance and form release agents from concrete.
 4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

- D. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
 - 1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of joint fillers.
 - b. Do not stretch, twist, puncture, or tear joint fillers.
 - c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
 - 2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.
- E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
 - 1. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
 - 2. Provide flush joint configuration, per Figure 5B in ASTM C 1193, where indicated.
 - a. Use masking tape to protect adjacent surfaces of recessed tooled joints.
 - 3. Provide recessed joint configuration, per Figure 5C in ASTM C 1193, of recess depth and at locations indicated.
- G. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and to comply with sealant manufacturer's directions for installation methods, materials, and tools that produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's recommendations.

3.4 QUALITY CONTROL

- A. Test installed sealants 30 days after installation.
- B. Provide manufacture's written certification that the installation is complete and that all sealant has been satisfactorily installed and cured.
- C. Where the manufacturer cannot certify sealant, remove the sealant and reinstall to the manufacturer's requirements.
 - 1. After reinstallation retest and provide manufacturer's certification.

3.5 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage

or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that and installations with repaired areas are indistinguishable from original work.

3.7 SCHEDULE OF SEALANTS

SEALANT TYPE		APPLICATION
1	a	Vertical control and expansion joints in exterior and interior masonry, precast concrete and stone surfaces
1	b	Vertical joints at the perimeter of window, door, storefront and curtainwall elements where adjacent to stone masonry or precast surfaces.
1	c	Joints in Exterior Insulated Finish systems (EIFS).
2	a	Horizontal control and expansion joints with slopes up to 10% in concrete, stone, masonry and tile flooring and at junctures between these materials and other adjacent materials.
3	a	General exterior sealing where paintability is not required including Aluminum curtain walls, precast panels, metal panels, window perimeters.
4	a.	Sealing of joints between plumbing fixtures and substrates and between plastic laminate splashes and adjacent tops and walls.
4	a.	Sealing joints between countertops and substrates in kitchen and elsewhere which may be in contact with food.
5	a.	General caulking as part of interior painting.
6	a.	Setting sill track, head track, and end studs to substrates on acoustically rated partitions. Refer to Division 9 for application requirements.
7	a.	Joints in stone work subject to chlorine exposure in fountains.
8	a.	Secondary seal at exterior designated plaza paving joints.
9	a.	Secondary joint seal at joints in exterior architectural precast concrete members.
10	a.	Joint fillers and accessories used in conjunction with waterproofing systems.

END OF SECTION

SECTION 08110 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes steel doors and frames.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.
- C. Shop Drawings showing fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.
- D. Door Schedule: Submit schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings.
 - 1. Indicate coordination of glazing frames and stops with glass and glazing requirements.
- E. Samples for verification of each type of exposed finish required, prepared on Samples not less than **3 by 5 inches** and of same thickness and material indicated for final unit of Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

1.4 QUALITY ASSURANCE

- A. Provide doors and frames complying with ANSI/SDI 100 "Recommended Specifications for Standard Steel Doors and Frames" and as specified.
- B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies tested for fire-test-response characteristics per ASTM E 152, and are labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Temperature-Rise Rating: Where indicated, provide doors that have a temperature-rise rating of **450 deg F** maximum in 30 minutes of fire exposure.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Inspect doors and frames on delivery for damage. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect; otherwise, remove and replace damaged items as directed.
- C. Store doors and frames at building site under cover. Place units on minimum **4-inch-** high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If cardboard wrappers on doors become wet, remove cartons immediately. Provide minimum **1/4-inch** spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Hot-Rolled Steel Sheets and Strip: Commercial-quality carbon steel, pickled and oiled, complying with **ASTM A 569**.
- B. Cold-Rolled Steel Sheets: Carbon steel complying with **ASTM A 366**, commercial quality, or **ASTM A 620**, drawing quality, special killed.
- C. Galvanized Steel Sheets: Zinc-coated carbon steel complying with **ASTM A 526**, commercial quality, or **ASTM A 642**, drawing quality, hot-dip galvanized according to **ASTM A 525**, with **A 60 or G 60** coating designation, mill phosphatized.
- D. Supports and Anchors: Fabricated from not less than **0.0478-inch-** thick steel sheet; **0.0516-inch-** thick galvanized steel where used with galvanized steel frames.
- E. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize complying with ASTM A 153, Class C or D as applicable.

2.2 DOORS

- A. Steel Doors: Provide **1-3/4-inch-** thick doors of materials and ANSI/SDI 100 grades and models specified below, or as indicated on Drawings or schedules:
 - 1. Exterior Doors: Grade II, heavy-duty, Model 1, full flush design, minimum **0.0516-inch-** thick (18 ga.) galvanized steel sheet faces.

2.3 FRAMES

- A. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, according to ANSI/SDI 100, and of types and styles as shown on Drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum **0.0478-inch-** thick cold-rolled steel sheet.
 - 1. Fabricate frames with mitered or coped corners, continuously welded construction for exterior applications and knocked down for field assembly at interior applications.
 - 2. Form exterior frames from **0.0635-inch-** thick (16 ga.) galvanized steel sheet.

2.4 FABRICATION

- A. Fabricate steel door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site. Comply with ANSI/SDI 100 requirements.
 - 1. Internal Construction: One of the following manufacturer's standard core materials according to SDI standards:
 - a. Resin-impregnated paper honeycomb.
 - b. Rigid polyurethane conforming to ASTM C 591.
 - c. Rigid polystyrene conforming to ASTM C 578.
 - d. Unitized steel grid.
 - e. Vertical steel stiffeners.
 - f. Rigid mineral fiber with internal sound deadener on inside of face sheets.
 - 2. Clearances: Not more than **1/8 inch** at jambs and heads, except not more than **1/4 inch** between non-fire-rated pairs of doors. Not more than **3/4 inch** at bottom.
 - a. Fire Doors: Provide clearances according to NFPA 80.
- B. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel sheet.
- C. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.

- E. Galvanized Steel Doors, Panels, and Frames: For the following locations, fabricate doors, panels, and frames from galvanized steel sheet according to SDI 112. Close top and bottom edges of doors flush as an integral part of door construction or by addition of minimum **0.0635-inch-** thick galvanized steel channels, with channel webs placed even with top and bottom edges. Seal joints in top edges of doors against water penetration.
 - 1. At exterior locations and where indicated.
- F. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
- G. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.
 - 1. Unless otherwise indicated, provide thermal-rated assemblies with U-value rating of **0.41 Btu/sq. ft. x h x deg F** or better.
 - 2. Unless otherwise indicated, provide acoustical assemblies with STC sound ratings of 33 or better.
- H. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of SDI 107 and ANSI A115 Series specifications for door and frame preparation for hardware.
- I. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
- J. Locate hardware as indicated on Shop Drawings or, if not indicated, according to the Door and Hardware Institute's (DHI) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
- K. Glazing Stops: Minimum **0.0359-inch-** thick steel or **0.040-inch-** thick aluminum.
 - 1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
 - 2. Provide screw-applied, removable, glazing beads on inside of glass, louvers, and other panels in doors.

2.5 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual" for recommendations relative to applying and designating finishes.
- B. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for steel sheet finishes.
- C. Apply primers and organic finishes to doors and frames after fabrication.

2.6 GALVANIZED STEEL SHEET FINISHES

- A. Surface Preparation: Clean surfaces with nonpetroleum solvent so that surfaces are free of oil or other contaminants. After cleaning, apply a conversion coating of the type suited to the organic coating applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
 - 1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.
- B. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply air-dried primer specified below immediately after cleaning and pretreatment.
 - 1. Shop Primer: Zinc-dust, zinc-oxide primer paint complying with performance requirements of FS TT-P-641, Type II.

2.7 STEEL SHEET FINISHES

- A. Surface Preparation: Solvent-clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if

present, from uncoated steel to comply with SSPC-SP 5 (White Metal Blast Cleaning) or SSPC-SP 8 (Pickling).

- B. Pretreatment: Immediately after surface preparation, apply a conversion coating of type suited to organic coating applied over it.
- C. Factory Priming for Field-Painted Finish: Apply shop primer that complies with ANSI A224.1 acceptance criteria, is compatible with finish paint systems indicated, and has capability to provide a sound foundation for field-applied topcoats. Apply primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.
- B. Placing Frames: Comply with provisions of SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
 - 1. Except for frames located in existing concrete, masonry, or gypsum board assembly construction, place frames before constructing enclosing walls and ceilings.
 - 2. Install fire-rated frames according to NFPA 80.
- C. Door Installation: Fit hollow-metal doors accurately in frames, within clearances specified in ANSI/SDI 100.

3.2 ADJUSTING AND CLEANING

- A. Prime Coat Touchup: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
- B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION

SECTION 08213 - PLASTIC FACED WOOD DOORS

PART 1 - GENERAL

- A. The Bidding Requirements, the General and Supplementary General Conditions and Division 1, General Requirements, of this project manual apply to all work required for this Section.
- 1.2 DESCRIPTION:
- A. Provide all plastic laminate faced doors indicated on the drawings and/or specified herein.
- 1.3 QUALITY ASSURANCE:
- A. Approved Suppliers - others require written approval:
 - 1. Vauter Door Co., Corpus Christi, Texas
 - 2. Timco Industries, Cuero, Texas
 - 3. Ragland Manufacturing Co., Houston, Texas
 - 4. Buell Door Co., Dallas, Texas
 - B. Products of other manufacturers may be submitted for approval in conformance with Section 01600.
 - C. Inspection: Architect shall be permitted to inspect the work at the shop at any time. Defective workmanship and/or materials shall be rejected and replaced. Inspection at the shop will not relieve the contractor of his responsibilities to complete the work in accordance with this specification.
- 1.4 SUBMITTALS:
- A. Submit shop drawings and samples for color and finish in conformance with Section 01300.
- 1.5 DELIVERY AND STORAGE:
- A. The building and/or storage area shall be sufficiently dry before doors are delivered to prevent the woodwork from being damaged by excessive changes in moisture content. Store doors in a manner recommended by the manufacturer.
 - B. Shipping, storing and handling:
 - 1. Factory wrap doors in heavy paper cartons.
 - 2. Protect doors during transit, handling and storage to prevent damage, soiling and deterioration.
 - 3. Store doors in a dry location and stack flat, on skids with covering intact.
- 1.6 GUARANTEE REQUIREMENTS:
- A. Submit guarantee in conformance with Section 01700.
 - B. Guarantee: Two (2) years against becoming unserviceable or causing an objectionable appearance resulting from either defective or non-conforming materials and workmanship. Defects shall include, but not be limited to the following:
 - 1. Warp in excess of 1/4" as defined by HWMA.
 - 2. Warp or twist to a degree that the door will not operate properly.
 - 3. Any show through of stiles, rails or core.
 - 4. Delamination.
 - C. Replace defective doors at no cost to Owner, including cost of rehangng and refinishing.

PART 2 - PRODUCTS

2.1 MATERIALS:

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

PSP # 407480

CONSTRUCTION DOCUMENTS – 2 MAY 2007

PLASTIC FACED WOOD DOORS

08213 - 1

- A. Adhesives: Water resistant, conforming to type II, CS 35-61.
- B. Doors: Presized, beveled, prepared for hardware and metal framed vision panels at the mill.
- C. Stiles and rails: 1-1/2" x 1-1/4" after factory trimming and prefitting laminated or solid hardwood, painted to match plastic laminate face. Seal wood with water proof penetrating sealer before shipment.
- D. Cores: 1-1/2" thick, type I, density C (average 30#/c.f.), class I, CS 236-66, matformed particle board.
- E. Plastic laminate: Conform to requirements of Section 06240.

PART 3 - EXECUTION

3.1 FABRICATION:

- A. Shop machine and mortise door panels for proper fit of finish hardware.
- B. Seal exposed wood surfaces with waterproof penetrating sealer before shipment.
- C. Mill tolerances shall not be over 1/8" for jambs, heads and meeting rails and not over 1/2" for bottoms without carpet or thresholds.

END OF SECTION

SECTION 08410 - ALUMINUM ENTRANCES & STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Exterior aluminum-framed entrances and storefronts.

1.3 SYSTEM DESCRIPTION

- A. General: Provide aluminum entrance and storefront systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project. Failure includes the following:
 - 1. Air infiltration and water penetration exceeding specified limits.
 - 2. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.
- B. Glazing: Physically and thermally isolate glazing from framing members.
- C. Glazing-to-Glazing Joints: Provide glazing-to-glazing joints that accommodate thermal and mechanical movements of glazing and system, prevent glazing-to-glazing contact, and maintain required edge clearances.
- D. Wind Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of authorities having jurisdiction or the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," 6.4.2, "Analytical Procedure," whichever are more stringent.
 - 1. Deflection of framing members in a direction normal to wall plane is limited to 1/175 of clear span or 3/4 inch, whichever is smaller, unless otherwise indicated.
 - 2. Static-Pressure Test Performance: Provide entrance and storefront systems that do not evidence material failures, structural distress, failure of operating components to function normally, or permanent deformation of main framing members exceeding 0.2 percent of clear span when tested according to ASTM E 330.
 - a. Test Pressure: 150 percent of inward and outward wind-load design pressures.
 - b. Duration: As required by design wind velocity; fastest 1 mile of wind for relevant exposure category.
- E. Live Loads: Provide entrance and storefront systems, including anchorage, that accommodate the supporting structures' deflection from uniformly distributed and concentrated live loads indicated without failure of materials or permanent deformation.
- F. Air Infiltration: Provide entrance and storefront systems with permanent resistance to air leakage through fixed glazing and frame areas of not more than 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a static-air-pressure difference of 1.57 lbf/sq. ft.
- G. Water Penetration: Provide entrance and storefront systems that do not evidence water leakage through fixed glazing and frame areas when tested according to ASTM E 331 at minimum differential pressure of 20 percent of inward-acting wind-load design pressure as defined by ASCE 7, "Minimum Design Loads for Buildings and Other Structures," but not less than 6.24 lbf/sq. ft. Water leakage is defined as follows:
 - 1. Uncontrolled water infiltrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and

gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

- H. Thermal Movements: Provide entrance and storefront systems, including anchorage, that accommodate thermal movements of systems and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, failure of doors or other operating units to function properly, and other detrimental effects.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- I. Structural-Support Movement: Provide entrance and storefront systems that accommodate structural movements including, but not limited to, sway and deflection.
- J. Condensation Resistance: Provide storefront systems with condensation resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.1.
- K. Dimensional Tolerances: Provide entrance and storefront systems that accommodate dimensional tolerances of building frame and other adjacent construction.

1.4 SUBMITTALS

- A. Shop Drawings: For entrance and storefront systems. Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work.
 - 1. For entrance systems, include hardware schedule and indicate operating hardware types, quantities, and locations.
- B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.
- C. Samples for Verification: Of each type of exposed finish required in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
- D. Cutaway Sample: Of each vertical-to-horizontal framing intersection of systems, made from minimum 6-inch lengths of full-size components and showing details of the following:
 - 1. Joinery.
- E. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing entrance and storefront systems similar to those required for this Project and who is acceptable to manufacturer.
 - 1. Engineering Responsibility: Prepare data for entrance and storefront systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Testing Agency Qualifications: Demonstrate to Architect's satisfaction, based on Architect's evaluation of criteria conforming to ASTM E 699, that the independent testing agency has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.
- C. Source Limitations: Obtain each type of entrance and storefront system through one source from a single manufacturer.
- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of entrance and storefront systems and are based on the specific systems indicated. Other manufacturers'

systems with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

1. Do not modify intended aesthetic effect, as judged solely by Architect, except with Architect's approval and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

- E. Welding Standards: Comply with applicable provisions of AWS D1.2, "Structural Welding Code-Aluminum."

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating systems without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.

1.7 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Submit a written warranty executed by the manufacturer agreeing to repair or replace components of entrance and storefront systems that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:
 1. Structural failures including, but not limited to, excessive deflection.
 2. Failure of system to meet performance requirements.
 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 4. Failure of operating components to function normally.
 5. Water leakage through fixed glazing and frame areas.
- C. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Storefront Manufacturer for Hospital or approved equal.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.
 1. Sheet and Plate: ASTM B 209.
 2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221.
 3. Extruded Structural Pipe and Tubes: ASTM B 429.
 4. Bars, Rods, and Wire: ASTM B 211.
 5. Welding Rods and Bare Electrodes: AWS A5.10.
- B. Steel Reinforcement: Complying with ASTM A 36 for structural shapes, plates, and bars; ASTM A 611 for cold-rolled sheet and strip; or ASTM A 570 for hot-rolled sheet and strip.

- C. Glazing as specified in Division 8 Section "Glazing."
- D. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.
- E. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.
- F. Structural Silicone Sealant: Type recommended by sealant and system manufacturers that complies with ASTM C 1184 requirements, is compatible with system components with which it comes in contact, and is specifically formulated and tested for use as a structural sealant.
 - 1. Color: As selected by Architect from manufacturer's full range of colors.
 - 2. Tensile Strength: 100 psi minimum.
 - 3. Provide sealant with modulus of elasticity that will not allow movement of more than 25 percent of joint width, unless less movement is required by structural-sealant-glazed systems' design.
 - 4. Use neutral-cure silicone sealant with insulating-glass units.
- G. Secondary Sealant: For use as weatherseal, compatible with structural silicone sealant and other system components with which it comes in contact, and that accommodates a 50 percent increase or decrease in joint width at the time of application when measured according to ASTM C 719.
 - 1. Use neutral-cure silicone sealant with insulating-glass units.
- H. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.
- I. Sealants and joint fillers for joints at perimeter of entrance and storefront systems as specified in Division 7 Section "Joint Sealants."
- J. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for 30-mil thickness per coat.

2.3 COMPONENTS

- A. Brackets and Reinforcements: Provide manufacturer's standard brackets and reinforcements that are compatible with adjacent materials. Provide nonstaining, nonferrous shims for aligning system components.
- B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Reinforce members as required to retain fastener threads.
 - 2. Do not use exposed fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.
- C. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.
- D. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing, compatible with adjacent materials, and of type recommended by manufacturer.
- E. Weather Stripping: Manufacturer's standard replaceable weather stripping as follows:
 - 1. Compression Weather Stripping: Molded neoprene complying with ASTM D 2000 requirements or molded PVC complying with ASTM D 2287 requirements.
 - 2. Sliding Weather Stripping: Wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing complying with AAMA 701 requirements.

- F. Thresholds: At exterior doors, provide manufacturer's standard threshold with cutouts coordinated for operating hardware, with anchors and jamb clips, and not more than 1/2-inch-high, with beveled edges providing a floor level change with a slope of not more than 1:2, and in the following material:
 - 1. Material: Aluminum, mill finish.
- G. Weather Sweeps: Manufacturer's standard weather sweep for application to exterior door bottoms and with concealed fasteners on mounting strips.

2.4 FABRICATION

- A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
 - 1. Fabricate components for screw-spline frame construction.
- B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.
- C. Prepare components to receive concealed fasteners and anchor and connection devices.
- D. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
- E. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- F. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual."
- G. Glazing Channels: Provide minimum clearances for thickness and type of plastic sheet indicated according to plastic sheet manufacturer's written instructions.
- H. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- I. Storefront: Fabricate framing in profiles indicated for flush glazing (without projecting stops). Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.
- J. Entrances: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.
 - 1. Exterior Doors: Provide compression weather stripping at fixed stops. At other locations, provide sliding weather stripping retained in adjustable strip mortised into door edge.

2.5 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are

acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

- C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- D. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 606.1 or AAMA 608.1.
 - 1. Color: Clear Anodized.

2.6 STEEL PRIMING

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying primer.
- B. Surface Preparation: Perform manufacturer's standard cleaning operations to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel.
- C. Priming: Apply manufacturer's standard corrosion-resistant primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of entrance and storefront systems. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
- B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
- D. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Comply with requirements of Division 7 Section "Joint Sealants."
- E. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.
- F. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.
 - 1. Install surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.

- G. Install glazing to comply with requirements of Division 8 Section "Glazing," unless otherwise indicated.
 - 1. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
 - 2. Install structural silicone sealant according to sealant manufacturer's written instructions.
 - 3. Mechanically fasten glazing in place until structural sealant is cured.
 - 4. Remove excess sealant from component surfaces before sealant has cured.
- H. Install secondary-sealant weatherseal according to sealant manufacturer's written instructions to provide weatherproof joints. Install joint fillers behind sealant as recommended by sealant manufacturer.
- I. Install perimeter sealant to comply with requirements of Division 7 Section "Joint Sealants," unless otherwise indicated.
- J. Erection Tolerances: Install entrance and storefront systems to comply with the following maximum tolerances:
 - 1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 12 feet; 1/4 inch over total length.
 - 2. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
 - 3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing agency to perform field quality-control testing indicated.
- B. Structural-Silicone-Sealant Adhesion Test: Test installed structural silicone sealant according to field adhesion test method described in AAMA CW #13, "Structural Sealant Glazing Systems (A Design Guide)."
 - 1. Test a minimum of 2 areas.
- C. Water Spray Test: After completing the installation of test areas indicated, test storefront system for water penetration according to AAMA 501.2 requirements.
- D. Repair or remove and replace Work that does not meet requirements or that is damaged by testing; replace to conform to specified requirements.

3.4 ADJUSTING AND CLEANING

- A. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.
- B. Remove excess sealant and glazing compounds, and dirt from surfaces.

3.5 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure entrance and storefront systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 08710 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes furnishing and installing door hardware, thresholds, weatherstripping and seals.
- B. Related Sections include the following:
 - 1. Division 8 Section 08110 "Hollow Metal Work".
 - 2. Division 8 Section 08213 "Plastic Faced Wood Doors".

1.3 PERFORMANCE REQUIREMENTS

- A. Furnish and install each door hardware item to provide proper operation and required function of every unit without binding or failure.
 - 1. Interior Door Opening Force: Adjust hardware operation at interior non-fire-rated doors to provide an opening force not greater than 5 lbs at a point 3" from latch, measured to leading edge of door.
 - 2. Exterior and Fire Rated Door Opening Force: At exterior doors and fire-rated doors, adjust hardware opening force in small increments above the opening force required for interior non-fire-rated doors to close and latch the door.
 - 3. Closer Sweep Adjustment: Adjust closer sweep period so that from a 70 degree open position, door will take at least 3 seconds to move to a point 3" from latch, measured to leading edge of door.

1.4 SUBMITTALS

- A. Submit manufacturer's technical product data for each item of hardware. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into vertical format "hardware sets" indicating complete designations of every item required for each door or opening. Use specification heading numbers with any variations suffixed a, b, etc
- B. Coordinate hardware with doors, frames, and related work to ensure proper size thickness, hand, function, and finish of hardware. If requested by Architect, submit one sample of each type of exposed hardware unit, finished as required, and tagged with full description for coordination with schedule. Submit data and schedule at earliest possible date, particularly where acceptance of schedule must precede fabrication of other work (e. g. hollow metal frames) that is critical to the Project construction schedule.
 - 1. Type, style, function, size and finish of each hardware item.
 - 2. Name and manufacturer of each item.
 - 3. Fastenings and other pertinent information.
 - 4. Hardware set location cross-referenced to both Drawing floor plan and door schedule indications.

5. Explanation of all abbreviations, symbols, and codes in schedule.
 6. Mounting locations for hardware.
 7. Door and frame sizes and materials.
- C. Coordinate keying instructions, and keying information. Deliver keys and key control box to Owner in person and obtain receipt (No Exceptions).

1.5 QUALITY ASSURANCE

- A. Supplier Qualifications: A recognized finish hardware supplier who has been furnishing hardware in the Project's vicinity for a period of not less than 2 years, and who is, or employs an experienced hardware consultant (AHC) who is available, at reasonable times during the course of the Work, for consultation about Project's hardware requirements, to Owner, Architect and Contractor.
- B. Coordination and Schedules: Hardware units and usage specified in Part 2 of this Section and scheduled on the Drawings establish quality, quantity, function and finish required for each door opening. Review, coordinate and confirm that hardware specified for each opening is the proper function. In case of controversy, make appropriate notations of proposed changes from specified requirements on supplier's hardware schedule and request written clarification from the Architect prior to proceeding.
- C. Fire-Rated Openings: Provide door hardware for fire rated openings that comply with NFPA Standards No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not. All hardware shall comply with standards UBC 702 (1997) and UL 10C.
1. Where emergency exit devices are required on fire-rated doors (with supplementary marking on doors' UL labels indicating "Fire Door to be equipped with Fire Exit Hardware") provide UL label on exit devices indicating "Fire Exit Hardware".

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.
- B. Packaging of door hardware is the responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.
- C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
- D. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).
- E. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

1.7 WARRANTY

- A. Special warranties:
 - 1. Door Closers: Ten year period
 - 2. Exit Devices: Three year period
 - 3. Automatic Door Operators: Two year period
 - 4. Locks and Cylinders: Three year period

1.8 MAINTENANCE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Parts kits: Furnish manufacturer's standard parts kits for locksets, exit devices, and door closers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. General: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws. With each hardware item, furnish machine screws for installation into steel, and provide threaded to the head wood screws for installation into wood; all-purpose threads are not acceptable. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed screws to match the hardware finish. Provide concealed fasteners for hardware units that are exposed when the door is closed, except to the extent no standard units of the type specified are available with concealed fasteners. Provide through bolts for closer installation.

2.2 HARDWARE UNITS AND USAGE

- A. Units specified below establish the design, grade, function, finish, size, and other qualities required for this Project. Provide the following hardware units in the quantities specified and locations indicated on the Door Schedule. Provide US 26D finish unless otherwise specified. Refer to Door Schedule on Drawings for door sizes, fire ratings, hardware function, exit devices, door closers, and other requirements at each door opening
 - 1. Butt Hinges: Provide the following butt hinges produced by Ives, or equivalent butt hinges produced by, Hager, or Bommer, as approved. Provide 1-1/2 pair per door leaf up to 7'-6" high and one additional hinge per leaf for each additional 2'-6" of door height.
 - a. Out-Swinging Exterior Doors Except Storefront: Ives 5BB1HW 4.5 x 4.5 NRP x non-ferrous.
 - b. In-swinging Exterior Doors: Ives 5BB1HW 4.5 x 4.5 non-ferrous.
 - c. Out-Swinging Interior High Frequency Doors: Ives 5BB1HW 4.5 x 4.5 x NRP.
 - d. In-Swinging Interior High Frequency Doors: Ives 5BB1HW 4.5 x 4.5
 - e. Out-Swinging Interior Average Frequency Doors: Ives 5BB1 4.5 x 4.5 NRP.
 - f. In-Swinging Interior Average Frequency Doors: Ives 5BB1 4.5 x 4.5.
 - 2. Door Closers

- a. Door Closers: Provide the following closers produced by Dor-O-Matic. Adjust operation to complying with ADA requirements. Provide type of arm recommended by closer manufacturer for door conditions (use, door hand and swing) indicated.
 - b. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with standards UBC 7-2 (1997) and UL 10C.
 - c. Door closer shall have fully hydraulic, full rack and pinion action.
 - d. Pressure relief valves are not acceptable for the exterior doors.
 - e. Hydraulic fluid shall be of a type requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to 10 degrees F.
 - f. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for the physically handicapped. Closers shall have separate adjustment for latch speed, general speed, and back check.
 - g. Closers to be installed to allow door swing as shown on plans. Doors swinging into exit corridors shall provide for corridor clear width as required by code. Where possible, mount closers on room side of door.
 - h. Door closers meeting this specification: Dor-O-Matic SC81 Series or equivalent by LCN.
3. Heavy Duty Cylindrical Locks and latches: as scheduled, fastened with through-bolts and threaded chassis hubs. Provide the following Corbin Russwin CL3300 series or equivalent by Falcon.
- a. Chassis: Cold-rolled steel, handing field-changeable without disassembly.
 - b. Latch bolts: 1/2-inch throw (3/4" on pairs of fire doors).
 - c. Lever Trim: Locksets shall be provided standard with release feature so that when outside lever is locked, it is not rigid but will move freely without operating the latchbolt. Trim shall have individual heavy-duty springs behind the rose for lever return and to prevent lever sag. All levers shall be solid and meet the federal and state ADA requirements.
 - d. Strikes: 16 gage curved steel, bronze or brass with 1" deep box construction, lips of sufficient length to clear trim and project clothing.
 - e. Certifications:
 - i. ANSI A156.2, Series 4000, Grade 1
 - ii. UL listed for 3-hour A labeled doors.
4. Exit Devices: Provide the following at the locations shown on the Door Schedule; Monarch.
- a. Exit Devices shall be touchpad type, fabricated of bronze, brass, stainless steel, or aluminum, plated to the standard architectural finishes to match the balance of the door hardware.
 - b. All exit devices and trim to be of one manufacturer as hereafter listed and in the hardware sets for continuity of design and consideration of warranty.
 - c. Exit Devices to be "UL" listed for life safety. All exit devices for labeled doors shall have "UL" label for "Fire Exit Hardware". All devices mounted on labeled wood doors are to be through-bolted or per the manufacturer's listing requirements. All devices shall conform to NFPA 80 and NFPA 101 requirements.
 - d. Touchpad shall extend a minimum of one half of the door width. Touchpad shall match exit device finish.
 - e. Exit devices meeting this specification: Monarch 18 Series or equivalent by Von Duprin.
5. Kick Plates, Push, and Pulls: Provide the following at locations designated; Ives or equivalent by Trimco or Rockwood.
- a. Kick Plates shall be 10" high x 2" less than door width x minimum 0.0538" (1.3 mm) thick x B3E.
 - b. Mop Plates shall be 4" high x 1" less than door width x minimum 0.0538" (1.3 mm) thick x B3E.

- c. Push/Pulls: 8200 6" x 16", 8302 6" x 16"; 8190-0; 9190-0.
- 6. Stops, Flush Bolts, Dust Proof Strikes, & Silencers: Provide the following at locations designated; IVES, or equivalent by Trimco or Rockwood.
 - a. Floor Stops: Ives FS436, FS41
 - b. Wall Stops: Ives ws407
 - c. Manual Flush Bolts: 1 set IVES FB458/FB358 x DP-1/DP-2 dustproof strike as required at each inactive leaf of a pair of doors (except equipped with exit devices).
 - d. Silencers: IVES SR 64; (3) per single leaf opening, (4) per double leaf opening.
- 7. Weather stripping, Seals and Thresholds: Provide the following at locations designated; National Guard Products or equivalent by Zero Weather stripping.

2.3 KEYING REQUIREMENTS

- A. Keys and Keying:
 - 1. All locks shall be keyed to the existing Corbin Russwin system as directed.
 - 2. Furnish Owner's written approval of the system. Provide construction key system in accordance with lock manufacturer's standard. Emboss keys "Do Not Duplicate" and key symbol.
 - 3. Provide 5 of each cut Master key and higher level.
 - 4. Provide 3 each cut key per lock.
 - 5. Provide 5 each construction master keys.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Custom Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect. Reinforce the attachment substrate for secure installation and adjust for proper operation. Provide clean, properly sized mortises and drilled holes for all mortised and surface applied finish hardware

3.2 INSTALLATION

- A. General: Install each hardware item in compliance with the manufacturer's instructions and recommendations.
- B. Do not install surface-mounted items until finishes have been completed on the substrate. Before painter's finish is applied, remove all finish hardware, except prime painted items. After finish coats are dry, permanently replace and readjust finish hardware for proper operation.
- C. Set units level, plumb, and true to line and location
- D. Cut and fit threshold and floor covers to profile of doorframes, with mitered corners and hairline joints. Join units with concealed welds or concealed mechanical joints. Cut smooth openings for bolts and similar items, if any. Screw thresholds to substrate with No. 10 or larger stainless steel screws

- E. Set up Pre-installation, Post installation meeting and final punch list with manufactures agent and hardware installer.

3.3 ADJUSTMENT

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units that cannot be adjusted and lubricated to operate freely and smoothly as intended for the application made.

3.4 HARDWARE SCHEDULE:

HW SET: 01
DOOR NUMBER:
112B 112C

EACH TO HAVE:
1 EA CYLINDER 951/985 AS REQ'D. X RESTRICTED KEYWAY 626 FAL
0 NOTE: BALANCE OF HARDWARE BY DOOR MFG. B/O

HW SET: 02
DOOR NUMBER:
111 108 109 112A

EACH TO HAVE:
3 EA HINGE 5BB1 4.5 X 4.5 652 IVE
1 EA STOREROOM LOCK CL3357 NZD (2-3/4 LATCH, ANSI STRIKE) 626 C-R
1 EA SURFACE CLOSER SC81 SC81 DS 689 DOR
1 SET SEALS 5020B BRN NGP

HW SET: 03
DOOR NUMBER:
113

EACH TO HAVE:
6 EA HINGE 5BB1HW 4.5 X 4.5 652 IVE
2 EA PANIC DEVICE 18-R-L-BE-DANE 630 MON
2 EA SURFACE CLOSER SC81 DS 689 DOR
1 SET SEALS 5020B BRN NGP
2 EA DRIP CAP 16A AL NGP
1 EA THRESHOLD 896V AL NGP

HW SET: 04
DOOR NUMBER:
104C

EACH TO HAVE:

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PANIC DEVICE	18-R-L-BE-DANE	630	MON
1	EA	SURFACE CLOSER	SC81 DS	689	DOR
1	EA	DRIP CAP	16A	AL	NGP
1	SET	SEALS	5020B	BRN	NGP
1	EA	THRESHOLD	896V	AL	NGP

HW SET: 05

DOOR NUMBER:

104A 104B 105A, 105B 106 107 110

EACH TO HAVE:

6	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
2	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	CL3357 NZD (2-3/4 LATCH, ANSI STRIKE)	626	C-R
1	EA	SURFACE CLOSER	SC71 SS/HO	689	DOR
1	EA	OVERHEAD STOP	900H	630	GLY
1	SET	SEALS	5020B	BRN	NGP
2	EA	DOOR SWEEP	101VA	AL	NGP
1	EA	DRIP CAP	16A	AL	NGP
1	EA	THRESHOLD	896V	AL	NGP

END OF SECTION 08710

SECTION 09250 - GYPSUM WALLBOARD

PART 1 - GENERAL

- A. The Bidding Requirements, the General and Supplementary General Conditions and Division 1, General Requirements, of this project manual apply to all work required for this Section.
- 1.2 DESCRIPTION:
- A. Furnish and install all wall and suspended ceiling gypsum wallboard work, including metal framing and accessories.
 - B. Install access panels furnished by others.
- 1.3 REFERENCES:
- A. Gypsum Association, Recommended Specifications for the Application and Finishing of Gypsum Board, GA 216.
 - B. Underwriters' Laboratories Building Materials Directory and Fire Resistance Index.
- 1.4 SUBMITTALS:
- A. Submit in conformance with Section 01300.
 - B. Submit Manufacturer's data catalog cuts, and brochures for all materials and installation instructions.
- 1.5 WARRANTY REQUIREMENTS:
- A. One (1) year contractor's warranty against all defects, including cracking, popping and delamination of sheets from date of Substantial Completion of each designated portion of the work. Repair work shall include all other work damaged by wallboard repair work all at no cost to the Owner.

PART 2 - PRODUCTS

- 2.1 MATERIALS:
- A. Framing:
 - 1. Floor Runners: 20 gauge steel, galvanized.
 - 2. Studs and Ceiling Runners: Non-load bearing, "C" and "C-H" shaped, electro-galvanized, 25-gauge steel or as shown on the drawings. Size, spacing and height as shown on the drawings.
 - 3. Other Framing Items: Cold rolled furring channels to be 16-gauge, 3/4" or 1-1/2" galvanized steel. Screw-type furring channels to be "hat-shaped" section, 25-gauge, 7/8" high, electro-galvanized steel. Wire to be 16-gauge for ties and 8-gauge for hangers.
 - B. Wallboard, Attachment and Accessory Items. ANSI A971.1:
 - 1. 5/8" thick gypsum wallboard with tapered edges, fire-rated at one hour. (UL labels required.) Screw application only. ASTM C36 and ASTM C442. Provide in lengths for no horizontal joints in walls. At fire-rated partitions, provide all components from same manufacturer when possible.
 - 2. Water-resistant 5/8" Thick Gypsum Wallboard: (ASTM 630.) Fire-rated with UL labels required. Seal at cut edges and nailheads. Use at locations where ceramic wall tile is located.
 - 3. Fasteners: Type S, self-drilling and self-tapping Phillips head sheet metal screws. Pan head for metal to metal connections. Bugle head for wallboard application.

4. Trim Accessories: Galvanized 26-gauge steel casing beads, corner beads, and control joints as required.
5. Sealant: Nonhardening, permanently flexible, resilient, acoustical sealant. At partitions noted to be fire-rated, provide perimeter caulking in conformance to fire-rating test.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Carefully position and align runner channels at floor and ceiling and secure in place with concrete stub nails and/or self-tapping sheet metal screws 4'-0" o.c., and at each end of runner.
- B. Erect studs at 16" o.c. except where noted otherwise. Studs shall span from floor structure to structure above except where otherwise indicated. Secure in place by clipping to runner channels with members specially designed for that purpose, or with sheet metal screws.
- C. Provide double studs at each side of door openings. Provide 3" or larger cold-rolled bracing channel behind all wall-mounted fixtures. Bracing shall secure to studs and run vertically to floor and an additional brace shall run horizontally securing to the vertical braces and forming a mounting plate for the fixture.
- D. Provide metal stud framing at all four sides around fire dampers, smoke dampers and fire/smoke dampers. Coordinate location and size of framed openings with HVAC installer.
- E. Apply 5/8" gypsum board to channel wall studs. Apply vertically and secure to studs with power-driven Phillips head screws not to exceed 12" o.c., 8" o.c. at panel edges. Block gypsum board panels 1/2" above floor during erection. Remove blocks and fill void with sealant.
- F. Place control joints consistent with building spaces and in a consistent pattern, with maximum spacing not to exceed GA 216 requirements.
- G. Hangers for suspended ceilings shall be spaced not to exceed 4'-0" along the 1-1/2" carrying channels spaced 4' o.c. DWC furring channels shall be attached to carrying channels at no greater spacing than 16" o.c. and shall be at right angles to 1-1/2" carrying channels.
- H. 5/8" gypsum wallboard shall be erected with long dimensions at right angles to furring channels.
- I. Gypsum board applied on ceilings shall be fastened with 1-1/4" USG drywall screws as specified for vertical wallboard application. Treatment of joints, screwheads, angles, corners, etc., shall be as specified above.
- J. Gypsum board partitions shall be straight, plumb and in a plane within a tolerance of 1/16" in 2 feet and 1/8" in 12 feet. Horizontal joints in exposed locations will not be acceptable.

END OF SECTION

SECTION 09251 - GYPSUM WALLBOARD FINISHING

PART 1 - GENERAL

- A. The Bidding Requirements, the General and Supplementary General Conditions and Division 1, General Requirements, of this project manual apply to all work required for this Section.
- 1.2 DESCRIPTION:
- A. Tape, fill and sand all exposed joints, edges, corners, openings and fasteners.
 - B. Tape and fill all joints, edges and corners of rated walls where not exposed to view when finished ceilings are installed.
- 1.3 REFERENCES:
- A. Gypsum Association, Recommended Specifications for the Application and Finishing of Gypsum Board, GA 216.
 - B. Underwriters Laboratories Building Materials Directory and Fire-Resistance Index. Provide products of single manufacturer to ensure rating of finished partitions.
- 1.4 SUBMITTALS:
- A. Submit in conformance with Section 01300.
 - B. Submit manufacturer's data catalog cuts, and brochures for all materials and installation instructions.
- 1.5 WARRANTY REQUIREMENTS:
- A. One (1) year contractor's warranty against all defects, including cracking, popping and delamination of sheets from date of Substantial Completion of each designated portion of the work. Repair work shall include all other work damaged by wallboard repair work all at no cost to the Owner.

PART 2 - PRODUCTS

- 2.1 MATERIALS:
- A. Joint reinforcing tape: USG Perf-A-Tape or approved product of other manufacturers; fiber reinforced paper tape conforming to requirements of GA 216.
 - B. Joint compound: USG Ready-Mixed Joint Compound - All Purpose, or approved product of other manufacturers; vinyl-based compound ready-to-use without mixing, thinning or retempering; with characteristics suitable for taping or topping. Powder joint compounds are not acceptable.

PART 3 - EXECUTION

- 3.1 HEATING AND VENTILATION:
- A. Assure that framing and drywall reach temperatures and moisture content as close as possible to those to be maintained in finished building. Provide heat in winter or during damp conditions to achieve a uniform temperature of 55-70°F. Provide adequate ventilation to remove excess moisture.
- 3.2 ACCEPTANCE OF DRYWALL WORK:

- A. Thoroughly inspect previous work and report to Architect any condition which may adversely affect proper application. Do not commence work until such defects have been corrected.
- B. Do not commence work on any drywall which exhibits moisture damage.

3.3 JOINT TREATMENT:

- A. Apply taping or embedding compound in a thin uniform layer to all joints and angles to be reinforced. Immediately apply reinforcing tape centered over joint and seated into compound. Sufficient compound - approx. 1/64" to 1/32" - remain under the tape to provide proper bond. Follow immediately with a thin skim coat to embed tape, but not to function as a second coat. Fold and embed tape properly in all interior angles to provide a true angle. The tape or embedding coat must be thoroughly dry prior to application of second coat.
- B. Apply second coat of joint compound over embedding coat, filling panel taper flush with surface; cover tape and feather out at least 2" beyond first coat. On joints with no taper, cover the tape and feather out at least 4" on either side of tape. Allow second coat to dry thoroughly prior to application of finish coat.
- C. Spread finish coat evenly and extend at least 2" beyond second coat on all joints and feather to a smooth uniform finish. Over tapered edges, do not allow finished joint to protrude beyond plane of the surface. Apply a finish coat to cover tape and taping compound at all tapered angles and provide a true angle. Where necessary, sand lightly between coats and following the final application of compound, to provide a smooth surface ready for decoration. When sanding, take care not to roughen face paper.
- D. The feathered surface of finish compound shall be a flat plane sloping from the outside of the protrusion to the face of the wall. Width of feathering varies with size of the protrusion as follows:
 - 1. 1/16" protrusion requires a 4" feather
 - 2. 1/8" protrusion requires an 8" feather
 - 3. 3/16" protrusion requires a 12" feather
 - 4. 1/4" protrusion requires a 16" feather
 - 5. Etc. at ratio of 1/16":4"

3.4 FINISHING FASTENERS:

- A. Apply a taping or all-purpose compound to fastener depressions as the first coat. Follow with a minimum of two additional coats of topping or all-purpose compound, leaving all depressions level with the surface plane.

3.5 FINISHING BEADS AND TRIMS:

- A. Apply first coat to all bead and trim and properly feather out from ground to surface plane. Compound must thoroughly dry prior to application of second coat.
- B. Apply second coat in same manner as first coat, extending compound slightly beyond onto face of panel. Compound must be thoroughly dry prior to application of finish coat.
- C. Apply finish coat to all bead and trim, extending compound slightly beyond second coat and properly feathering from ground to surface plane. Sand finish as necessary to provide a flat smooth surface ready for decoration. When sanding, take care not to roughen face paper.

3.6 SPECIAL WALLS:

- A. Review Finish Schedule to determine location of walls scheduled to receive smooth, high or medium gloss finishes. Take special care when finishing these walls not to roughen face paper. If necessary to achieve a uniform surface suitable for such finishes, apply a skim coat over entire area.

3.7 FIRE-RATED WALLS:

- A. Finish joints and fasteners in fire-rated drywall partitions to meet requirements of tested assembly. At joints above finished ceilings, apply reinforcing tape over joints and corners, seated into joint compound. Apply embedding coat and when dry, second coat of compound over tape, filling panel taper flush and feather out 2" beyond tape. Fill fastener depressions with compound, to make surface level with drywall face. No sanding is required at concealed joints and fasteners.

END OF SECTION

SECTION 09651 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Vinyl composition floor tile.

1.3 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Samples for Verification: Full-size tiles of each different color and pattern of resilient floor tile specified, showing the full range of variations expected in these characteristics.
 - 1. For resilient accessories, manufacturer's standard-size samples, but not less than 12 inches long, of each resilient accessory color and pattern specified.
- C. Product Certificates: Signed by manufacturers of resilient products certifying that each product furnished complies with requirements.
- D. Maintenance Data: For resilient floor tile to include in the maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.
- B. Source Limitations: Obtain each type, color, and pattern of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- C. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Critical Radiant Flux: 0.45 W/sq. cm or greater when tested per ASTM E 648.
 - 2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
- B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50 and 90 deg F.
- C. Store tiles on flat surfaces.
- D. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

1.6 PROJECT CONDITIONS

- A. Maintain a temperature of not less than 70 deg F or more than 95 deg F in spaces to receive products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After postinstallation period, maintain a temperature of not less than 55 deg F or more than 95 deg F.
- B. Do not install products until they are at the same temperature as the space where they are to be installed.
- C. Close spaces to traffic during flooring installation and for time period after installation recommended in writing by manufacturer.
- D. Install tiles and accessories after other finishing operations, including painting, have been completed.
- E. Do not install flooring over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive, as determined by flooring manufacturer's recommended bond and moisture test.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Furnish not less than one box for each 50 boxes or fraction thereof, of each type, color, pattern, class, wearing surface, and size of resilient tile flooring installed.
 - 2. Furnish not less than 10 linear feet for each 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient accessory installed.
 - 3. Deliver extra materials to Owner.

PART 2 - PRODUCTS

2.1 RESILIENT TILE

- A. Vinyl Composition Floor Tile: Products complying with ASTM F 1066 and with requirements specified in the Drawings.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by flooring manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
- C. Vinyl Edge Strips: Vinyl of width shown, of height required to protect exposed edge of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by flooring manufacturer.

2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving resilient flooring.
 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with resilient product manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- D. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 TILE INSTALLATION

- A. General: Comply with tile manufacturer's written installation instructions.
- B. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half of a tile at perimeter.
 1. Lay tiles square with room axis, unless otherwise indicated.
- C. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.
 1. Lay tiles running with grain direction north to south in patterns indicated on plans, unless noted otherwise.
- D. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- E. Extend tiles into toe spaces, door reveals, closets, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent, nonstaining marking device.
- G. Install tiles on covers for telephone and electrical ducts, and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on covers. Tightly adhere edges to perimeter of floor around covers and to covers.
- H. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to comply with tile manufacturer's written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
 1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- I. Hand roll tiles according to tile manufacturer's written instructions.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. General: Install resilient accessories according to manufacturer's written installation instructions.

- B. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
 - 1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
 - 2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 - 3. Do not stretch base during installation.
 - 4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
 - 5. Form outside corners on job from straight pieces of maximum lengths possible, without whitening at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
 - 6. Form inside corners on job, from straight pieces of maximum lengths possible, by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.
- C. Place resilient accessories so they are butted to adjacent materials and bond to substrates with adhesive. Install reducer strips at edges of flooring that would otherwise be exposed.

3.5 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing resilient products:
 - 1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.
 - 2. Sweep or vacuum floor thoroughly.
 - 3. Do not wash floor until after time period recommended by flooring manufacturer.
 - 4. Damp-mop floor to remove marks and soil.
- B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by flooring manufacturer.
 - 1. Apply protective floor polish to floor surfaces that are free from soil, visible adhesive, and surface blemishes, if recommended in writing by manufacturer.
 - a. Use commercially available product acceptable to flooring manufacturer.
 - b. Coordinate selection of floor polish with Owner's maintenance service.
 - 2. Cover products installed on floor surfaces with undyed, untreated building paper until inspection for Substantial Completion.
 - 3. Do not move heavy and sharp objects directly over floor surfaces. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.
- C. Clean floor surfaces not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations.
 - 1. Before cleaning, strip protective floor polish that was applied after completing installation only if required to restore polish finish and if recommended by flooring manufacturer.
 - 2. After cleaning, reapply polish to floor surfaces to restore protective floor finish according to flooring manufacturer's written recommendations. Coordinate with Owner's maintenance program.

END OF SECTION

SECTION 09652 - SHEET VINYL FLOOR COVERINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Sheet vinyl floor coverings with backing.
- B. Related Sections include the following:
 - 1. Division 9 Section "Resilient Tile Flooring" for resilient wall base, reducer strips, and other accessories installed with sheet vinyl floor coverings.
 - 2. Division 9 Section "Resilient Wall Base and Accessories" for resilient wall base, reducer strips, and other accessories installed with sheet vinyl floor coverings.

1.3 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Shop Drawings: Show location of seams and edges. Indicate location of columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutout locations.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of sections of units showing the full range of colors and patterns available for each type of product indicated.
- D. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch (150-by-230-mm) sections of each different color and pattern of sheet vinyl floor covering specified, showing the full range of variations expected in these characteristics.
 - 1. For heat-welding bead, manufacturer's standard-size samples, but not less than 9 inches (230 mm) long, of each color specified.
- E. Product Certificates: Signed by manufacturers of sheet vinyl floor coverings certifying that each product furnished complies with requirements.
- F. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- G. Maintenance Data: For sheet vinyl floor coverings to include in the maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an installer who is competent in the technique required by manufacturer for heat-welding seams.
 - 1. Engage installers who are certified by floor covering manufacturer for heat-welded seam installation.
- B. Source Limitations: Obtain each type, color, and pattern of sheet vinyl floor covering specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

- C. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Critical Radiant Flux: 0.45 W/sq. cm or greater when tested per ASTM E 648.
 - 2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet vinyl floor coverings and installation accessories to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
- B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50 and 90 deg F (10 and 32 deg C).
- C. Store rolls upright.
- D. Move sheet vinyl floor coverings and installation accessories into spaces where they will be installed at least 48 hours before installation, unless longer conditioning periods are recommended in writing by manufacturer.

1.6 PROJECT CONDITIONS

- A. Maintain a temperature of not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C) in spaces to receive sheet vinyl floor coverings for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After postinstallation period, maintain a temperature of not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- B. Do not install sheet vinyl floor coverings until they are at the same temperature as the space where they are to be installed.
- C. Close spaces to traffic during sheet vinyl floor covering installation and for time period after installation recommended in writing by manufacturer.
- D. Install sheet vinyl floor coverings and accessories after other finishing operations, including painting, have been completed.
- E. Where demountable partitions and other items are indicated for installation on top of sheet vinyl floor coverings, install floor coverings before these items are installed.
- F. Do not install sheet vinyl floor coverings over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive, as determined by floor covering manufacturer's recommended bond and moisture test.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet (3 linear m) in roll form for each 500 linear feet (150 linear m) or fraction thereof, of each different composition, wearing surface, color, and pattern of sheet vinyl floor covering installed.
 - 2. Deliver extra materials to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE
PSP # 407480

SHEET VINYL FLOOR COVERINGS
CONSTRUCTION DOCUMENTS – 2 MAY 2008

09652 - 2

2.2 SHEET VINYL FLOOR COVERINGS

- A. Sheet Vinyl Floor Coverings with Backing: Products complying with ASTM F 1913 and with requirements specified in the Drawings.

2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by floor covering manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit sheet vinyl floor covering and substrate conditions indicated.
- C. Heat-Welding Bead: Solid-strand product of floor covering manufacturer for heat-welding seams.
 - 1. Color: As selected by Architect from manufacturer's full range of colors to match field color of sheet vinyl floor covering.
- D. Cove Strip: 1-inch- (25.4-mm-) radius support for integral flash cove base provided or approved by floor covering manufacturer.
- E. Cove-Base Cap Strip: Square metal, vinyl, or rubber cap for integral flash cove base provided or approved by floor covering manufacturer.
- F. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of sheet vinyl floor coverings, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where installation of sheet vinyl floor coverings will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are satisfactory for floor covering installation and comply with requirements specified.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by floor covering manufacturer.
 - 2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving resilient flooring.
 - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

3.2 PREPARATION

- A. General: Comply with sheet vinyl floor covering manufacturer's written installation instructions for preparing substrates indicated to receive sheet vinyl floor coverings.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

- D. Broom and vacuum clean substrates to be covered immediately before installing sheet vinyl floor coverings. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. General: Comply with sheet vinyl floor covering manufacturer's written installation instructions.
- B. Unroll sheet vinyl floor coverings and allow them to stabilize before cutting and fitting, if recommended in writing by manufacturer.
- C. Lay out sheet vinyl floor coverings to comply with the following requirements:
 - 1. Maintain uniformity of sheet vinyl floor covering direction.
 - 2. Arrange for a minimum number of seams and place them in inconspicuous and low-traffic areas, and not less than 6 inches (150 mm) away from parallel joints in flooring substrates. Arrange seams per drawings when shown.
 - 3. Match edges of sheet vinyl floor coverings for color shading and pattern at seams according to manufacturer's written recommendations.
 - 4. Avoid cross seams.
- D. Scribe, cut, and fit sheet vinyl floor coverings to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- E. Integral Flash Cove Base: Where indicated, cut sheet vinyl floor coverings to form integral base of height indicated at vertical surfaces.
- F. Extend sheet vinyl floor coverings into toe spaces, door reveals, closets, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent, nonstaining marking device.
- H. Install sheet vinyl floor coverings on covers for telephone and electrical ducts, and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on covers. Tightly adhere edges to perimeter of floor around covers and to covers.
- I. Adhere sheet vinyl floor coverings to flooring substrates to comply with floor covering manufacturer's written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
 - 1. Produce completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
 - 2. Form integral flash cove base by flashing floor covering up vertical surfaces. Support floor covering at horizontal and vertical junction with cove strip. Butt floor covering at top of base against cap strip.
- J. Heat-Welded Seams: Rout joints and heat weld with welding bead, permanently fusing sections into a seamless floor covering. Prepare, weld, and finish seams according to manufacturer's written instructions and ASTM F 1516 to produce surfaces flush with adjoining floor covering surfaces.
- K. Hand roll sheet vinyl floor coverings in both directions from center out to embed floor coverings in adhesive and eliminate trapped air. At walls, door casings, and other locations where access by roller is impractical, press floor coverings firmly in place with flat-bladed instrument.

3.4 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing sheet vinyl floor coverings:

1. Remove adhesive and other surface blemishes using cleaner recommended by floor covering manufacturer.
 2. Sweep or vacuum floor thoroughly.
 3. Do not wash floor covering until after time period recommended by floor covering manufacturer.
 4. Damp-mop floor to remove marks and soil.
- B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by floor covering manufacturer.
1. Apply protective floor polish to sheet vinyl floor covering surfaces that are free from soil, visible adhesive, and surface blemishes, if recommended in writing by manufacturer.
 - a. Use commercially available product acceptable to floor covering manufacturer.
 - b. Coordinate selection of floor polish with Owner's maintenance service.
 2. Cover sheet vinyl floor coverings with undyed, untreated building paper until inspection for Substantial Completion.
 3. Do not move heavy and sharp objects directly over sheet vinyl floor coverings. Place plywood or hardboard panels over floor coverings and under objects while they are being moved. Slide or roll objects over panels without moving panels.
- C. Clean sheet vinyl floor coverings not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean floor coverings according to manufacturer's written recommendations.
1. Before cleaning, strip protective floor polish that was applied after completing installation only if required to restore polish finish and if recommended by floor covering manufacturer.
 2. After cleaning, reapply polish to floor surfaces to restore protective floor finish according to floor covering manufacturer's written recommendations. Coordinate with Owner's maintenance program.

END OF SECTION

SECTION 09653 - RESILIENT WALL BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Resilient wall base.

1.3 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Samples for Initial Selection: Manufacturer's standard sample sets consisting of sections of units showing the full range of colors and patterns available for each type of product indicated.
- C. Samples for Verification: In manufacturer's standard sizes, but not less than 12 inches long, of each product color and pattern specified.
- D. Product Certificates: Signed by manufacturers of resilient wall base and accessories certifying that each product furnished complies with requirements.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.
- B. Source Limitations: Obtain each type and color of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- C. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Critical Radiant Flux: 0.45 W/sq. cm or greater when tested per ASTM E 648.
 - 2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
- B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50 and 90 deg F.
- C. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

1.6 PROJECT CONDITIONS

- A. Maintain a temperature of not less than 70 deg F or more than 95 deg F in spaces to receive resilient products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After postinstallation period, maintain a temperature of not less than 55 deg F or more than 95 deg F.
- B. Do not install products until they are at the same temperature as the space where they are to be installed.
- C. For resilient products installed on traffic surfaces, close spaces to traffic during installation and for time period after installation recommended in writing by manufacturer.

- D. Coordinate resilient product installation with other construction to minimize possibility of damage and soiling during remainder of construction period. Install resilient products after other finishing operations, including painting, have been completed.
- 1.7 EXTRA MATERIALS
- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for each 500 linear feet or fraction thereof, of each different type, color, pattern, and size of resilient product installed.
 - 2. Deliver extra materials to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, wall base and accessories that may be incorporated into the Work include, but are not limited to, the products specified in room finish schedules. Match scheduled products visual and qualitative features and as specified herein.
 - 1. Roppe
 - 2. Johnsonite

2.2 RESILIENT WALL BASE

- A. Vinyl Wall Base: Products complying with FS SS-W-40, Type II.
 - 1. Roppe rubber base at VCT and concrete floors.
 - a. Topset Coved.
 - b. Height: 4".
 - c. Color as selected by the Architect.
 - 2. Roppe wall base at carpeted floors:
 - a. Straight
 - b. Height: 4"
 - c. Color as selected by architect

2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by resilient product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements, including those for maximum moisture content. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- D. Broom and vacuum clean substrates to be covered immediately before installing resilient products. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. General: Install resilient products according to manufacturer's written installation instructions.
- B. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
 - 1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
 - 2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 - 3. Do not stretch base during installation.
 - 4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
 - 5. Form outside corners on job, from straight pieces of maximum lengths possible, without whitening at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
 - 6. Form inside corners on job, from straight pieces of maximum lengths possible, by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.
- C. Place resilient products so they are butted to adjacent materials and bond to substrates with adhesive. Install reducer strips at edges of flooring that would otherwise be exposed.

3.4 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing resilient products:
 - 1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.
 - 2. Sweep or vacuum horizontal surfaces thoroughly.
 - 3. Do not wash resilient products until after time period recommended by resilient product manufacturer.
 - 4. Damp-mop or sponge resilient products to remove marks and soil.
- B. Protect resilient products against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by resilient product manufacturer.
 - 1. Apply protective floor polish to vinyl resilient products installed on floors that are free from soil, visible adhesive, and surface blemishes, if recommended by manufacturer.
 - a. Coordinate selection of floor polish with Owner's maintenance service.
 - 2. Cover resilient products installed on floors with undyed, untreated building paper until inspection for Substantial Completion.
- C. Clean resilient products not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations.

END OF SECTION

SECTION 09900 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes surface preparation and field painting of the following:
1. Exposed exterior items and surfaces.
 2. Exposed interior items and surfaces.
 3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
1. Prefinished items include the following factory-finished components:
 - a. Elevator entrance doors and frames.
 - b. Elevator equipment.
 - c. Finished mechanical and electrical equipment.
 - d. Light fixtures.
 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Foundation spaces.
 - b. Furred areas.
 - c. Utility tunnels.
 - d. Pipe spaces.
 - e. Duct shafts.
 - f. Elevator shafts.
 3. Finished metal surfaces include the following:
 - a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 4. Operating parts include moving parts of operating equipment and the following:
 - a. Motor and fan shafts.
 5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.3 DEFINITIONS

- A. General: Standard-coating terms defined in ASTM D 16 apply to this Section.
1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
 2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
 3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.

4. Semigloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

1.4 SUBMITTALS

- A. Product Data: For each paint system specified. Include block fillers and primers.
 1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
 3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).
- B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.
- C. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
 1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
 2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.
 3. Submit Samples on the following substrates for the Architect's review of color and texture only:
 - a. Painted Wood: Provide two 12-inch-square samples of each color and material on hardboard.
 - b. Stained or Natural Wood: Provide two 4-by-8-inch samples of natural- or stained-wood finish on actual wood surfaces.
 - c. Ferrous Metal: Provide two 4-inch-square samples of flat metal and two 8-inch-long samples of solid metal for each color and finish.
- D. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.
- C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each type of coating and substrate required on the Project. Comply with procedures specified in PDCA P5. Duplicate finish of approved prepared samples.
 1. The Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted.
 - a. Wall Surfaces: Provide samples on at least 100 sq. ft. of wall surface.
 - b. Small Areas and Items: The Architect will designate an item or area as required.
 2. After permanent lighting and other environmental services have been activated, apply coatings in this room or to each surface according to the Schedule or as specified. Provide required sheen, color, and texture on each surface.
 - a. After finishes are accepted, the Architect will use the room or surface to evaluate coating systems of a similar nature.
 3. Final approval of colors will be from job-applied samples.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
 - 1. Product name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions.
 - 6. Application instructions.
 - 7. Color name and number.
 - 8. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 PROJECT CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F.
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F.
- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.8 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.
 - 1. Quantity: Furnish the Owner with an additional 1 percent, but not less than 1 gal. or 1 case, as appropriate, of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in the paint schedules.
- B. Manufacturers Names: The following manufacturers may be referred to in the paint schedules by use of shortened versions of their names, which are shown in parentheses:
 - 1. ICI Dulux Paint (ICI).
 - 4. Benjamin Moore & Co. (Moore).
 - 5. PPG Industries, Inc. (PPG).
 - 6. Pratt & Lambert, Inc. (P & L).
 - 7. Sherwin-Williams Co. (S-W).

2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
 - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the

exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

- C. Colors: Match colors indicated by reference to manufacturer's color designations. Where no color is scheduled provide color selections made by the Architect from the manufacturer's full line including all standard, special and custom colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
 - 1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 - 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.
 - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
 - 1. Provide barrier coats over incompatible primers or remove and reprime.
 - 2. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
 - c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
 - 3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
 - a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.
 - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

- c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.
 4. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
 - D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- 3.3 APPLICATION
 - A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
 1. Paint colors, surface treatments, and finishes are indicated in the schedules.
 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 3. Provide finish coats that are compatible with primers used.
 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
 5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
 9. Sand lightly between each succeeding enamel or varnish coat.
 - B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
 1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 2. Omit primer on metal surfaces that have been shop primed and touchup painted.
 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.
 - C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
 1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.

2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.
- F. Mechanical items to be painted include, but are not limited to, the following:
1. Piping, pipe hangers, and supports.
 2. Heat exchangers.
 3. Tanks.
 4. Ductwork.
 5. Insulation.
 6. Motors and mechanical equipment.
 7. Accessory items.
- G. Electrical items to be painted include, but are not limited to, the following:
1. Conduit and fittings.
 2. Panelboards.
- H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- I. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.
- J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- 3.4 FIELD QUALITY CONTROL
- A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:
1. The Owner will engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.
 2. The testing agency will perform appropriate tests for the following characteristics as required by the Owner:
 - a. Quantitative material analysis.
 - b. Abrasion resistance.
 - c. Apparent reflectivity.
 - d. Flexibility.
 - e. Washability.
 - f. Absorption.
 - g. Accelerated weathering.
 - h. Dry opacity.
 - i. Accelerated yellowness.
 - j. Recoating.
 - k. Skinning.
 - l. Color retention.
 - m. Alkali and mildew resistance.
 3. The Owner may direct the Contractor to stop painting if test results show material being used does not comply with specified requirements. The Contractor shall remove noncomplying paint from the site, pay for testing, and repaint surfaces previously coated

with the rejected paint. If necessary, the Contractor may be required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the 2 coatings are incompatible.

3.5 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Paint all shop primed equipment. Paint shop prefinished items where exposed to view in finished spaces. In mechanical rooms, repair shop pre-finished coatings, which have been scratched or otherwise, damaged with identical touch-up paint. Sand prior to touching up as required.
- B. Paint all grilles, and grilles to match adjacent wall and ceiling surfaces, except that factory pre-finished items need not be painted if installed in a suspended acoustical ceiling system where the acoustical panels match the mechanical or electrical item color.
- C. In all finished spaces, prime and paint exposed pipes, conduit, boxes, ducts, hangers, brackets, collars and supports. Paint to match adjacent surfaces.
- D. Paint concrete support bases with gray floor deck enamel.
- E. Pipe hangers and other supports need not be painted except where installed in crawl spaces, where they shall be painted with a thick coat of asphaltic paint.

3.6 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
 - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.7 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
 - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.8 EXTERIOR PAINT SCHEDULE

- A. Precast Concrete Panels: Provide the following clear finish over exterior precast concrete panels:
 - 1. 100% Acrylic Emulsion: 2 even saturated coats
 - a. ICI deluxe seal-krete waterproofing sealer.
- B. Concrete Masonry Units: Provide the following finish systems over exterior concrete masonry units:
 - 1. Low-Luster Acrylic Finish: 2 finish coats over a block filler.
 - a. Block Filler: High-performance, latex block filler applied at spreading rate recommended by the manufacturer to achieve a total dry mill thickness of not less than 4.0 mils.
 - 1) ICI: 4000 Bloxfil Interior/Exterior H/D Acrylic.
 - 2) PPG: 6-7 Speedhide Interior/Exterior Masonry Latex Block Filler.
 - 3) P & L: Z/F 98 Pro-Hide Plus Block Filler.
 - b. First and Second Coats: Low-luster (eggshell or satin), exterior, acrylic-latex paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.3 mils.
 - 1) ICI: 2402 Dulux Professional Exterior Acrylic Satin Finish.
 - 2) P & L: Z/F 1800 Series Aqua-Shell Exterior Latex Eggshell Paint.

- C. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.
1. Low-Luster Acrylic Finish: 2 finish coats over a rust-inhibitive primer.
 - a. Primer: Rust-inhibitive metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils.
 - 1) ICI: 4160 Devguard Multi-purpose Tank and Structural Primer.
 - 2) PPG: 6-208 Speedhide Interior/Exterior Rust Inhibitive Steel Primer, Red or 6-212, white.
 - 3) P & L: S/D 1009 Suprime "9" Interior/Exterior Alkyd Metal Primer.
 - b. First and Second Coat: Low-sheen (eggshell or satin), exterior, acrylic-latex paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils.
 - 1) ICI: 2402 Dulux Professional Exterior Acrylic Satin Finish.
 - 2) PPG: 6-2200 Series Speedhide Exterior House & Trim Acrylic Satin Latex.
 - 3) P & L: Z/F 4200 Series Accolade Exterior Eggshell.
 2. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a rust-inhibitive primer.
 - a. Primer: Rust-inhibitive metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils.
 - 1) ICI: 4160 Devguard Multi-purpose Tank and Structural Primer.
 - 2) PPG: 6-208 Speedhide Interior/Exterior Rust Inhibitive Steel Primer.
 - 3) P & L: S/D 1009 Suprime "9" Interior/Exterior Alkyd Metal Primer.
 - b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.
 - 1) ICI: 2406 Dulux Professional Exterior Acrylic Semigloss Finish.
 - 2) PPG: 6-900 Series Speedhide Semi-Gloss Acrylic Latex House and Trim Paint.
 - 3) P & L: Z/F 3100 Series Aqua Royal Latex House & Trim Finish.
- D. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated (galvanized) metal surfaces:
1. Low-Luster Finish: 2 finish coats over a galvanized metal primer.
 - a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.
 - 1) ICI: 4020 Devflex DTM Interior/Exterior Waterborne Primer Finish.
 - 2) PPG: 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
 - 3) P & L: Z/F 1003 Suprime "3" Interior/Exterior Latex Metal Primer.
 - b. First and Second Coat: Low-luster (eggshell or satin), exterior, acrylic-latex paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils.
 - 1) ICI: 2402 Dulux Professional Ext. Acrylic Satin Finish.
 - 2) PPG: 6-2200 Series Speedhide Exterior House & Trim Acrylic Satin Latex.
 - 3) P & L: Z/F 4200 Series Accolade Exterior Eggshell.

END OF SECTION

SECTION 09963 - ELASTOMERIC COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes surface preparation and application of elastomeric coatings to exterior surfaces scheduled.

1.3 DEFINITIONS

- A. Stucco: A portland cement-based plaster used on exterior locations.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric coating systems with the following properties as determined by the test methods indicated:
 - 1. Elongation at Break: Not less than 280 percent at 77 deg F (25 deg C) and not less than 50 percent at 0 deg F (minus 18 deg C) according to ASTM D 412.
 - 2. Low-Temperature Flexibility: Passes a 1/8-inch (3-mm), 180-degree mandrel bend at minus 15 deg F (minus 26 deg C) at 20-mil (0.5-mm) dry film thickness according to ASTM C 711.
 - 3. Water-Vapor Transmission: Not less than 2.0 perms (115 ng/Pa x s x sq. m) according to ASTM E 96.
 - 4. Wind-Driven Rain Resistance: No water penetration according to procedures in FS TT-C-555.
 - 5. Minimum Solids Content by Volume: Not less than 45 percent.

1.5 SUBMITTALS

- A. Product Data: For each elastomeric coating system specified. Include block fillers and primers.
 - 1. Material List: An inclusive list of each required coating material. Indicate each material and cross-reference the specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 - 2. Manufacturer's Information: Manufacturer's technical information and instructions for handling, storing, and applying each coating material proposed for use.
 - 3. Certification by elastomeric coating manufacturer that products supplied comply with local regulations controlling use of VOCs.
- B. Samples for Initial Color Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.
 - 1. After color selection, the Architect will return color chips indicating colors selected for surfaces to be coated.
- C. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative samples of actual substrate.
 - 1. Provide stepped samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.

2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.
3. Submit samples on the following substrates for the Architect's review of color and texture only:
 - a. Concrete, Masonry, and Stucco: Provide two 4-inch (100-mm) square samples of actual substrate material for each color and texture.
 - b. Concrete Masonry: Two 8-inch (200-mm) square samples of concrete masonry, with mortar joint in the center, for each color and texture.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- E. Product Test Reports: From a qualified independent testing and inspecting agency indicating compliance of elastomeric coatings with requirements based on comprehensive testing within the last 2 years of current product formulations.
- F. Material Certificates: In lieu of agency test reports, when permitted by the Architect, certificates signed by manufacturers certifying that each material complies with requirements specified.

1.6 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed coating system applications similar in material and extent to those indicated for this Project with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers, primers, and other undercoat materials from the same manufacturer as the finish coats.
- C. Benchmark Samples (Mockups): Provide full-coat benchmark finish samples of each type of coating and substrate required on the Project. Comply with procedures specified in PDCA P5. Duplicate finish of approved prepared samples.
 1. The Architect will select one exterior wall surface to represent surfaces and conditions for each substrate.
 - a. Wall Surfaces: Prepare benchmark samples on at least 100 sq. ft. (9.3 sq. m) of wall surface.
 2. After benchmark samples are approved, these surfaces will be used to evaluate coating systems.
 3. Obtain the Architect's approval of benchmark samples before starting application of coatings.
 4. Final approval of colors will be from benchmark samples, not samples submitted for verification.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project site in manufacturer's original, unopened packages and containers bearing the manufacturer's name and label, and the following information:
 1. Product name or title of material.
 2. Manufacturer's stock number and date of manufacture.
 3. Contents by volume, for pigment and vehicle constituents.
 4. Thinning instructions (if permitted).
 5. Application instructions.
 6. Color name and number.

7. Handling instructions and precautions.
 8. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage of coatings in a clean condition, free of foreign materials and residue.
1. Protect elastomeric coating materials from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure workers and work areas are protected from fire and health hazards resulting from handling, mixing, and applying coatings.

1.8 PROJECT CONDITIONS

- A. Temperature Conditions: Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 90 deg F (10 and 32 deg C), unless otherwise permitted by manufacturer's written instructions.
- B. Weather Conditions: Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C)) above the dew point; or to damp or wet surfaces.
1. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before starting or continuing coating operation.

1.9 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Elastomeric Coating Warranty: Submit a written warranty, executed by the manufacturer, agreeing to repair or replace elastomeric coatings that fail within the specified warranty period. Failures include, but are not limited to, water penetration through the coating.
- C. Warranty Period for Elastomeric Coatings: 5 years from the date of Substantial Completion.

1.10 EXTRA MATERIALS

- A. Furnish extra elastomeric coating materials from the same production run as the materials applied in quantities described below. Package materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.
1. Quantity: Furnish the Owner with one extra case of each color of elastomeric coating materials applied.
 2. Quantity: Furnish the Owner with an additional 5 percent, but not less than 1 gal. (3.8 L) or 1 case, as appropriate, of each color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into this Project include, but are not limited to, those indicated in the Coating Schedule.
- B. Products: Subject to compliance with requirements, provide one of the products indicated in the Coating Schedule.

- C. Manufacturers Names: The following manufacturers are referred to in the Coating Schedule by use of shortened versions of their names, which are shown in parentheses:

1. Devoe & Raynolds Co. (Devoe).
2. Fuller-O'Brien Paints (Ful-Tek).
3. Moore: Benjamin Moore & Co. (Moore).
4. PPG Industries, Inc.; Pittsburgh Paints (Pittsburgh).
5. Sonneborn Building Products (Sonneborn).
6. Sto Concrete Restoration (Sto).
7. Tamms Industries Company (Tamms).
8. Thoro Systems (Thoro).

2.2 ELASTOMERIC COATING MATERIALS, GENERAL

- A. Material Compatibility: Provide crack fillers, block fillers, primers, elastomeric finish coat materials, and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide the manufacturer's best-quality elastomeric coating material complying with requirements of FS TT-C-555. Material containers not displaying manufacturer's product identification are not acceptable.
1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance of proposed substitutions.
- C. Colors and Textures: Provide custom colors and textures of the finished elastomeric coating system to match the Architect's samples.
- D. Colors and Textures: Match colors and textures indicated by reference to manufacturer's standard color designations for elastomeric coating systems.
1. See the Coating Schedule at the end of Part 3 for color selections. Where colors are not indicated, the Architect will select from manufacturer's full range of colors and textures.
- E. Colors and Textures: Provide color and texture selections made by the Architect from manufacturer's full range of colors for elastomeric coating systems.

2.3 CRACK FILLERS

- A. Crack Fillers: Provide the manufacturer's standard factory-formulated acrylic emulsion crack fillers that are compatible with substrate and finish coat materials indicated.
- B. Available Products: Subject to compliance with requirements, crack fillers that may be incorporated into the Work include, but are not limited to, the following:
- C. Products: Subject to compliance with requirements, provide one of the following:
1. Crack Filler: For cracks up to 1/16 inch (1.5 mm), provide the following:
 - a. Ful-Tek: 9200 Elastomeric Sealant.
 - b. Pittsburgh: Buttering Grade Vinyl Sealant 236-2414.
 - c. Sonneborn: Hydrocide 750 Brush Grade or Knife Grade Patching Compound.
 - d. Sto: Sto Flexible Crack Filler.
 - e. Thoro: Thorolastic Knife Grade.
 2. Crack Filler: For cracks more than 1/16 inch (1.5 mm), provide the following:

- a. Ful-Tek: 9200 Elastomeric Sealant.
- b. Pittsburgh: Regular Grade Vinyl Sealant 236-2397.
- c. Sonneborn: Hydrocide 750 Knife Grade Patching Compound.
- d. Sto: Sto Flexible Crack Filler.
- e. Tamms: Tamms Thin Patch.
- f. Thoro: Thorolastic Knife Grade.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with the Applicator present, under which elastomeric coating systems will be applied for compliance with application requirements. Surfaces to receive elastomeric coatings must be thoroughly dry before coatings are applied.
 - 1. Notify the Architect in writing of anticipated problems using coatings specified with substrates primed by others.
 - 2. Begin application only after unsatisfactory conditions have been corrected and surfaces to receive coating are thoroughly dry.
 - 3. Start of coating within a particular area will be construed as the Applicator's acceptance of surface conditions.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, light fixtures, and similar items already installed that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
 - 1. After completing coating operations in each area, reinstall items removed, using workers skilled in trades involved.
- B. Cleaning: Before applying coatings or other surface treatments, clean substrates of substances that could impair bond of coating systems. Remove oil and grease before cleaning.
 - 1. Schedule cleaning and coating application so dust and other contaminants will not fall on wet, newly coated surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be coated according to manufacturer's written instructions for the particular substrate conditions and as specified.
 - 1. Cementitious Surfaces: Prepare concrete, concrete masonry, stucco, and similar surfaces to receive elastomeric coatings. Remove efflorescence, chalk, dust, dirt, release agents, grease, oils, and similar conditions by water blasting followed by a clear water rinse.
 - a. Remove mildew and neutralize surfaces according to manufacturer's written recommendations before patching materials are applied.
 - b. Roughen as required to remove glaze. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
 - c. If hardeners or sealers have been used to improve concrete curing, use mechanical methods for surface preparation.
 - d. Determine alkalinity and moisture content of surfaces to be coated by performing appropriate tests. Do not apply coatings over surfaces where moisture content exceeds that permitted in manufacturer's written instructions.

2. Crack Repair: Fill cracks according to manufacturer's written recommendations before coating surfaces.
 3. Deep Hairline Cracks: Remove dust and dirt from around cracks. Remove mildew by sterilizing before filling. Apply manufacturer's recommended primer to cracks before patching. If shrinkage occurs after applying crack filler, apply additional filler material to cracks before initially applying elastomeric coatings.
 - a. Cracks up to 1/16 Inch (1.5 mm): Clean surface around cracks. Apply primer penetrating cracks as deeply as possible, overflowing crack 2 inches (50 mm) on each side. When primer is dry, apply manufacturer's recommended sealant, forced well into cracks using a brush, putty knife, or trowel. Smooth edges around cracks over primed area. Allow for sealant shrinkage when applying.
 - b. Cracks up to 3/8 Inch (9.5 mm): Open cracks to 1/4 to 3/8 inch (6 to 9.5 mm) wide and 1/8 inch (3 mm) deep. Clean cracks and surrounding area removing dust, dirt, and other impurities. Apply primer recommended by manufacturer with a brush to obtain uniform coverage and spread approximately 2 inches (50 mm) on each side of cracks. Fill cracks with manufacturer's recommended crack filler applied with a putty knife or trowel, and allow for shrinkage. If excessive shrinkage occurs, reapply crack filler.
- D. Material Preparation: Mix and prepare materials according to coating manufacturer's written instructions.
1. Stir materials before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film that may form into material. Remove film and, if necessary, strain coating material before using.
 2. If manufacturer permits thinning, use only thinners recommended by manufacturer, and only within limits recommended by manufacturer.

3.3 APPLICATION

- A. General: Apply elastomeric coatings to exposed surfaces indicated, according to manufacturer's written instructions.
- B. Labels: Do not paint over UL, FM, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- C. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
 1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
 2. If undercoats or other conditions show through final coat, apply additional coats until coating film is of uniform finish, color, and appearance. Ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
 3. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat does not cause undercoat to lift or lose adhesion.
- D. Application Procedures: Apply elastomeric coatings by brush, roller, or spray according to manufacturer's written instructions.
 1. Brushes: Use brushes best suited for material being applied.

2. Rollers: Use professional-quality quick-release rollers of carpet, velvet back, or high-pile sheep's wool covers with a 1- to 1-1/4-inch (25.4- to 31.8-mm) nap as recommended by the manufacturer for material and texture required.
 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for material and texture required.
 4. Minimum Coating Thickness: Apply each material no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness as recommended by the manufacturer.
 5. Wherever spray application is used, apply each coat to provide equivalent hiding of brush-applied coats. Do not double back with spray equipment, building up film thickness of 2 coats in 1 pass.
- E. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
 - F. Prime Coats: If recommended by the manufacturer, apply a primer to material being coated before applying finish coats.
 - G. Brush Application: Brush out and work brush coats into surfaces in an even film. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.
 - H. Roller Application: Keep the cover wet at all times; do not dry roll. Work in sections. Lay on required amount of material, working material into grooves and rough areas; then level material, working it into surface.
 - I. Spray Application: Use spray equipment for application only when permitted by manufacturer's written recommendations and authorities having jurisdiction.
 - J. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or recoat work not complying with specified requirements.

3.4 FIELD QUALITY CONTROL

- A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when coating operations are being conducted:
 1. The Owner will engage the services of a qualified independent testing and inspecting agency to sample coating used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in presence of the Contractor.
 2. The testing and inspecting agency will perform appropriate tests for the following characteristics as required by the Owner:
 - a. Quantitative materials analysis.
 - b. Elongation at break.
 - c. Tensile strength.
 - d. Percent of recovery.
 - e. Resistance to wind-driven rain.
 - f. Water-vapor transmission.
 - g. Flexibility.
 - h. Accelerated weathering.
 - i. Impact resistance.
 - j. Alkali resistance.
 - k. Abrasion resistance.
 - l. Mildew resistance.
 3. If results show materials do not comply with requirements, the Contractor may be directed to stop work, remove noncomplying materials, pay for testing, recoat surfaces

coated with rejected materials, or remove rejected materials from previously coated surfaces if, on recoating with specified materials, the 2 coatings are not compatible.

3.5 CLEANING

- A. Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from the Project site.
 - 1. After completing coating work, clean glass and spattered surfaces. Remove spattered coatings by washing, scraping, or other methods, being careful not to scratch or damage adjacent finished surfaces.

3.6 PROTECTION

- A. Protect work of other trades from damage whether being coated or not. Correct damage by cleaning, repairing, replacing, and recoating as approved by the Architect. Leave in an undamaged condition.
- B. Provide "Wet Paint" signs to protect newly coated finishes. Remove temporary protective wrappings provided by others to protect their work after completing coating operations.
 - 1. After construction activities of other trades are complete, touch up and restore damaged or defaced coated surfaces.

3.7 COATING SCHEDULE

- A. Concrete: Provide the following elastomeric coating systems over exterior concrete surfaces:
 - 1. Smooth Elastomeric Finish: One or 2 finish coats, as recommended by manufacturer, over primer.
 - a. Primer: Manufacturer's recommended factory-formulated primer applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than 4 mils (0.10 mm).
 - 1) Devoe: Primer not required.
 - 2) Ful-Tek: Ful-Tek Bond Coat Elastomeric Primer/Sealer #9410.
 - 3) Moore: Moore's Acrylic Masonry Sealer #066.
 - 4) Pittsburgh: Primer not required with 2-coat system (use Speedhide Alkali Resistant Primer 6-3 if a 1-finish-coat system is required).
 - 5) Sonneborn: Colorflex Sealer #751 (not required on new construction; on existing construction, if necessary because of chalking).
 - 6) Sto: Sto Plex-W.
 - 7) Tamms: H/P Primer.
 - 8) Thoro: Primer not required.
 - b. First Coat: Smooth, factory-formulated, 100 percent acrylic elastomeric coating applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than 7 mils (0.18 mm).
 - 1) Devoe: H57XX Smooth Hydrolastic Elastomeric Waterproofing Coating.
 - 2) Ful-Tek: Ful-Tek Tekmafilm Smooth Elastomeric Waterproof Coating #9600.
 - 3) Moore: Moorlastic Elastomeric Waterproof Coating #055.
 - 4) Pittsburgh: Pitt-Flex Exterior Masonry Coating 100 Percent Acrylic Elastomeric 4-110.
 - 5) Sonneborn: Hydrocide Colorflex Waterproof Elastomeric Coating.

- 6) Sto: Stolastic Elastomeric Coating #212.
 - 7) Tamms: Tammolastic Smooth Elastomeric Decorative and Protective Coating.
 - 8) Thoro: Thorolastic Smooth Elastomeric Coating.
- c. Second Coat: Textured, factory-formulated, 100 percent acrylic elastomeric coating applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than 7 mils (0.18 mm).
- 1) Devoe: H57XX Textured Hydrolastic Elastomeric Waterproofing Coating.
 - 2) Ful-Tek: Ful-Tek Decoflex Dirt Resistant Elastomeric Waterproof Coating #9630.
 - 3) Moore: Moorlastic Elastomeric Waterproof Coating #055.
 - 4) Pittsburgh: Pitt-Flex Exterior Masonry Coating 100 Percent Acrylic Elastomeric 4-110.
 - 5) Sonneborn: Hydrocide Colorflex Waterproof Elastomeric Coating.
 - 6) Sto: Stolastic Elastomeric Coating #212.
 - 7) Tamms: Tammolastic Textured Elastomeric Decorative and Protective Coating.
 - 8) Thoro: Thorolastic Textured Elastomeric Coating.
- B. Concrete Masonry: Provide the following elastomeric coating systems over exterior concrete masonry surfaces:
- 1. Smooth Elastomeric Finish: One or 2 finish coats, as recommended by manufacturer, over block filler.
 - a. Block Filler: Manufacturer's recommended, factory-formulated, masonry block filler applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than 4 mils (0.10 mm).
 - 1) Devoe: Block filler not required.
 - 2) Ful-Tek: Ful-Tek Tekmafilm FBR Fibrated Waterproof Elastomeric Sealant #9610.
 - 3) Moore: Moorecraft Interior & Exterior Block Filler #173.
 - 4) Pittsburgh: 16-90 High-Performance Acrylic Block Filler.
 - 5) Sonneborn: Colorflex Block Filler #749.
 - 6) Sto: Sto Leveler #244.
 - 7) Tamms: H/P Primer.
 - 8) Thoro: Super Quickseal Intermix with Thorosheen Tint Base.
 - b. Primer: Factory-formulated primer, if recommended by manufacturer, applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than 4 mils (0.10 mm).
 - 1) Pittsburgh: Speedhide Alkali Resistant Primer 6-3.
 - c. First Coat: Smooth, factory-formulated, 100 percent acrylic elastomeric coating applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than 7 mils (0.18 mm).
 - 1) Devoe: H58XX Textured Hydrolastic Elastomeric Waterproofing Coating.
 - 2) Ful-Tek: Ful-Tek Tekmafilm Smooth Elastomeric Waterproof Coating #9600.
 - 3) Moore: Moorlastic Elastomeric Waterproof Coating #055.

- 4) Pittsburgh: Pitt-Flex Exterior Masonry Coating 100 Percent Acrylic Elastomeric 4-110.
 - 5) Sonneborn: Hydrocide Colorflex Waterproof Elastomeric Coating.
 - 6) Sto: Sto Stolastic Elastomeric Coating #212.
 - 7) Tamms: Tammolastic Smooth Elastomeric Decorative and Protective Coating.
 - 8) Thoro: Thorolastic Smooth Elastomeric Coating.
- d. Second Coat: Smooth, factory-formulated, 100 percent acrylic elastomeric coating applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than 7 mils (0.18 mm).
- 1) Devoe: H57XX Smooth Hydrolastic Elastomeric Waterproofing Coating.
 - 2) Ful-Tek: Ful-Tek Decoflex Dirt Resistant Elastomeric Waterproof Coating #9630.
 - 3) Moore: Moorlastic Elastomeric Waterproof Coating #055.
 - 4) Pittsburgh: Pitt-Flex Exterior Masonry Coating 100 Percent Acrylic Elastomeric 4-110.
 - 5) Sonneborn: Hydrocide Colorflex Waterproof Elastomeric Coating.
 - 6) Sto: Stolastic Elastomeric Coating #212.
 - 7) Tamms: Tammolastic Smooth Elastomeric Decorative and Protective Coating.
 - 8) Thoro: Thorolastic Smooth Elastomeric Coating.

END OF SECTION

SECTION 10200 - LOUVERS AND VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Fixed, extruded-aluminum louvers.
 - 2. Blank-off panels for louvers.

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section, unless otherwise defined in this Section or in referenced standards.
- B. Standard Free Area: Free area of a louver 48 inches wide by 48 inches high, identical to that provided.
- C. Maximum Standard Airflow: Airflow at point of beginning water penetration through a louver 48 inches wide by 48 inches high, identical to that provided.
- D. Drainable-Blade Louver: Louver designed to collect and drain water to exterior at sill by means of gutters in front edges of blades and channels in jambs and mullions.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide exterior metal louvers capable of withstanding the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; or permanent damage to fasteners and anchors.
 - 1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward or outward.
 - 2. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, and other detrimental effects:
 - a. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- B. Air-Performance, Water-Penetration, and Air-Leakage Ratings: Provide louvers complying with performance requirements indicated, as demonstrated by testing manufacturer's stock units 48 inches wide by 48 inches high. Test units according to AMCA 500.
 - 1. Perform testing on unpainted, cleaned, degreased units.
 - 2. Perform water-penetration testing on louvers without screens.
- C. Airborne Sound Transmission Loss: Provide acoustical louvers complying with airborne sound transmission loss ratings indicated, as demonstrated by testing manufacturer's stock units according to ASTM E 90.

1.5 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Shop Drawings: For louver units and accessories. Include plans; elevations; sections; and details showing profiles, angles, and spacing of louver blades. Show unit dimensions related to

wall openings and construction; free area for each size indicated; profiles of frames at jambs, heads, and sills; and anchorage details and locations.

1. For installed louvers indicated to comply with design loadings, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.
 - D. Samples for Verification: Of each type of metal finish required, prepared on Samples of same thickness and material indicated for final Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
 - E. Product Certificates: Signed by manufacturers of louvers certifying that the products furnished comply with requirements and are licensed to bear the AMCA seal based on tests made according to AMCA 500 and complying with AMCA's Certified Ratings Program.
 - F. Product Test Reports: Indicate compliance of products with requirements based on comprehensive testing of current products.
 - G. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.6 QUALITY ASSURANCE

- A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of louvers that are similar to those indicated for this Project in material, design, and extent.
- B. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where alike in one or more respects regarding type, design, or factory-applied color finish.
- C. Welding Standards: As follows:
 1. Comply with AWS D1.2, "Structural Welding Code--Aluminum."
 2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- D. SMACNA Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" recommendations for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Airline Products Co.
 2. Airolite Co.

3. Construction Specialties, Inc.

2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Aluminum Castings: ASTM B 26/B 26M, alloy 319.
- D. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.
 - 1. Use types and sizes to suit unit installation conditions.
 - 2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.
- E. Anchors and Inserts: Of type, size, and material required for loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as needed for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.
- F. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 but containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
 - 1. Continuous Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates and without interrupting blade-spacing pattern.
- B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining materials' tolerances, and perimeter sealant joints.
 - 1. Frame Type: Channel type, unless otherwise indicated.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less. At horizontal joints between louver units, provide horizontal mullions, unless continuous vertical assemblies are indicated.
- F. Provide sill extensions and loose sills made of same material as louvers where indicated or required for drainage to exterior and to prevent water penetrating to interior.
- G. Join frame members to one another and to fixed louver blades with fillet welds concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.4 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Louver Construction: Provide fixed-blade louvers with extruded-aluminum frames and blades.
- B. Vertical, Drainable-Blade Louvers: As follows:
 - 1. Louver Depth: 6 inches, unless otherwise indicated.
 - 2. Frame Thickness: 0.125 inch.
 - 3. Blade Thickness: 0.125 inch.

4. Blade Angle and Spacing: 45 degrees and 6 inches o.c. for 6-inch-deep louvers.

2.5 LOUVER SCREENS

- A. General: Provide louvers with screens at locations indicated.
 1. Screen Location for Adjustable Louvers: Interior face, unless otherwise indicated.
 2. Screening Type: Bird screening, unless otherwise indicated.
- B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate screen frames with mitered corners to louver sizes indicated and to comply with the following requirements:
 1. Metal: Same kind and form of metal as indicated for louver to which screens are attached.
 - a. Reinforce extruded-aluminum screen frames at corners with clips.
 2. Finish: Same finish as louver frames to which louver screens are attached.
 3. Type: Rewirable frames with a driven spline or insert for securing screen mesh.
- D. Louver Screening for Aluminum Louvers: As follows:
 1. Bird Screening: Stainless steel, 1/2-inch-square mesh, 0.047-inch wire.

2.6 BLANK-OFF PANELS

- A. General: Fabricate blank-off panels from materials and to sizes indicated and comply with the following requirements:
 1. Finish: Same as finish applied to louvers, but black color.
 2. Attach blank-off panels to back of louver frames with clips.
- B. Insulated, Blank-off Panels: Laminated metal-faced panels consisting of insulating core surfaced on back and front with metal sheets, complying with the following requirements:
 1. Thickness: 2 inches.
 2. Metal Facing Sheets: Aluminum sheet, 0.032 inch thick.
 3. Insulating Core: Unfaced, rigid, glass-fiberboard insulation complying with ASTM C 612, Class 1 and 2.
 4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames 0.081 inch thick, with corners mitered and with same finish as panels.
 5. Seal perimeter joints between panel faces and louver frames with 1/8-by-1-inch PVC compression gaskets.

2.7 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish louvers after assembly.

2.8 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
- B. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 606.1 or AAMA 608.1.
 1. Color: Clear Anodized.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate Setting Drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.2 INSTALLATION

- A. Locate and place louver units level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- G. Install concealed gaskets, flashings, joint fillers, and insulation, as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 Section "Joint Sealants" for sealants applied during louver installation.

3.3 ADJUSTING, CLEANING, AND PROTECTING

- A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
- B. Periodically clean exposed surfaces of louvers and vents that are not protected by temporary covering to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
- C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- D. Protect louvers and vents from damage during construction. Use temporary protective coverings where needed and approved by louver manufacturer. Remove protective covering at the time of Substantial Completion.
- E. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Clean and touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 10520 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Portable fire extinguishers.
 - 2. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.
 - 3. Fire-protection accessories.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.
 - 1. Fire Extinguishers: Include rating and classification.
 - 2. Cabinets: Include details showing mounting methods, relationships of box to surrounding construction, door hardware, cabinet type and panel style.
- B. Samples for Verification: For each type of exposed cabinet finish required, prepared on Samples of size indicated below and of same thickness and material indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
 - 1. Size: ~~6-by-6-inch~~ square Samples.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire extinguishers and cabinets through one source from a single manufacturer.
- B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."
- C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide extinguishers listed and labeled by FM.

1.5 COORDINATION

- A. Coordinate size of cabinets to ensure that type and capacity of fire extinguishers indicated and provided by Owner under separate Contract are accommodated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Portable Fire Extinguishers:
 - a. J.L. Industries, Inc.
 - b. Larsen's Manufacturing Company.
 - c. Potter-Roemer; Div. of Smith Industries, Inc.
 - 2. Fire-Protection Cabinets:
 - a. J.L. Industries, Inc.
 - b. Larsen's Manufacturing Company.
 - c. Potter-Roemer; Div. of Smith Industries, Inc.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A 366/A 366M, commercial quality, stretcher leveled, temper rolled.
- B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:

1. Sheet: **ASTM B 209**.
 2. Extruded Shapes: **ASTM B 221**.
- C. Stainless-Steel Sheet: ASTM A 666/A 666M, Type 302 or Type 304 alloy.
- 2.3 PORTABLE FIRE EXTINGUISHERS
- A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.
 - B. Dry-Chemical Type: UL-rated 40-B, **10-lb** nominal capacity, in enameled-steel container, unless noted otherwise. Located in kitchen.
- 2.4 FIRE-PROTECTION CABINETS
- A. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
 1. Fire-Rated Cabinets: Listed and labeled to meet requirements of ASTM E 814 for fire-resistance rating of wall where it is installed.
 - a. Construct fire-rated cabinets with double walls fabricated from **0.0478-inch-** thick, cold-rolled steel sheet lined with minimum **5/8-inch-** thick, fire-barrier material.
 - b. Provide factory-drilled mounting holes.
 2. Cabinet Metal: Enameled-steel sheet.
 - B. Cabinet Type: Suitable for the following:
 1. Fire extinguisher.
 - C. Cabinet Mounting: Suitable for the following mounting conditions:
 1. Surface Mounted Cabinet. Cabinet box fully exposed and mounted directly on wall with no trim.
 - D. Door Style: Manufacturer's standard design to match scheduled item.
 - E. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.
 - F. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide handles meeting accessibility requirements. Provide concealed or continuous-type hinge permitting door to open 180 degrees.
- 2.5 ACCESSORIES
- A. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish.
 1. Provide brackets for extinguishers not located in cabinets.
 - B. Lettered Door Handle: Provide one-piece, cast-iron door handle with the word "FIRE" embossed into face.
 - C. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Locate as indicated by Architect.
 1. Identify bracket-mounted extinguishers with the words "FIRE EXTINGUISHER" in red-letter decals applied to wall surface.
 2. Identify fire extinguisher in cabinet with the words "FIRE EXTINGUISHER" applied to door.
 - a. Application Process: Silk-screened.
 - b. Lettering Color: White, unless noted otherwise.
 - c. Orientation: Vertical.
- 2.6 COLORS AND TEXTURES
- A. Colors and Textures: As selected by Architect from manufacturer's full range for these characteristics.
- 2.7 FINISHES, GENERAL
- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 STEEL FINISHES

- A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.
- B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of **2 mils**.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for hose valves, hose racks, and cabinets to verify actual locations of piping connections before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where recessed and semi-recessed cabinets are to be installed.
- C. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged units.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing fire-protection specialties.
- B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
 - 1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
 - 2. Fasten mounting brackets to structure and cabinets, square and plumb.
 - 3. Fasten cabinets to structure, square and plumb.

3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust cabinet doors that do not swing or operate freely.
- B. Refinish or replace cabinets and doors damaged during installation.
- C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

3.4 FIRE-PROTECTION CABINET SCHEDULE

- A. Fire-Extinguisher Cabinet FEC: Where this designation is indicated, provide fire-extinguisher cabinet complying with the following:
 - 1. Products: Available products include the following:
 - a. J.L. Industries, Ambassador #1012F10, ADAC option.
 - 2. Construction: Nonrated.
 - 3. Cabinet Material: Enameled-steel sheet
 - 4. Type: Fire extinguisher
 - 5. Mounting: Surface Mounted.
 - 6. Door Material: Steel sheet.
 - 7. Accessories: Mounting brackets; Identification lettering.
 - 8. Color and Texture: As selected by Architect from manufacturer's full range.
 - a. Steel Finish: Baked enamel.

END OF SECTION

SECTION 14210 - ELECTRIC TRACTION ELEVATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes electric traction passenger and freight elevators.
 - 1. Seismic switches required by ASME A17.1 are included.
- B. Related Sections include the following:
 - 1. Division 3 Section "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
 - 2. Division 5 Section "Structural Steel" for the following:
 - a. Attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.
 - b. Machine beams.
 - c. Divider beams.
 - d. Hoist beams.
 - e. Structural-steel shapes for subsills and entrance frames that are part of steel frame.
 - 3. Division 5 Section "Metal Fabrications" for the following:
 - a. Attachment plates and angle brackets for supporting guide-rail brackets.
 - b. Machine beams.
 - c. Divider beams.
 - d. Hoist beams.
 - e. Structural-steel shapes for subsills and entrance frames.
 - f. Pit ladders.
 - 4. Division 9 Section "Painting" for field painting hoistway entrances.
 - 5. Division 9 Section "Resilient Tile Flooring" for finish flooring in elevator cars.
 - 6. Division 13 Section "Fire Alarm" for smoke detectors in elevator lobbies to initiate emergency recall operation and heat detectors in shafts and machine rooms to disconnect power from elevator equipment before sprinkler activation and for connection to elevator controllers.
 - 7. Division 16 Section "Premises Telephone Wiring" for telephone service to elevators.
 - 8. Division 16 Sections for electrical service for elevators to and including fused disconnect switches at machine room door and standby power source, transfer switch, and connection from auxiliary contacts in transfer switch to controller.

1.3 DEFINITIONS

- A. Defective Elevator Work: Operation or control system failures; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

1.4 SUBMITTALS

- A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information.
- B. Shop Drawings: Show plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment and signals. Indicate variations from specified

requirements, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

- C. Samples: For exposed finishes of cars, hoistway doors and frames, and signal equipment; 3-inch-square samples of sheet materials; and 4-inch lengths of running trim members.
- D. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, including emergency generator, as shown and specified, are adequate for elevator system being provided.
- E. Maintenance Manuals: Include operation and maintenance instructions, parts listing with sources indicated, recommended parts inventory listing, emergency instructions, and similar information. Include diagnostic and repair information available to manufacturer's and Installer's maintenance personnel. Submit for Owner's information at Project closeout as specified in Division 1.
- F. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Elevator manufacturer or an experienced installer approved by elevator manufacturer who has completed elevator installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Regulatory Requirements: In addition to local governing regulations, comply with applicable provisions in ASME A17.1, "Safety Code for Elevators and Escalators" (Seismic Risk Zone: Project is located in Zone 0).
 - 1. 2003 IBC with City of Sugar Land amendments.
 - 2. State of Texas "Elevator Code".
- C. Accessibility Requirements: In addition to local governing regulations, comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)." Section 407 in ICC A117.1, and Texas Accessibility Standards.

1.6 COORDINATION

- A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
- B. Coordinate locations and dimensions of other work relating to electric traction elevators including pit ladders, sumps, and floor drains in pits; entrance subsills; and electrical service, electrical outlets, lights, and switches in pits and machine rooms.

1.7 WARRANTY

- A. Special Manufacturer's Warranty: Written warranty, signed by manufacturer agreeing to repair, restore, or replace defective elevator work within specified warranty period.
 - 1. Warranty Period: 12 months from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance service by skilled employees of the elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Provide parts and supplies as used in the manufacture and installation of original equipment.
 - 1. Perform maintenance, including emergency callback service, during normal working hours.
 - 2. Include 24-hour-per-day, 7-day-per-week emergency callback service.
 - a. Response Time: Two hours or less.

- B. Continuing Maintenance Proposal: Provide a continuing maintenance proposal from Installer to Owner in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.
- C. Continuing Maintenance Proposal: Provide a continuing maintenance proposal from Installer to Owner with terms, conditions, and obligations as set forth in, and in the same form as, "Draft of Elevator Maintenance Agreement" at end of this Section, starting on date initial maintenance service is concluded.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide electric traction elevators by the following:
 - 1. Otis Elevator Company, Gen2 Machine Room-less Elevator.

2.2 MATERIALS AND COMPONENTS

- A. General: Provide manufacturer's standard elevator systems. Where components are not otherwise indicated, provide standard components, published by manufacturer as included in standard pre-engineered elevator systems and as required for a complete system.
- B. Passenger Elevator Machines: Provide variable-voltage, variable-frequency ac-type hoisting machines. Provide solid-state power converters.
 - 1. Provide regenerative system.
 - 2. Limit total harmonic distortion of regenerated power to 5 percent per IEEE 519.
 - 3. Provide means for absorbing regenerated power when elevator system is operating on standby power.
 - 4. Provide line filters or chokes to prevent electrical peaks or spikes from feeding back into building power system.
- C. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work where installation of devices is specified in another Specification Section.
- D. Machine Beams: Provide framing to support elevator hoisting machine and deflector sheaves from the building structure. Comply with Division 5 Section "Metal Fabrications" for materials and fabrication.
- E. Roller Guides: Provide roller guides at top and bottom of car and counterweight frames.
- F. Car Frame and Platform: Welded steel units.
- G. Finish Materials: Provide the following materials and finishes for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated:
 - 1. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS for flat applications; color, texture, and pattern as selected by Architect from plastic-laminate manufacturer's full range of products.
 - 2. Rolled Steel Floor Plate: ASTM A 786/A 786M.
 - 3. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Pattern 1, alloy 6061-T6.

2.3 OPERATION SYSTEMS

- A. Passenger Elevators: Provide manufacturer's standard microprocessor operation system for each elevator or group of elevators as required to provide type of operation system indicated.
 - 1. Multiple-Car Group: Provide re-programmable group automatic system that controls car movements in a zoned operation. System dispatches selected cars in a regulated sequence in response to hall calls. System automatically adjusts to changes in demand for different traffic conditions including heavy incoming, heavy two-way, heavy outgoing, and light off-hours as variations of normal two-way traffic. System prioritizes hall calls according to waiting time.
 - 2. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

3. Products: Subject to compliance with requirements, provide one of the following:
 - a. Otis Elevator Company, Gen2 Machine Room-less Elevator.
- B. Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:
 1. Standby Power Operation: On activation of standby power, cars are returned, one at a time, to a designated floor and parked with doors open. If a car cannot be returned, it is removed from the system. When all cars have been returned or removed from the system, one car can be put in service on standby power by a selector switch in control panel located at first floor.
 2. Independent Service: Keyswitch in car control station removes car from group operation and allows it to respond only to car calls. Key cannot be removed from keyswitch when car is in independent service. When in independent service, doors close only in response to the door close button.
 3. Loaded-Car Bypass: When car load exceeds a predetermined weight, car will respond only to car calls, not to hall calls. Predetermined weight can be adjusted.
 4. Automatic Dispatching of Loaded Car: When car load exceeds a predetermined weight, doors will begin closing.
 5. Nuisance Call Cancel: When car calls exceed a preset number while the car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.
 6. Distributed Parking: When cars are not required for response to calls, they are parked with doors closed, distributed in predetermined zones throughout the building. One zone shall include the main floor and the adjacent floors; the remaining floors shall be divided into approximately equal zones.
- C. Security Features: In addition to above operational features, provide the following security features, where indicated. Security features shall not affect emergency firefighters' service.
 1. Keyswitch Feature: Car and hall push buttons are activated and deactivated by security keyswitches. Key is removable only in deactivated position.
 2. Secured Landing Feature: Allows each landing to be secured or cleared. If landing is secured, car buttons for that landing do not register a call unless landing access code is entered within a predetermined time period after landing button is pressed. When a secured landing button is pressed, a "Restricted Floor" lamp lights and remains lit until landing access code has been entered or predetermined time period has elapsed.
 - a. Access codes are programmed at each car operating panel using a security keyswitch. Secured landing feature is activated and deactivated by a security keyswitch at the main landing.
 3. Card Key Access Control: Each car is to be equipped with a programmable card-key access for restricting the access to secured floors and after hour operations.

2.4 SIGNAL EQUIPMENT

- A. General: Provide signal equipment for each elevator or group of elevators with hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements of acrylic or other permanent, non-yellowing translucent plastic.
- B. General: Provide signal equipment designed for destination-based system for each elevator or group of elevators. Fabricate lighted elements of acrylic or other permanent, non-yellowing translucent plastic.
- C. Car Control Stations: Provide manufacturer's standard semirecessed car control stations. Mount in return panel adjacent to car door, if not otherwise indicated.
- D. Car Control Stations: Provide fully recessed car control stations with applied metal faceplates. Mount in return panel adjacent to car door, if not otherwise indicated.

- E. Swing-Return Car Control Stations: Provide car control stations fully recessed in hinged return panel adjacent to car door. Exposed car fixtures to be satin finished stainless steel.
 - 1. Include call buttons for each landing served and other buttons, switches, and controls required for specified car operation.
 - 2. Mark buttons and switches with manufacturer's standard identification for required use or function that complies with ASME A17.1.
 - 3. Mount controls at heights complying with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)." ICC A117.1, and Texas Accessibility Standards.
 - 4. Provide two car control stations in each passenger elevator; equip only one with required keyswitches, if any.
- F. Emergency Communication System: Provide system that complies with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)." On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
- G. Fire Department Communication System: Provide telephone jack in each car and required conductors in traveling cable for fire department communication system specified in Division 16 Sections.
- H. Car Position Indicator: For passenger elevator cars, provide illuminated-signal type, digital-display type, or segmented type, located above car door or above car control station. Also provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served.
 - 1. Include travel direction arrows if not provided in car control station.
- I. Hall Push-Button Stations: Provide one hall push-button station at each landing for each elevator or group of elevators, but not less than one station for each four elevators in a group. For each group of passenger elevators, locate between two elevators at center of group or at location most convenient for approaching passengers.
- J. Hall Push-Button Stations: Provide hall push-button stations at each landing for each elevator or group of elevators as indicated. Exposed push buttons stations and fixtures to be satin finished stainless steel.
 - 1. Provide units with flat faceplate for mounting with body of unit recessed in wall.
 - 2. Provide units with direction-indicating buttons; two buttons at intermediate landings; one button at terminal landings.
 - 3. Provide units with buttons for registering destination that incorporate a visual and audible signaling system to verify floor selection and to direct passenger to assigned car and a button to indicate that passenger has disabilities so control system can allow extra room in assigned car.
- K. Hall Lanterns: Provide units with illuminated arrows, but provide single arrow at terminal landings. Exposed metal surfaces to be satin stainless steel.
 - 1. Provide units with flat faceplate for mounting with body of unit recessed in wall and with illuminated elements projecting from faceplate for ease of angular viewing.
 - 2. Place lanterns either above or beside each hoistway entrance, unless otherwise indicated. Mount at a minimum of 72 inches above finished floor.
 - 3. With each lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
 - a. At manufacturer's option, audible signals may be placed on each car.

- L. Hall Position Indicators: Provide illuminated-signal type or digital-display type, located above each hoistway entrance at ground floor. Provide units with flat faceplate for mounting with body of unit recessed in wall.
 - 1. Integrate ground-floor hall lanterns with hall position indicators.
 - M. Corridor Call Station Pictograph Signs: Provide signs matching hall push-button stations with text and graphics according to ASME A17.1, Appendix H.
- 2.5 DOOR REOPENING DEVICES
- A. Infrared Array: Provide door reopening devices with a uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more of the light beams shall cause doors to stop and reopen.
 - B. Door Edge Device: Provide retractable edge shoes on elevator entrance doors that cause doors to stop and reopen on contacting an obstruction. Include photoelectric device with timed cutout that projects dual-light beams across car entrance at 5- and 29-inch heights; the beams, when interrupted, cause doors to stop and reopen.
 - 1. Provide keyswitch in car operating panel for photoelectric device.
 - 2. Nudging Feature: After car doors are prevented from closing for a predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.
- 2.6 ELEVATOR CAR ENCLOSURES
- A. General: Provide stainless steel car enclosures with removable solid polymer wall panels, manufacturer's mirror finish stainless steel, suspended ceiling, trim, accessories, access doors, doors, power door operators, sills (thresholds), lighting, and ventilation.
 - 1. Floor finish is to be carpet. Prepare floor substrate for installation of floor finish.
 - 2. Stainless Steel Wall Panels: #4 Brushed Stainless Steel.
 - 3. Fabricate car with recesses and cutouts for signal equipment.
 - 4. Fabricate car door frame integrally with front wall of car.
 - 5. Typical Car finish (unless noted otherwise): Satin finished stainless steel and solid polymer panels.
 - 6. Sills: Extruded metal, with grooved surface, 1/4 inch thick. Provide mill finish .
 - 7. Ceiling: #8 Polished Stainless Steel, concealed frame with recessed incandescent downlights..
 - 8. Handrails: Manufacturer's standard handrails, of satin finish stainless steel.
- 2.7 HOISTWAY ENTRANCES
- A. General: Provide manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Provide frame size and profile to coordinate with hoistway wall construction.
 - 1. Where gypsum board wall construction is indicated, provide self-supporting frames with reinforced head sections.
 - B. Materials and Fabrication: Provide manufacturer's standards but not less than the following:
 - 1. Satin Finish Stainless Steel-Steel Frames: Formed steel sheet
 - 2. Satin Finish Stainless Steel-Steel Doors: Flush, hollow-metal construction - polished and etched design at first floor.
 - 3. Sills: Extruded metal, with grooved surface, 1/4 inch thick. Provide mill finish.
 - 4. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.
- 2.8 PASSENGER ELEVATORS
- A. Elevator Nos.:1, 2 and 3.
 - 1. Type: Geared.

2. Rated Load: 3000 lb
3. Rated Speed: 350 fpm
4. Operation System: Selective collective automatic operation. Group automatic operation with automatic variation of zoned control.
5. Auxiliary Operations:
 - a. Standby power operation.
 - b. Emergency hospital service at all floors, one elevator.
 - c. Independent service.
 - d. Loaded-car bypass.
 - e. Automatic dispatching of loaded car.
 - f. Nuisance call cancel.
 - g. Distributed parking.
6. Security Features: Keyswitch feature, secured landing feature, and car-to-lobby feature, controlled card access at fourth floor.
7. Car Enclosures: As follows:
 - a. Inside Width: 77 inches (Elevators 1, 2 and 3) .
 - b. Inside Depth: 57 inches (Elevators 1 and 2), 65 inches (Elevator 3).
 - c. Inside Height: 96 inches.
 - d. Front Walls: Satin stainless steel.
 - e. Car Fixtures: Satin stainless steel.
 - f. Side and Rear Wall Panels: Stainless Steel
 - g. Reveals: Stainless Steel
 - h. Door Faces (Interior): Satin finish Stainless Steel.
 - i. Door Sills: Aluminum.
 - j. Ceiling: Stainless Steel
 - k. Floor prepared to receive carpet (specified in Division 9 Section "Carpet")
 - l. Single-ended Car.
8. Hoistway Entrances: As follows:
 - a. Width: 42 inches.
 - b. Height: 84 inches.
 - c. Type: Single speed center opening.
 - d. Frames: Satin Finish Stainless Steel.
 - e. Doors: Satin Finish Stainless Steel.
 - f. Sills: Aluminum.
 - g. Single-ended Hoistway Entrance.
9. Hall Fixtures: Surface type with satin finish stainless steel.
10. Additional Requirements: As follows:
 - a. Provide inspection certificate in each car, mounted under acrylic cover with satin stainless-steel frame.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Examine hoistways, hoistway openings, pits, and machine rooms as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed. Proceed with installation only after unsatisfactory conditions have been corrected.

1. For the record, prepare a written report, endorsed by Installer, listing dimensional discrepancies and conditions detrimental to performance.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions.
- B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.
- C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to minimize transmission of vibrations to structure and thereby minimize structure-borne noise from elevator system.
- D. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.
- E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- F. Leveling Tolerance: 1/8 inch, up or down, regardless of load and direction of travel.
- G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting use (either temporary or permanent) of elevators, perform acceptance tests as required and recommended by ASME A17.1 and governing regulations and agencies.
- B. Operating Test: Load elevators to rated capacity and operate continuously for 30 minutes over full travel distance, stopping at each level and proceeding immediately to the next. Record temperature rise of elevator machines during 30-minute test period. Record failure of elevators to perform as required.

1. Perform operating test specified above on one elevator of each type, capacity, speed, and travel distance.

- C. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times tests are to be performed on elevators.

3.4 DEMONSTRATION

- A. Instruct Owner's personnel in proper use, operation, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of operational failure and other building emergencies. Train Owner's personnel in procedures to follow in identifying sources of operational failures or malfunctions. Confer with Owner on requirements for a complete elevator maintenance program.
- B. Make a final check of each elevator operation with Owner's personnel present and before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

3.5 PROTECTION

- A. Temporary Use: Do not use elevators for construction purposes unless cars are provided with temporary enclosures, either within finished cars or in place of finished cars, to protect finishes from damage.

1. Provide full maintenance service by skilled, competent employees of elevator Installer for elevators used for construction purposes. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Use same parts and supplies as used in the manufacture and installation of original equipment.

2. Provide protective coverings, barriers, devices, signs, and other procedures to protect elevators. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return

items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

END OF SECTION

SECTION 15090 - PIPE HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 EXTENT OF WORK

- A. Comply with Division 15 Sections, as applicable. Refer to other Divisions for coordination work.
- B. Provide labor, materials, equipment, tools and service, and perform operations required for, and reasonably incidental to, the providing of systems of pipe hangers and supports.
- C. The Contractor shall provide complete submittals on all pipe hangers designating the manufacturer, type, size, service, and number to be provided.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Pipe hangers and supports shall conform to the recommendations of ASHRAE, ASPE, ANSI, and MSS; and shall be of Anvil, Shaw Piping Engineering & Hanger Group, B-Line, or Fee and Mason manufacturers. Hangers and supports to be painted, galvanized, or cadmium plated.
- B. Except as otherwise indicated, provide factory-fabricated pipe hangers and supports in which materials, design, and manufacture comply with ANSI/MSS SP-58. Select and apply pipe hangers and supports in compliance with MSS SP-69, and manufacturer's published product information. Fabricate and install pipe hangers and supports in compliance with MSS SP-89.
- C. Use only one type hangers and supports, by one manufacturer, for each piping service.
- D. All thread rods, nuts, washers, and similar to be cadmium plated.
- E. Provide copper-plated hangers and supports for copper piping systems where hangers are in contact with bare pipe.
- F. Provide isolation type hangers on all medical gas piping and all dissimilar metals to prevent electrolysis.

2.2 VIBRATION ISOLATION HANGERS: REFER TO SECTION 15161.

2.3 HORIZONTAL PIPING HANGERS AND SUPPORTS

- A. Select size of hangers and supports to exactly fit pipe size for bare piping, and around piping insulation with saddle or shield for insulated piping.
- B. For suspension of non-insulated or insulated stationary pipelines: Adjustable steel clevises, MSS Type I.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

- C. For suspension of non-insulated stationary pipelines: Adjustable band hangers, MSS Type 7 or 9; or split pipe rings, MSS Type II.
- D. For support of piping where horizontal movement due to expansion and contraction may occur, and where a low coefficient of friction is desired: Pipe slides and slide plates, MSS Type 35, including guided plate mounted on a concrete pedestal or structural steel support.
- E. For support of pipe from floor stanchion, using floor flange to secure stanchion to floor: Adjustable pipe stanchion saddles, MSS Type 37 or 38, including steel pipe base support and cast-iron floor flange.
- F. For suspension of pipe from two (2) rods where longitudinal movement due to expansion and contraction may occur: Adjustable roller hangers, MSS Type 43.
- G. For suspension of pipe from a single rod where horizontal movement due to expansion and contraction may occur: Adjustable roller hangers, MSS Type 43.
- H. For support of pipe from a single rod where horizontal movement due to expansion and contraction may occur, but vertical adjustment is not necessary: Pipe roll stands, MSS Type 45.
- I. For support of pipe where small horizontal movement due to expansion and contraction may occur, but vertical adjustment is not necessary: Pipe rolls and plates, MSS Type 45.
- J. For support of pipe lines where vertical and lateral adjustment during installation may be required in addition to provision for expansion and contraction: Adjustable pipe roll stands, MSS Type 46.

2.4 VERTICAL PIPING CLAMPS

- A. Select size of vertical piping clamps to exactly fit pipe size of bare pipe.
- B. For support and steadying of pipe risers: Two-bolt riser clamps, MSS Type 8 or 42.

2.5 HANGER ROD ATTACHMENTS

- A. Select size of hanger rod attachments to suit hanger rods.
- B. For adjustment up to six (6) inches for heavy loads: Steel turnbuckles, MSS Type 13.
- C. For use on high temperature piping installations: Steel clevises, MSS Type 14.
- D. For use with split pipe rings, MSS Type II: Swivel turnbuckles, MSS Type 15.
- E. For attaching hanger rod to various types of building attachments: Malleable iron sockets, MSS Type 16 or 17.

2.6 BUILDING ATTACHMENTS

- A. Select size of building attachments to suit hanger rods.

- B. For upper attachment for suspending pipe hangers from concrete: Concrete inserts MSS Type 18.
- C. For attachment to top flange of structural shape: Top beam C-clamps, MSS Type 19.
- D. For attachment to bottom flange of structural shape: Side beam or channel clamps, MSS Type 20 or 27.
- E. For attachment to center of bottom flange of beams: Center beam clamps, MSS Type 21.
- F. For attachment to bottom of beams where heavy loads are encountered and hanger rod sizes are large: Welded attachments, MSS Type 22.
- G. For attachment to structural shapes: C-clamps, MSS Type 23.
- H. For attachment to top of beams when hanger rod is required tangent to edge of flange: Top I-beam clamps, MSS Type 25.
- I. For attachment to bottom of steel I-beams for heavy loads: Steel I-beam/WF-beam clamps with eye nut, MSS Type 28 or 29.
- J. Steel brackets, for indicated loading:
 - 1. Light duty, 750 pounds, MSS Type 31.
 - 2. Medium duty, 1500 pounds, MSS Type 32.
 - 3. Heavy duty, 3000 pounds, MSS Type 33.
- K. For use on sides of steel beams: Side beam brackets, MSS Type 34.

2.7 SPRING HANGERS AND SUPPORTS

- A. Select spring hangers and supports to suit pipe size and loading.
- B. For control of piping movement: Restraint control devices, MSS Type 47.
- C. For light loads where vertical movement does not exceed 13-inch: Spring cushion hangers, MSS Type 48.
- D. For equipping Type 41 roll hanger with springs: Spring cushion roll hangers, MSS Type 49.
- E. For retardation of sway or thermal expansion in piping systems: Spring sway braces, MSS Type 50.
- F. For absorbing expansion and contraction of piping system from hanger: Variable spring hangers, MSS Type 51; preset to indicated load and limit variability factor to 25%.

- G. For absorbing expansion and contraction of piping system from base support: Variable spring base supports, MSS Type 52; preset to indicated load and limit variability factor to 25%; include load flange.
- H. For absorbing expansion and contraction of piping system from trapeze support: Variable spring trapeze hangers, MSS Type 53; preset to indicated load and limit variability factor to 25%.
- I. Constant supports: Provide one of the following types, selected to suit piping system. Include auxiliary stops for erection and hydrostatic test, and field load-adjustment capability.
 - 1. Horizontal Type: MSS Type 54.
 - 2. Vertical Type: MSS Type 55.
 - 3. Trapeze Type: MSS Type 56.

2.8 PIPE INSULATION HANGER SHIELDS

- A. Where hangers are placed outside the jackets of pipe insulation, provide shields or equivalent by Elcen Metal Products Company.
- B. Insulation and shields shall consist of a 360 degree insert of high-density, 100 psi, waterproof calcium silicate, encased in a 180 degree galvanized sheet steel shield. Insert shall be same thickness as adjoining pipe insulation, and shall extend 1-inch beyond sheet metal shield in each direction. Shield lengths and minimum sheet metal gauges shall be as directed below:

<u>PIPE SIZE</u>	<u>SHIELD LENGTH</u>	<u>MINIMUM GAUGE</u>
1/2" to 8"	12"	16
10" & Larger	22"	16

- C. Shields shall be Model CS-CW, except for pipe roller applications and where pipe hanger spacing exceeds 10 feet, then provide Model CSX-CW.
- D. At the Contractor's option, shop-fabricated galvanized metal shields may be provided based on approved shop drawings. Length and gauge of sheet metal shall be as specified above.

2.9 METAL FRAMING: PROVIDE PRODUCTS COMPLYING WITH NEMA ML-1.

2.10 STEEL PLATES, SHAPES AND BARS: PROVIDE PRODUCTS COMPLYING WITH ANSI/ASTM A-36.

2.11 PIPE GUIDES:

- A. Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of a bolted two-section outer cylinder and base, with a two-section guiding spider bolted tight to pipe or as shown on the Drawings. Size guides and spiders to clear pipe,

cylinder, and insulation, if any. Provide guides of length recommended by manufacturer to allow indicated travel.

2.12 REINFORCED CONCRETE: CONFORM TO DIVISION 3 OF THESE SPECIFICATIONS.

2.13 ROOF SUPPORTS

- A. Equipment supports shall be all welded 18 gauge galvanized steel shell, baseplate and counterflashing with internal bulkhead re-enforcement and factory installed wood nailer. Supports shall be manufactured by Thy Curb, Cooper B-Line, PPH, or Pate and equal to the Thy Curb models as follows:
1. Model TEMS-1 for insulated roof decks.
 2. Model TEMS-2 for un-insulated roof decks and existing roofs.
 3. Model TEMS-3 for single-ply roof systems.
- B. Pipe curbs with covers shall be all welded 18 gauge galvanized steel shell and baseplate with fully mitered 3" raised cant, wood nailer and TP-1 Duro EPDM cover or TP-2 pipe cover, as detailed on the drawings, for pipe penetration(s). Same curb models (without the pipe cover) may be used for fan equipment or duct roof penetrations. Pipe curbs shall be manufactured by Thy Curb, Cooper, B-Line, PPH or Pate and equal to the Thy Curb models as follows:
1. Model TC-1 for insulated roof decks.
 2. Model TC-2 for un-insulated and existing roof decks.
 3. Model TC-3 for Bulb-T roof decks.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including, but not limited to proper placement of inserts, anchors and other building structural attachments.

3.2 INSTALLATION OF BUILDING ATTACHMENTS

- A. Install building attachments at required locations within concrete or on structural steel for proper support. Space attachments within maximum piping span length specified in this Section. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, and expansion joints; at changes in direction of piping; and, where required by a limited carrying capacity of the structure. Install concrete inserts before concrete is placed; fasten inserts securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts. In existing concrete structures, building attachments shall be based on approved details.

3.3 INSTALLATION OF HANGERS AND SUPPORTS

- A. Install hangers, supports, clamps and attachments to support piping and ductwork properly from building structure in compliance with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together in trapeze-type hangers where possible. Install supports with maximum spacing as specified in this Section. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for small diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
- B. Install hangers and supports complete with necessary bolts, rods, nuts, washers, and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
- C. Support fire protection water piping independently of other piping.

3.4 PROVISIONS FOR MOVEMENT

- A. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, offsets, expansion bends and similar units.
- B. Load Distribution: Install hangers and supports so that piping, live and dead loading, and stresses from movement will not be transmitted to connected equipment.
- C. Pipe Slopes: Install hangers and supports to provide necessary pipe slopes, and so that maximum pipe deflections allow by ANSI B-31 are not exceeded.

3.5 INSULATED PIPING REQUIREMENTS

- A. Hangers for insulated cold piping shall be placed around the outside of the insulation and vapor barrier. Hangers for other insulated piping may be placed directly against the piping with insulation carried completely over and around hanger and rod.
- B. Clamps: Attach clamps including spacers, if any, to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B-31.
- C. Factory Manufactured Insulation Hanger Shields: Install in accordance with manufacturer's instructions.

3.6 HANGER SPACING AND ROD SIZES

- A. Hangers shall be spaced so as to support piping properly and as shown on the Drawings. Cast iron pipes shall be supported on hangers spaced not more than pipe length being employed. Hangers for all other copper or steel piping shall be spaced according to the following schedule:

<u>PIPE SIZE</u>	<u>MAXIMUM HANGER SPACING</u>	<u>MINIMUM ROD SIZE</u>	<u>MAX.ALTERNATE HANGER SPACING</u>	<u>MIN.ALTERNATE ROD SIZE</u>
1/2"	6'	3/8"	-	-
3/4"	6'	3/8"	-	-
1"	7'	3/8"	-	-
1 1/4"	8'	3/8"	-	-
1 1/2"	9'	3/8"	-	-
2"	10'	3/8"	-	-
2 1/2"	11'	1/2"	-	-
3"	12'	1/2"	8'	3/8"
3 1/2"	13'	5/8"	8'	3/8"
4"	14'	5/8"	8'	3/8"
5"	16'	5/8"	10'	1/2"
6"	17'	3/4"	10'	1/2"
8"	19'	7/8"	10'	1/2"
10"	20'	7/8"	10'	1/2"
12"	20'	7/8"	10'	1/2"
14"	20'	1"	16'	7/8"
16"	20'	1 1/8"	14'	7/8"
18"	20'	1 1/4"	10'	7/8"
20"	20'	1 1/4"	10'	7/8"
24"	20'	1 1/4"	8'	7/8"

- B. If the Contractor elects to deviate from the above hanger rod sizes and/or hanger spacing, he does so at his own risk.
- C. Spacing and rod sizes for other piping materials shall be as recommended by the manufacturer. For example, where PVC piping is utilized it may require continuous support depending on sizes and application.

3.7 INSTALLATION OF ANCHORS

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B-31, and to prevent transfer of loading and stresses to connected equipment.
- B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B-31, with AWS standards, and with the details shown on the Drawings.
- C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturers written instructions to limit movement of piping and forces to maximums recommended by manufacturer for each unit.

- D. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe runs and at intermediate points in pipe runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.8 INSTALLATION OF TRAPEZES OR PIPE RACKS

- A. Light/Medium Duty: Assemble from standard manufactured metal framing systems, in accordance with manufacturer's recommendations.
- B. Heavy Duty: Fabricate from structural steel shapes selected for loads required. Weld steel in accordance with AWS standards.

3.9 INSTALLATION OF PEDESTALS

- A. Construct pedestals from reinforced concrete or structural steel shapes as shown on the Drawings.

3.10 THRUST BLOCKS

- A. Concrete thrust blocks shall be installed at underground mechanical piping connections to prevent separation under pressure at the following locations:
 - 1. Changes in direction 22-1/2 deg. And greater (both horizontal and vertical)
 - 2. Terminal ends.
 - 3. All valves, so as to support the body weight and prevent excessive torque on pipe connections.
- B. Each thrust block shall be sized to accommodate the piping and soil conditions.
- C. Thrust blocks:
 - 1. Provide concrete thrust blocks at all changes in direction of piping of non-restrained mechanical jointed pressure systems and other systems as required.
 - a. Provide thrust blocks for restrained mechanical jointed piping systems where indicated.
 - 2. Provide 3,000 psi minimum concrete mix.
 - 3. Provide thrust blocks of the required size and shape necessary for the specific system pressure and soil bearing capacity at the particular location.
 - 4. Exercise Care to avoid encasing fittings, bends, valves, etc., in concrete to the extent that it will hamper maintenance.

END OF SECTION

SECTION 15260 - PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Piping insulation.
- B. Jackets and accessories.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Section 15310 - Fire Protection Piping: Placement of hangers and hanger inserts.
- B. Section 15410 - Plumbing Piping: Placement of hangers and hanger inserts.
- C. Section 15510 - Hydronic Piping: Placement of hangers and hanger inserts.
- D. Section 15520 - Steam Piping: Placement of hangers and hanger inserts.

1.3 REFERENCES

- A. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- B. ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded- Hot-Plate Apparatus.
- C. ASTM C195 - Mineral Fiber Thermal Insulation Cement.
- D. ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.
- E. ASTM C449 - Mineral Fiber Hydraulic-setting Thermal

- F. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- G. ASTM C533 - Calcium Silicate Block and Pipe Thermal Insulation.
- H. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- I. ASTM C547 - Mineral Fiber Preformed Pipe Insulation.
- J. ASTM C552 - Cellular Glass Block and Pipe Thermal Insulation.
- K. ASTM C578 - Preformed, Block Type Cellular Polystyrene Thermal Insulation.
- L. ASTM C585 - Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
- M. ASTM C591 - Rigid Preformed Cellular Urethane Thermal Insulation.
- N. ASTM C610 - Expanded Perlite Block and Pipe Thermal Insulation.
- O. ASTM C640 - Corkboard and Cork Pipe Thermal Insulation.
- P. ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.
- Q. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
- R. ASTM D1667 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed Cell Foam).
- S. ASTM D2842 - Water Absorption of Rigid Cellular Plastics.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

- T. ASTM E84 - Surface Burning Characteristics of Building Materials.
- U. ASTM E96 - Water Vapor Transmission of Materials.
- V. NFPA 255 - Surface Burning Characteristics of Building Materials.
- W. UL 723 - Surface Burning Characteristics of Building Materials.

1.4 QUALITY ASSURANCE

- A. All insulation, jacket, adhesives, mastics, sealers, etc., utilized in the fabrication of these systems shall meet NFPA for fire resistant ratings (maximum of 25 flame spread and 50 smoke developed ratings) and shall be approved by the insulation manufacturer for guaranteed performances when incorporated into their insulation system, unless a specific product is specified for a specific application, and is stated as an exception to this requirement. Fire ratings should be determined by the standard method of testing for surface-burning characteristics of building materials, ASTM E84 or NFPA Standard 255. Insulation approved for use shall have a UL label or a certified test report from an approved testing laboratory. Insulation materials should not be installed on systems until all necessary tests have been conducted for each component and insulated surfaces have been thoroughly cleaned and are in a dry state. Certificates to this effect shall be submitted along with Contractor's submittal data for this section of the Specifications. No material may be used that, when tested by the ASTM E84-89 test method, is found to melt, drip or delaminate to such a degree that the continuity of the flame front is destroyed, thereby resulting in an artificially low flame spread rating.
- B. All surfaces to be insulated shall be clean and dry before applying the insulation. All sections of molded pipe covering shall be firmly butted together. Where an insulation covering is applied, it shall lap the adjoining section of insulation by at least three inches (3"). Where insulation terminates, it shall be neatly beveled and finished with mastics and glass fabric (mastic shall be applied and smoothed until no glass fabric is visible). All exposed insulation shall be smoothly finished with mastic and glass fabric (mastic shall be applied and smoothed until no glass fabric is visible). No insulation shall be applied until the pipe, duct, etc., have been pressure tested and found tight. Piping, flexible connections, flanges, valves, strainers, and unions shall be covered unless specifically noted otherwise. All materials used shall be fire retardant or nonflammable. Refer to Section 15010.
- C. All adhesives, sealers, vapor barrier coatings, and so on used in conjunction with insulation should be compatible with the material to which they are applied. Any cement, sealer or coating used should be resistant to vermin and mold. All insulation

surfaces should be durable and, where exposed, protected from damage due to maintenance operations, vandalism, weather, and normal wear and tear. Preformed insulation systems are preferred at pumps, valves, strainers, and access doors for ease of maintenance and to lower cost. Protective jackets consisting of 0.23 kg canvas or 0.41 mm aluminum shall be used for exposed insulation systems.

- D. All insulation shall be continuous at full thickness without any gaps, including but not limited to; through walls, floors and other surfaces; where piping is routed parallel to other piping, valves, or jacket, etc.
- E. All mastics shall be water based. All mastic applied externally to the outside of insulation shall anti-microbial type.
- F. All piping, equipment, ductwork, all plenums including metal and masonry construction, fans, etc., shall be insulated as indicated on the Drawings, as specified herein, and as required for a complete system. In each case, the insulation shall be equal to that specified and materials applied and finished as described in these Specifications.
- G. To be considered, alternate materials shall have equivalent thermal and moisture resistance of the specified materials.
- H. No open cell or fibrous insulating materials shall be used within the BSL-3, ABSL-3, or BSL-2 environments. Insulation inside the barrier in such environments shall be elastomeric, closed cell insulation with cleanable sealed PVC cover. Adhesions shall be provided between overlap faces at all joints and seams. Smooth silicate seal shall be provided at exterior face of all joints and seams.

1.5 QUALIFICATIONS

- A. All insulation shall be applied by mechanics skilled in this particular work and regularly engaged in such occupation.
- B. All insulation shall be applied in strict accordance with these Specifications and with factory printed recommendations on items not herein mentioned. Unsightly, inadequate, or sloppy work will not be acceptable, and all such work shall be removed and replaced as many times as necessary to achieve an acceptable installation. The company performing the work of this section shall have a minimum of three years experience specializing in the trade.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.
- C. All insulation materials to be asbestos free.

1.7 PIPE, ELBOWS, VALVES AND FITTINGS INSULATION

- A. Pipe elbows should be insulated using pre-formed insulation elbows of the same material as the insulation in the straight section of pipe. Pipe fittings and valves, where possible, should be protected using factory premolded fittings, covers, and factory-protect insulation. Large valves and specialties should be protected using custom-made canvas jackets with straps and buckles to allow frequent removal and reinstallation without damaging the jacket. Metallic components used for the installation of insulation systems should be suitable for the intended environment and should not corrode. Exposed external corners on duct and equipment insulation in occupied areas shall be protected by corner beads consisting of 50 x 50 x 0.41 mm-thick aluminum.
- B. Insulation systems should be specified to meet industry standards, and installation requirements shall, as a minimum, include the following:
 - 1. Insulation should be continuous at all hangers, hanger rods, supports, sleeves, and openings. Vapor seals must be provided for all cold surfaces and should be continuous. Where supports must occur below the insulation surface, the thickness shall be maintained over the support and extend sufficiently beyond the support to prevent condensation. Insulation should be sealed where it terminates because of a valve, union, flange, and so on.
 - 2. All insulation should be arranged to permit expansion and contraction of systems without causing damage to the insulation or surface.
 - 3. The actual insulation thickness must be at least equal to the minimum specified at all locations, including supports in contact with cold surfaces.

4. It is critical that insulation materials be installed in a first-class manner with smooth and even surfaces. Scrap pieces of insulation should not be permitted where a full-length section will fit.
5. High-density pipe saddles or welded pipe standoffs should be provided at all points of pipe support.
6. All valves and strainers shall be insulated, and premolded covers and factory precut insulation or custom-fabricated jackets should be used where applicable. Unions and flanges shall not be insulated except on cold services.
7. Valves should be insulated up to and including bonnets, except for cold water valves, which should be insulated over packing nuts in a manner to permit removal for adjustment and repacking.
8. Strainers should be insulated to permit removal of the basket without disturbing the insulation of the strainer.

1.8 PIPE INSULATION

- A. Refer to Tables 2 and 3 for services for which insulation shall be installed, specification standards, type, class, vapor barrier, maximum conductivity, and minimum thicknesses. Refer to the following specifications for supplemental requirements.

PART 2 - PRODUCTS

2.1 Provide insulation from the following manufacturers or approved equal:

- A. Fiberglass insulation:
 1. Johns Manville Microlock
 2. Owen Corning ASJII
 3. Knauf ASJII
- B. Cellular glass insulation:
 1. Pittsburg Corning "Foam Glas"

- C. Koolphen K

- D. Elastometric Closed Cell:
 - 1. Armaflex II
 - 2. Rubatex

- E. Calcium silicate
 - 1. Johns Manville Thermo-12 Gold

- F. Mineral Fiber
 - 1. Johns Manville Roxul

2.2 DOMESTIC HOT AND COLD WATER:

- A. All domestic hot and cold water lines in buildings, including valves, strainers, unions, flanges, etc., except where specifically noted to the contrary, shall be insulated.

- B. All domestic hot and cold water piping systems shall be insulated with preformed insulation. All insulating products shall be guaranteed not to react with copper piping. Valves shall be insulated with mitered pipe covering with voids filled with glass fiber blanket insulation. Fittings on concealed insulation shall be built up to the thickness of adjacent insulation with glass fiber fitting wrap. Exposed fitting insulation shall be built up to same thickness as adjoining pipe insulation. The lap and butt joints shall be secured with staples and a field applied adhesive (self-sealing lap and butt joints alone are not acceptable). The insulation thickness shall be as scheduled. Cold water piping shall include vapor seal insulation to match chilled water piping requirements.

- C. The only domestic hot and cold water piping that will not require insulation is the exposed runouts under non-handicap plumbing fixtures. Where pipe chases are tight, adequate provision shall be made at the rough in stage utilizing offset fittings or other means (except springing the pipe) to insure that insulation can be applied throughout the length of the pipe. At these locations, provide pre-formed fire retardant anti-fungal, closed cell foam insulation kit with PVC covering and adhesive for washable assembly.

2.3 ROOF DRAIN BODIES AND STORM DRAIN PIPING:

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

- A. All horizontal runs of roof drain piping in the building (from drain body insulation to one foot vertical downstream or connection to vertical storm drain riser, and the bottom of all roof drains shall be insulated and sealed. Vertical storm drain piping inside the building shall not be insulated. (Exception: Where PVC piping is installed, vertical drain piping shall also be insulated.)

2.4 STEAM, STEAM VENT, AND CONDENSATE PIPING:

- A. Steam, steam vent, and condensate piping shall be insulated with specified insulation with a factory applied aluminum cover .016" thick (Metal-On). Joints shall be sealed with aluminum snap straps provided, fastened in place with $\frac{3}{4}$ " wide x .020" stainless steel bands. Fittings and valves shall be insulated with the same thickness as that applied to the adjacent pipe and shall have an outer removable covering of aluminum as manufactured by Premetco. If Premetco jacketing is used, it shall be aluminum banding (.020" thick) using three section of covering
- B. Pipe insulation shall be firmly wired in place by the use of no less than six (6) loops of No. 16 annealed copper clad iron wire per three foot section of insulation. These sections shall be staggered. The ends of these loops shall be twisted together tightly and bent over and hammered into the insulation so as to leave no projection. Bands shall be .020" thick, $\frac{3}{4}$ " wide, and 3 bands per section of insulation. Fittings, valves, etc., shall have bands on each side.
- C. All fittings on pipe 4" and larger shall be covered with the same material as the pipe, mitered and smoothed, and securely wired to the pipe.
- D. Fittings and valves for pipe smaller than 4" shall be insulated with Manville's No. 301 hydraulic setting cement and each application shall be in layers not thicker than $\frac{1}{2}$ ". Each layer shall be allowed to dry before the next layer is applied.
- E. All cracks and voids in this insulation shall be filled carefully with Manville's Cement No. 301 so that the resulting surface is smooth and continuous.
- F. At all pipe flanges, the insulation shall be beveled in such a manner that access may be had to the bolt studs and nuts without injuring the insulation where removable covers have been specified.
- H. A layer of 40-pound rosin-size paper or $\frac{3}{4}$ pound deadening felt shall be wrapped around the insulation before an 8-ounce canvas jacket is pasted in place. This canvas jacket shall be pasted onto the covered pipe valves and fittings (where insulated) in a neat and workmanlike fashion, using Arabol adhesive.
- I. All flanges, valves, pressure-regulating valves, strainers, and any other hot surfaces shall be covered with a built-up removable covering made of mineral fiber Pipe Covering with a finishing coat of Ryder hydraulic setting cement. This removable covering shall be banded on the valve or joint in such a fashion that it can readily be removed and replaced; it shall be of the same thickness as the insulation on the adjoining pipe.
- J. Piping insulated with calcium silicate pipe insulation and finished with canvas outer jacket shall be prepared for painting.
- K. Refer to Sections 15010 and 09900 for painting requirements.
- L. All field joints and connections in pre-insulated piping systems shall be insulated using joint installation kits furnished by the piping system manufacturer and installed per the piping

system manufacturer's written installation instructions. Field installed insulation and casing shall match the insulation value and integrity of the factory insulated piping.

2.5 CHILLED WATER PIPING:

- A. Chilled Water Piping: Pre-welded insulation shall be installed on chilled water lines. Prior to application of any insulation, all metal surfaces shall be thoroughly cleaned. The metal shall then be primed with an asphaltic primer consisting of one (1) coat of Foster No. 60-26 Primer or Pittcote 300 Primer. Cleaning and priming specified in this paragraph is not included in requirements for "Cleaning and Painting" specified in other sections of the Specifications. Insulation shall be applied to the piping with butt joints staggered and all joints tightly butted and sealed with a ¼" bead of joint sealer ½" from outside edge. Hold in place with 14 ga. copper clad wire 9" o.c. After insulation has been wired in place, a 1/16" minimum thick, 3" wide band of asphaltic vapor seal mastic shall be brushed or trowelled on the outside of the insulation at the approximate location of the aluminum bands. (Note that the asphaltic material specified in this paragraph is intended to be an exception to the flame spread and smoke generation limitations found elsewhere in this specification.) Any voids in the completed installation of the insulation shall not be filled with vapor seal coating but shall be eliminated by refitting or replacing insulation.
- B. Insulation on flanges, valves and other fitting shall consist of prefabricated fitting covers of the same thickness as specified for adjoining pipe insulation.
- C. Fitting covers shall be built up of shaped segments of cellular glass insulation. Fitting covers shall be applied in same manner as pipe application except that 16 ga. aluminum wire may be used to secure screwed fitting covers. Protruding metal parts (such as valve stems) shall be completely sealed off. Fitting cover jacketing shall be equal to Gasco, Papco or RPR Metals prefabricated fitting covers of 0.016" paper coated aluminum, secured as recommended by the manufacturer. These fitting covers shall be adhered in place using "Foster No. 30-35 80" water based vapor seals, then smoothly covered by a one-quarter inch (1/4") thick application of one coat white insulating cement. All this piping and fittings shall be finished with an eight-ounce canvas jacket neatly applied using Arabol adhesive.
- D. Valves, fittings, etc., in congested areas around coil and heat exchanger equipment, in valve pits, etc., shall be insulated by building up fitting segments and premolded sections of cellular glass insulation, plus white vapor seal mastic, plus Manville No. 301 finishing cement to smooth surfaces, plus canvas applied and sized for painting with fire resistant adhesive. In addition, all manufactured vapor barrier jacketing in mechanical rooms and finished spaces shall be finished with canvas or glass fiber reinforced mesh (20 x 20) applied and sized for painting with fire resistant adhesive. The adhesive shall be smoothly applied so no canvas or glass fabric is visible.
- E. No chilled water pipe supporting structures shall pierce the insulation except as anchor points as shown on the Drawings. At these points, the anchor member shall occur on the bottom of the piping to allow condensation to drain. The rigid section of insulation shall be provided on the bottom of the chilled water piping at each support point. The rigid section shall be covered with jacket equal to the insulation system in which it is installed.
- F. Provide insulation isolation seals at the end of all fittings, valves, etc. and at each twenty-four (24) feet of straight pipe for chilled and cold water systems. The isolation seal shall be composed of a liberal applicant of vapor barrier mastic on the end of the insulation and piping. Apply "blue" tape at each location where a seal has been applied.
- G. Refer to Section 15050, for insulation, re-insulation of existing insulation damaged or removed as part of the construction process.

2.6 HEATING HOT WATER PIPING – BUILDINGS (Below 200 deg):

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

- A. Hot water piping and fittings for heating systems, including unions, valves, strainers, etc., shall be insulated as specified above for "Domestic Hot Water". Refer to Tables 2 and 3 for thickness and insulation type specific to heating hot water.

2.7 PROTECTIVE JACKETING:

- A. Provide protective jacketing for exterior locations, in mechanical rooms below 8'-0" AFF, and elsewhere where required to meet other specification section requirements.
- B. Jacketing and fitting covers shall be .016 aluminum smooth as manufactured by Premetco or Childers. The jacket shall be pre-cut, pre-rolled, and lapped a minimum of two inches (2") in all directions to shed water. The metal shall be secured at each joint with a minimum of one (1) each 3/4" wide .020 aluminum or stainless steel band and seal. The metal jacketing and fitting covers shall be fabricated of 0.016" aluminum or stainless steel with a smooth finish. Longitudinal joints shall be placed with overlap directed to bottom of pipe. Provide end and side caps and sealant for a complete vapor free, waterproof insulation.
- C. In indoor applications, Proto Corp. LoSmoke PVC jacketing and fitting covers may be used. Material shall have 25/50 rating and shall be limited to piping systems operating at 140 degrees or below.

2.8 EXPANSION JOINTS

- A. Where expansion bends occur in the lines, a two foot (2') double layer contraction joint shall be provided in the main line starting two feet from the end of the main line ells on both sides of the expansion loop. Contraction joints shall consist of two 1-1/2" thick x 24" long pipe covering cuts into 17-1/4" and 6" lengths to provide a 3/4" space by 10-1/4". A slip joint mastic (Pittseal III) shall be placed between layers from the 3/4" space provided on the inside layer to the 3/4" space on the outside layer.
- B. The 3/4" space on inside layer shall be filled with mineral wool loose fill and the 3/4" space on the outer layer shall also be filled with same loose fill and joint sealer pressed 1/2" deep into space for sealing (Pittseal III). Around the outside layer at the 3/4" space, there shall be wrapped a 4" wide piece of glass fabric and sealed down with vapor seal mastic. Both inner and outer layer shall be equally sized thickness for sum to match insulation schedule minimum thickness.
- C. The joint and vapor seal mastic shall be Pittsburgh Corning Corporation Pittcote 300. (Note that the asphaltic material specified in this paragraph is intended to be an exception to the flame spread and smoke generation limitations found elsewhere in this specification.
- D. The slip joint sealer shall be Pittsburgh Corning Corporation's Pittseal III.

2.9 PUMPS:

- A. The chilled water pump and hot water pumps shall not be insulated but the insulation of the connecting piping shall be continued up to the face of the flanges on the piping connection to the pump and any bare metal that projects over the bed plate of the pump and from which condensation might drip onto the floor.
- B. Receivers of the steam condensate pumps shall be insulated with a minimum of two (2) layers of 6 lb. density cellular glass board or rigid wrap insulation with a factory applied All Service Jacket (ASJ). Each layer shall be held in place with stainless steel wire around the insulation. All joints shall be filled with insulating cement. The joints of the first layer shall be over lapped by the second layer. The entire assembly shall be covered with All Service Jacket (ASJ) material stapled in place and sealed with adhesive. The cover shall be

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

installed so the jacket joints are staggered so the jacket over lap the insulation joints. Thickness shall be as scheduled.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions in the absence of specific instruction herein.
- B. On exposed piping, locate insulation and cover seams in least visible locations, but not higher than at the side of the pipe at the "90°" position, with the seam lapped such that the lap is directed down.
- C. Insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature: Vapor barriers are required. The vapor barrier shall be on the outside. Extreme care shall be taken that the vapor barrier is unbroken. Joints, etc., shall be sealed. Where insulation with a vapor barrier terminates, it shall be sealed off with the vapor barrier being continuous to the surface being insulated. Ends shall not be left raw.
 - 1. Provide vapor barrier jackets, factory applied or field applied.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe.
 - 3. Finish with glass cloth and vapor barrier adhesive.
- D. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
- E. For insulated pipes conveying fluids above ambient temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory applied or field applied.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.
- F. Only factory assembled premolded insulation fitting covers or field assembled, multi-mitered (minimum three (3) mitres per fitting) and glued fittings covers shall be used for this project. Insulation "diapers" are not acceptable. If PVC fitting covers are used they shall have 25/50 rating.
- G. For hot piping conveying fluids 140°F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- H. For hot piping conveying steam or fluids over 140°F, insulate flanges and unions, including those at equipment, but label the insulation to indicate a concealed flange or union. See 2.5.
- I. No staples shall be used on the installation of piping insulation chilled water or cold water systems.
- J. The insulation at coils and air handling unit (AHU) casings shall be sealed to the coil or AHU casings by applying a metal plate over the opening and applying multiple layers of insulation (larger than the opening) and sealed with mastic to casing. Refer to detail on drawings.

- K. The insulation thickness shall not be compressed more than 10% (i.e. uncompressed thickness of 1" may be compressed to a thickness of 0.9" maximum) at any point in an insulation system. If piping is installed so the full thickness cannot be applied, the contractor shall remove and relocate piping.
- L. Where mastic and glass fabric tape is required the contractor shall apply and smooth multiple layer of mastic to the glass fabric until the glass fabric is no longer visible.

3.3 INSERTS, SUPPORTS and SHIELDS:

- A. Application: Piping 2 inches diameter or larger for all systems except direct buried.
- B. Shields: Install between pipe hangers or pipe hanger rolls and inserts. Hangers shall be on the outside of the insulation and shall not be in contact with the pipe. Curved metal shields shall be used between the hangers or support points and the bottom of the insulated pipe for Insulated pipes 2" and larger. Curved metal shields shall be designed to limit the bearing stress on the insulation to 35 psi and shall be curved to fit up to mid-perimeter of the insulated pipe. Shields shall be made of galvanized iron, or black iron painted on both sides with two coats of aluminum paint. Required metal shield sizes are as follows:

Nominal IPS	Metal Thickness	Lengths of Shield
up thru 2"	14 gauge	12"
thru 6"	12 gauge	16"
and above	10 gauge	20"

C. Inserts:

1. Location: Between support shield and piping and under the finish jack.
2. Insert Configuration: Minimum 2" inches longer than length of shield, of same thickness and contour as adjoining insulation; may be factory fabricated.
3. Insert Material: Heavy density insulating material suitable for the planned temperature range, and the weight of the pipe. Cover the insert with jacket material that matches the jacket of the insulation on either side of the insert. Provide insulation isolation as specified herein before seal on either end of the insert.
4. The shields at support points shall be secured with ½" x 0.016" stainless steel bands and seals.

D. Finish insulation at supports, protrusions, and interruptions.

E. In lieu of the above, the following system of support may be used:

1. At the pipe support positions, the insulation and vapor barrier shall be continuous and shall not be punctured by the support. The insulation at the support shall be the full circumference of 7.5lbs/ft³ cellular glass insulation material to withstand the bearing loads transmitted from the pipe to the support, it shall extend for at least 1" on either side of the support to allow sealing of the joints with the pipe insulation jacket.
2. The load bearing insulation at the support shall be capable of withstanding the maximum static compressive loads generated by pipe supported at the centers shown in Table 1.

Variations: Pipe loads greater than those generated at the support centers shown in Table 1 shall be referred to the manufacturer to establish the length and density of the insulated support block. The support centers are based on the weight of Sch 80 pipe filled with water and covered with 1" thickness of 2.2 lbs/ft³ standard insulation including FSK/ASJ vapor barrier.

Table 1 Block Support Centers

Nominal Pipe Size	¾"-1-¼"	2"-3"	4"	6"	8"-12"	14"	16"	18"-24"
Max support centers (feet) Sch 80 pipe filled with water covered with 1" of Standard Insulation	6.5	10	10	10	14	20	20	20
Metal Saddle Gauge (Galvanized Steel)	22	20	16	14	14	14	14	14
Length of K Block (inches)	6	6	6	9	9	9	9	12

Table Notes:

1. The insulation at supports shall be a cellular glass insulation (cold and hot piping) faced with factory applied FSK/ASJ vapor barrier and fitted with a galvanized steel 1800

- saddle bonded to the bottom section, for all pipe sizes 1 1/2" and larger. Calcium silicate may be applied for steam, steam condensate or hot water piping.
2. The vapor barrier shall be completed by the use of a FSK/ASJ overlap and factory applied self-seal lap tape and sealed with vapor barrier adhesive.
 3. At all support positions, other than those where the insulated pipe support block is surrounded by a clip or saddle in direct contact with the block, a block designed to accept the loads generated by the pipe shall be presented to the engineer for approval.
 4. In all cases where roller supports are used the length of the insulation and the wearing plate where fitted shall extend beyond the limits of the pipe movement.
- 3.4. For heat traced piping, insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracing. Cover with aluminum jacket with seams located on bottom side of horizontal piping.
 - 3.5. Where canvas finish is specified, use Arabol or Foster's anti-microbial lagging adhesive to prevent mildew in securing canvas. Do not use wheat paste. In addition, cover all canvas insulation with a fire retardant coating.
 - 3.6 For purpose of definition in this Specification: "concealed" areas are those areas which cannot be seen by the building occupants, and "exposed" areas are all areas which are exposed to view by the building occupants, including under counter and inside cabinet areas, plus all mechanical rooms.
 - 3.7 Self-Sealing Lap and butt joints will not be acceptable as the only seal on piping insulation joints. Self Sealing Lap and butt joints may be utilized only if the joints are additionally secured with field applied vapor barrier adhesive (on piping Systems requiring vapor barriers) and field applied adhesive (on piping system which do not require a vapor barrier jacket). Mechanical fasteners shall be used whenever possible to assure permanent installation.
 - 3.8. Special Protection: All insulated piping in the mechanical rooms within 8'-0" of the floor and in tunnels and valve pits shall be encased in a protective jacket, and where applicable, finish at top with nickel-plated brass flange plate with set screws or end joint sealing butt strips.
 - 3.9. All exposed outdoor piping shall have metal jacket.
 - 3.10. Fitting insulation shall be applied in same manner as pipe application. Protruding metal parts (such as valve stems) shall be completely sealed off. Fitting cover jacketing shall be equal to Gasco, Pabco or RPR Metals prefabricated fitting covers of 0.016" paper coated aluminum, secured as recommended by the manufacturer.
 - 3.11. Valves, fittings, etc., in congested areas around coil and heat exchanger equipment, etc., shall be insulated by building up fitting segments and premolded sections as necessary.
 - 3.12. No pipe supporting device (other than guides or anchors attached directly to the pipe) shall penetrate the insulation.
 - 3.13 PAINTING:
 - A. All exposed insulation shall be prepared to receive painting specified under Section 09900.
 - B. The pipe primer shall be Pittsburgh Corning Corporation Pittcote 300.
 - 3.14 INSULATION TABLES:

TABLE 2 - INSULATION MATERIAL REQUIREMENTS FOR EACH SERVICE APPLICATION

Service	Material	Specifications	Type	Clas	Vapor	Conductivity
---------	----------	----------------	------	------	-------	--------------

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
 PARKING GARAGE PACKAGE

TABLE 2 - INSULATION MATERIAL REQUIREMENTS FOR EACH SERVICE APPLICATION

				s	Barrie r	k-Factor (Max)	Mean Temp
						Btu*In/Hr*ft^2*F	deg F
Chilled Water (40 to 60F Water Temperatures) (Interior Conditioned Environment)							
Cellular Glass	ASTM C552	II		2	Yes	0.29	75
Fiberglass (VM Alternate)	ASTM C547	I			Yes	0.23	75
Chilled Water (40 to 60F Water Temperatures) (Outdoor Environment)							
Cellular Glass	ASTM C552	II		2	Yes	0.29	75
Heating Hot Water (Up to 200 F)							
Cellular Glass	ASTM C552	II		2	No	0.33	150
Calcium Silicate	ASTM C533	I			No	0.41	200
Fiberglass (VM Alternate)	ASTM C547	I			No	0.24	150
Low Pressure Steam (Up to 15 PSIG) and All Steam Condensate							
Mineral Fiber	ASTM C547			1	No	0.3	150
Calcium Silicate	ASTM C533	I			No	0.41	200
		I or					
Cellular Glass	ASTM C552	II		2	No	0.33	150
Fiberglass (VM Alternate)	ASTM C547	I			No	0.24	150
Medium Pressure Steam (Up to 100 PSIG, 330F)							
Calcium Silicate	ASTM C533	I			No	0.41	200
		I or					
Cellular Glass	ASTM C552	II		2	No	0.37	200
Fiberglass (VM Alternate)	ASTM C547	I			No	0.29	200
Compressed Air Discharge (Up to 350 F)							
Mineral Fiber	ASTM C547			1	No	0.32	200
Calcium Silicate	ASTM C533	I			No	0.41	200
		I or					
Cellular Glass	ASTM C552	II		2	No	0.37	200
Fiberglass (VM Alternate)	ASTM C547	I			No	0.29	200
Domestic Hot Water Supply and return piping, (Up to 140 F)							
		I or					
Cellular Glass	ASTM C552	II		2	No	0.33	150
Fiberglass (VM Alternate)	ASTM C547	I			No	0.24	100
Domestic Cold Water Supply piping - Above and Below Ceiling) Fire Lines in Garage							
		I or					
Cellular Glass	ASTM C552	II		2	Yes	0.29	75
Fiberglass (VM Alternate)	ASTM C547	I			Yes	0.23	75
Roof Drain Leaders and Storm Drain Piping (Horizontal Drains To First 1 Ft of Vertical Piping)							
Mineral Fiber	ASTM C547			1	Yes	0.25	100
Fiberglass (VM Alternate)	ASTM C547	I			Yes	0.23	75
Drain Bodies for Roof Drains and Floor Drains Receiving A/C Condensate Drain piping, (40 to 60 F)							
Elastomeric Cellular	ASTM C534	I			Yes	0.27	75

TABLE 2 - INSULATION MATERIAL REQUIREMENTS FOR EACH SERVICE APPLICATION

A/C Condensate Drains Drain piping, (40 to 60 F)							
Mineral Fiber	ASTM C547		I or II	1	Yes	0.25	100
Cellular Glass	ASTM C552		II	2	Yes	0.29	75
Elastomeric Cellular	ASTM C534		I		Yes		75
Drinking Fountain Drain Piping Drain piping to Sewer Piping							
Mineral Fiber	ASTM C547			1	Yes	0.25	100
Cellular Glass	ASTM C552		II	2	Yes	0.29	75
Elastomeric Cellular	ASTM C534		I		Yes	0.27	75
Exposed Lavatory Drains, Exposed Domestic Water Piping and Drains to Areas for Handicapped Personnel							
Preformed Fire-Retardant, Anti-Fungal, Closed Cell Foam Insulation Kit	ASTM C534		I	1	Yes		
Refrigerant Suction Piping (Up to 350 F.)							
Cellular Glass	ASTM C552		I or II	2	Yes	0.37	200
Equipment Insulation							
Surface Temps between -240 & up to 801 deg F	Cellular Glass	ASTM C552	1,2,3	427 deg F			deg C
Surface Temps between 100 & up to 399 deg F	Cellular Glass	ASTM C552	1,2,3	204 deg F			deg C
	Flexible Mineral Fiber	ASTM C553	1	B-3			
	Rigid Mineral Fiber	ASTM C612		1,2			
Surface Temps between 100 & up to 849 deg F	Rigid Mineral Fiber	ASTM C612		454 deg F			deg C
				3			
Diesel Engine Exhaust							
Calcium Silicate	ASTM C533		I		No	0.65	700
Rigid Mineral Fiber	ASTM C547			1	No	0.7	700
Boiler Exhaust							
Exhaust Engineered Exhaust System							

TABLE 3 - INSULATION MINIMUM THICKNESSES

Chilled Water - Insulation Minimum Thickness (Interior Conditioned Environment, 40 to 60 F)					
	Pipe Min	0.25	1.5	4	6
	Pipe Max.	1.25	3	5	10
	Insulation				
Cellular Glass	(In.)	1.5	1.5	1.5	1.5
Fiberglass (VM Alternate)		1.5	1.5	1.5	1.5

Chilled Water - Insulation Minimum Thickness (Outdoors, 40 to 60 F)					
	Pipe Min	0.25	1.5	4	6
	Pipe Max.	1.25	3	5	10
	Insulation				
Cellular Glass	(In.)	1.5	2	2	2.5

Heating Hot Water - Insulation Minimum Thickness (Up to 200 F)					
	Pipe Min	0.25	1.5	4	6
	Pipe Max.	1.25	3	5	10
	Insulation				
Calcium Silicate	(In.)	2	2	2.5	2.5
Cellular Glass		1.5	1.5	2	2
Fiberglass (VM Alternate)		1.5	1.5	2	2

Low Pressure Steam - Insulation Minimum Thickness (Up to 15 psig, 212 F) Also Applies To All Steam Condensate					
	Pipe Min	0.25	1.5	4	6
	Pipe Max.	1.25	3	5	10
	Insulation				
Mineral Fiber	(In.)	1.5	2	2.5	3
Calcium Silicate		2.5	3	4	4
Cellular Glass		2	2.5	2.5	2.5
Fiberglass (VM Alternate)		1.5	2	2	2

Med Pressure Steam - Insulation Minimum Thickness (Up to 100 psig, 330 F)					
	Pipe Min	0.25	1.5	4	6
	Pipe Max.	1.25	3	5	10
	Insulation				
Calcium Silicate	(In.)	3.5	4	4.5	4.5
Cellular Glass		3	3.5	3.5	3.5
Fiberglass (VM Alternate)		2.5	3	3	3

Compressed Air Discharge - Insulation Minimum Thickness					
	Pipe Min	0.25	1.5	4	6
	Pipe Max.	1.25	3	5	10
	Insulation				
Mineral Fiber	(In.)	1.5	2	2.5	3
Calcium Silicate		2.5	3	4	4
Cellular Glass		2	2.5	2.5	2.5
Fiberglass (VM Alternate)		1.5	2	2	2

Domestic Hot Water - Insulation Minimum Thickness				
Supply and return piping, (Up to 140 F)				
	Pipe Min	0.25	1.5	4
	Pipe Max.	1.25	3	4
	Insulation			
Cellular Glass	(In.)	1.5	1.5	1.5
Fiberglass (VM Alternate)		1.5	1.5	1.5

Domestic Cold Water - Insulation Minimum Thickness				
Supply piping - Above and Below Ceiling)				
	Pipe Min	0.25	1.5	4
	Pipe Max.	1.25	3	4
	Insulation			
Cellular Glass	(In.)	1.5	1.5	1.5
Fiberglass (VM Alternate)		1.5	1.5	1.5

Horizontal Roof Drain Leaders						
Horizontal Drains To First ___ Ft of Vertical Piping						
	Pipe Min	0.25	1.5	4	6	11
	Pipe Max.	1.25	3	4	10	16
	Insulation					
Mineral Fiber	(In.)	1	1	1.5	1.5	2
Fiberglass (VM Alternate)		1	1	1.5	1.5	2

A/C Condensate Drains and Drinking Fountain Drains				
Drain piping including secondary drain piping to vertical sewer piping				
	Pipe Min	0.25	1.5	4
	Pipe Max.	1.25	3	4
	Insulation			
Mineral Fiber	(In.)	1	1	1
Cellular Glass		1.5	1.5	1.5
Flexible Cellular		0.5	0.5	0.5

Exposed Lavatory Drains, Exposed Domestic Water Piping and Drains to Areas for Handicapped Personnel				
	Pipe Min	0.25	1.5	4
	Pipe Max.	1.25	3	4
	Insulation			
Mineral Fiber	(In.)	1	1	1
Cellular Glass		1.5	1.5	1.5
Flexible Cellular		0.5	0.5	0.5

Refrigerant Suction Piping (Up to 350 F.)				
	Pipe Min	0.25	1.5	4
	Pipe Max.	1.25	3	4
	Insulation			
Cellular Glass	(In.)	1.5	1.5	1.5

Equipment Insulation (In Conditioned Environment) Chilled Water Pumps, Tanks, Separators				
Cellular Glass	Insulation (In.) for all Surfaces			1.5

Equipment Insulation Hot Water Pumps, Tanks, Separators				
Cellular Glass	Insulation (In.) for all Surfaces			2.0

Equipment Insulation Low Pressure Steam Equipment				
Heat Exchangers, Condensate Receivers, Dearators, Vent Outlets				
	Insulation (In.) for all Surfaces			
Rigid Mineral Fiber				3
Calcium Silicate				4
Cellular Glass				3

Equipment Insulation Medium Pressure Steam Equipment Condensate Receivers, Dearators, Vent Outlets				
	Insulation (In.) for all Surfaces			
Calcium Silicate				4.5
Cellular Glass				3.5

Diesel Engine Exhaust				
Thickness is sum of two equal thickness layers with off-set joints and Stainless Steel Bands				
	Pipe Min	4	6	11
	Pipe Max.	5	10	16
Calcium Silicate	Insulation (In.)	6	6	6
Mineral Fiber		6	6	6

PART 4 – COMMISSIONING

- A. General: The contractor is responsible for all submittal reviews, material installation inspections and testing procedures/equipment noted here and in Division I Project Commissioning and Division 18 Commissioning. The Owner's designated Commissioning Agent will visually inspect all installation workmanship in addition to the Contractor's inspection.
- B. Scope: All materials incorporated by this section will be subject to verification. All equipment and auxiliary devices to support the equipment that is installed under this section will be subject to installation verification. Refer to Division I Project Commissioning and Division 18 Commissioning for methods and forms.
- C. Documentation: Contractor shall complete the commissioning forms acknowledging their material submittal review, installation inspection, start-up and final testing/check-out procedures of all equipment and system performance. Refer to Division I Project Commissioning and Division 18 Commissioning for methods and forms.

END OF SECTION

SECTION 15010 - GENERAL PROVISIONS - MECHANICAL

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. The General Provisions, Supplemental General Provisions, Special Provisions, Division 1 Specification Section and all relevant documents shall form a part of this Division of the Specifications, and shall be incorporated in this Section and each Division 16 Section hereinafter as if repeated verbatim herein. All conditions imposed by these documents shall be applicable to all portions of the Work under this Division. These references are intended to point out specific items to the Contractor, but in no way relieve him of the responsibility of reading and complying with all relevant parts of the entire Specification.
- B. The Contractor shall examine and coordinate with all Contract Drawings and Specifications, and all Addenda issued. Failure to comply shall not relieve them of responsibility. The omission of details of other portions of the Work from this Division shall not be used as a basis for a request for additional compensation.
- C. The specific features and details for other portions of the Work related to the construction in progress or to the existing building(s) shall be determined by examination at the site.

1.2 SCOPE OF WORK

- A. The requirements contained in this Section apply to all Work performed under Division 15 of these Specifications.
- B. The Work covered by this Division of the Specifications comprises the furnishing of labor, material, equipment, transportation, tools and services, and performing operations required for, and reasonably incidental to, the installation of the Work in accordance with the applicable Contract Documents, and subject to the terms and conditions of the Contract.
- C. The Work shall include modifications and extensions to existing systems, and the modification of the existing structure as required to accommodate the installation of the Work.
- D. Refer to other Divisions of the Specifications for related Work.

1.3 DEFINITION OF CONTRACTOR

- A. Where the word "Contractor" is used under any Section of this Division of the Specifications, it shall mean the Contractor who is engaged to execute the work included under that Section, even though he may be technically described as a Subcontractor, or his authorized representative.
- B. If the Contractor, engaged to execute a portion of the work, employs a Subcontractor to perform some of that work, he shall be completely responsible for the proper execution of this Subcontractor's work, in full conformity with the Contract Documents.

1.4 RESPONSIBILITY OF CONTRACTOR

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

GENERAL PROVISIONS
- MECHANICAL

- A. The Contractor shall be responsible for all Work of every description in connection with this Division of the Specifications. The Contractor shall specifically and distinctly assume, and does so assume, all risk for damage or injury from whatever cause to property or person used or employed on or in connection with this Work and of all damages or injury to any person or property wherever located, resulting from an action or operation under the Contract in connection with the Work, and undertake the promise to defend the Owner against all claims on account of any such damage or injury.
- B. The Contractor will be held responsible for the satisfactory execution and completion of the Work in accordance with the true intent of the Contract Documents. The Contractor shall provide without extra charge all incidental items required as part of the Work, even though it may not be specifically indicated. If the Contractor has reason for objecting to the use of any material, equipment, device or method of construction as indicated, he shall make report of such objections to the Owner's Representative, obtain proper approval and adjustment to the Contract, and shall proceed with the Work.

1.5 TERMINOLOGY

- A. Wherever the words "provide", or "furnish and install" are used, the materials and equipment described shall be furnished, installed and connected under this Division, complete for operation, unless specifically noted to the contrary. Wherever, the word "furnish" is used, the material, equipment, etc. to be supplied, but not installed by the supplier.
- B. It is also the intent, unless specifically noted to the contrary, that all materials and equipment described and specified under this Division, shall be provided whether or not a phrase as described in the preceding paragraph has been actually included.

1.6 ORDINANCES, PERMITS AND CODES

- A. It shall be the Contractor's duty to perform the work and provide the materials covered by these specifications in conformance with all ordinances and regulations of all authorities having jurisdiction.
- B. The Contractor shall obtain and pay for all permits, connection and specification fees as required for the complete installation of the specified systems.
- C. All work herein shall conform to all applicable laws, ordinances and regulations of the local utility companies.
- D. The work shall be in accordance with, but not limited to, the requirements of:
 - 1. National Fire Protection Association
 - 2. National Safety Code
 - 3. TDSHS =(State) Hospital Licensing
 - 4. City of WEBSTER Building Codes
- E. Codes and standards referred to are minimum standards. Where the requirements of

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

GENERAL PROVISIONS
- MECHANICAL
15010 - 2

these specifications or drawings exceed those of the codes and regulations, the drawings and specifications govern.

- F. The Contractor shall obtain permits, plan checks, inspections and approvals applicable to the Work as required by the regulatory authorities. Fees and costs of any nature whatsoever incidental to these permits, inspections and approvals shall be assumed and paid by the Contractor. The pro-rata costs, if any, for utilities serving this property will be paid for by the Owner and shall not be included as part of this Contract.

1.7 MATERIALS, EQUIPMENT AND DEVICE DESCRIPTION

- A. Materials, equipment and devices shall be of the best quality customarily applied in quality commercial practice, and shall be the products of reputable manufacturers. Each major component shall bear a nameplate giving the name and address of the manufacturer, and the catalog number or designation of the component.
- B. Materials, equipment and devices furnished under this Division of the Specifications shall be essentially the standard product of the specified manufacturer, or where allowed, an alternate manufacturer. Where two or more units of the same kind or class of a specific item are required, these shall be the products of a single manufacturer; however, the component parts of the item need not be the products of one manufacturer.
- C. In describing the various materials, equipment and devices, in general each item will be described singularly, even though there may be a multiplicity of identical items. Also, where the description is only general in nature, exact sizes, duties, space arrangements, horsepower requirements and other data shall be determined by reference to the Contract Documents.
- D. Equipment called for on the plans and not listed herein shall be provided and installed as though it were fully described herein.
- E. Equipment called for herein shall be completely provided and installed, whether fully detailed or not on the plans, and/or scheduled.
- F. All equipment as indicated on the plans and as described herein shall be installed per manufacturer's recommendations to allow for proper operation and maintenance of the equipment.

1.8 QUALITY ASSURANCE

- A. Materials, equipment and devices shall be new and of the quality specified, and shall be free from defects at the time of installation. Materials, equipment and devices damaged in shipment or otherwise damaged or found defective prior to acceptance by the Owner shall not be repaired at the job site, but shall be replaced with new materials, equipment or devices identical with those damaged, unless specifically approved otherwise by the Owner's Representative.
- B. Wherever a UL standard has been established for a particular type of material, equipment or device, each item of such material, equipment or device provided on this project shall meet the requirements of the UL standard in every way, and shall be UL listed and labeled.

1.9 REFERENCE STANDARDS

- A. Materials, equipment, devices and workmanship shall comply with applicable local, county, state and national codes, laws and ordinances, utility company regulations and industry standards.
- B. In case of differences between building codes, state laws, local ordinances, industry standards, utility company regulations and the Contract Documents, the most stringent shall govern. The Contractor shall promptly notify the Owner's Representative in writing of any such difference. Should the Contractor perform any Work that does not comply with local codes, laws and ordinances, industry standards or other governing regulations, the Work shall be corrected on noncompliance deficiencies with the Contractor bearing all costs.
- C. In addition to the aforementioned ordinances, industry standards published by the following organizations shall apply:

AABC	-	ASSOCIATED AIR BALANCE COUNCIL
AASHO	-	AMERICAN ASSOCIATED OF STATE HIGHWAY OFFICIALS
ACI	-	AMERICAN CONCRETE INSTITUTE
ADC	-	AIR DIFFUSION COUNCIL
AGA	-	AMERICAN GAS ASSOCIATION
AISC	-	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
AMCA	-	AIR MOVING AND CONDITIONING ASSOCIATION
ANSI	-	AMERICAN NATIONAL STANDARDS INSTITUTE
API	-	AMERICAN PETROLEUM INSTITUTE
ARI	-	AIR CONDITIONING & REFRIGERATION INSTITUTE
ASHRAE	-	AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR CONDITIONS ENGINEERS, INC.
ASME	-	AMERICAN SOCIETY OF MECHANICAL ENGINEERS
ASTM	-	AMERICAN SOCIETY FOR TESTING AND MATERIALS
AWSC	-	AMERICAN WELDING SOCIETY CODE
AWWA	-	AMERICAN WATER WORKS ASSOCIATION
CISPI	-	CAST IRON SOIL PIPE INSTITUTE
CTI	-	COOLING TOWER INSTITUTE
FM	-	FACTORY MUTUAL
IRI	-	INDUSTRIAL RISK INSURERS
NBS	-	NATIONAL BUREAU OF STANDARDS
NFPA	-	NATIONAL FIRE PROTECTION ASSOCIATION
PDI	-	PLUMBING AND DRAINAGE INSTITUTE
SMACNA	-	SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION
TDSHS -	TEXAS	DEPARTMENT OF STATE HEALTH SERVICES
UL	-	UNDERWRITER'S LABORATORIES

- D. Where the Contract Documents exceed the above requirements, the Contract Documents shall govern. In no case shall Work be installed contrary to or below the minimum legal standards.

1.10 DRAWINGS AND SPECIFICATIONS

- A. The inter-relation of the specifications, the drawings, and the schedules are as follows:

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

GENERAL PROVISIONS
- MECHANICAL

1. The specifications provide the written requirements for the quality, standard, nature of the materials, equipment and construction systems.
 2. The drawings establish the quantities, dimensions, details and location of equipment.
 3. The schedules give the capacities, characteristics and components.
- B. For any individual project, if there is conflict between the drawings and or specifications, they are equivalent in authority and priority. Should they disagree in themselves, or with each other, prices shall be based on the most expensive combination of quality and quantity of work indicated. In the event of the above mentioned disagreements the resolution shall be determined by the Architect.
- C. Contractor is responsible to bring any conflicts in drawings and/or specifications to the attention of the Architect, immediately, prior to any work being done.
- D. Where the specifications do not fully agree with the schedules, the schedules shall govern. Figures given on drawings govern scale measurements and large scale details govern small scale drawings.

1.11 SUBMITTALS

- A. See the material and requirements under the General Conditions and the specific specification sections for indication of submittal data.
- B. A submittal shall be provided for review on each item proposed for use hereunder, to include but not limited to, the following:
1. Valves
 2. Hangers/Supports
 3. Vibration isolation
 4. Insulation
 5. Piping Materials/Fittings
 6. Pumps and Accessories
 7. Plumbing Equipment
 8. Plumbing Fixtures/Trim
 9. Fire Protection Systems/Equipment
 10. DX Split Systems
 11. Variable Frequency Drives/Starters

12. Air Distribution Materials/Devices
 13. Test and Balance Qualifications
 14. Fire/Smoke Dampers (Include U.L. Detail proposed for use)
 15. Duct Fabrication Methods
 16. Control/Backdraft Dampers
 17. Heat Trace Cable
 18. Water heaters
- C. Process submittal data to insure that it conforms to the requirements of the Plans and Specifications and that there are no omissions and/or duplications.
 - D. Each submittal shall designate the exact item offered and be clearly identified to correspond with the contract documents; unidentified items on manufacturer's data sheets are not acceptable. Provide separate submittals corresponding to each section. Multiple spec sections bundled into one submittal will be rejected without review. Submittals to include parts list with descriptive part numbers for belts, sheaves, motors, filters, fan blades, terminal and AHU EMS controllers, damper and valve actuators and other similar applicable components.
 - E. In each case, the various material submissions of related items, procured from a single manufacturer or supplier, shall be assembled in brochures or in other suitable package form and shall not be submitted in a multiplicity of loose sheets.
 - F. The Contractor shall assemble these brochures, checking them for accuracy and coordination and submit six (6) copies in bound "Project Manuals" to the Architect for review by the Architect.
 - G. The contractor shall submit all submittals in a timely manner to allow 10 working days review period by the engineer unless otherwise agreed upon in advance. After review, the architect and the engineer shall each retain one (1) copy for their records. Four marked copies shall be returned to the contractor for distribution. All additional copies submitted shall be returned to the contractor unmarked.
 - H. The submittals shall include room-by-room tabulations of air distribution devices, fire dampers, etc. They shall not cover detailed lists of plumbing fixtures, carriers, drains, valves, and similar items.
 - I. The Contractor shall sign the submittal as an indication of compliance with the Contract Documents. If there are any deviations from the Contract Documents, he shall so indicate on the submittal. Any deviations not so indicated shall be cause for rejection and removal of the non-complying equipment at the Contractor's expense.
 - J. Each submittal shall include a readily available 4" x 4" space for the engineer's submittal review stamp.

- K. Submittals that do not comply strictly with the above format may be returned to the contractor, without review, at the discretion of the engineer.

1.12 SHOP/FABRICATION DRAWINGS

- A. See the material under General Conditions.
- B. Prepare shop drawings as called for elsewhere herein or directed by the Architect to coordinate this work with the work of other Divisions, to illustrate changes in this work to facilitate its concealment in finished spaces, to avoid obstructions, or to illustrate the installation of a substitute equipment item. Engineer shall review these drawings. Shop drawings shall be provided for the following:
- C. "Shop/Fabrication Drawings" shall clearly identify utility systems in a singular fashion. Drawings shall be used by the contractor as the basis of system fabrication and shall clearly indicate all system components as they are intended to be fabricated, constructed, and installed.

1.13 INSTALLATION DRAWINGS

- A. Prepare special drawings as called for elsewhere herein or directed by the Architect to coordinate this work with the work of other Divisions, to illustrate changes in this work to facilitate its concealment in finished spaces, to avoid obstructions, or to illustrate the installation of a substitute equipment item.
- B. "Installation/Coordination Drawings" shall clearly identify the building utility systems in a holistic fashion. Drawings shall be used as the basis of systems field installation and shall clearly indicate the coordination efforts of all utility systems being installed on a single composite document.
- C. Use these drawings in the field for the installation of the work. Unless otherwise directed, do not submit these drawings for review, but provide 3 copies to the Architect for information.

1.14 INSPECTION OF SITE

- A. The accompanying drawings do not indicate existing mechanical installations other than to identify modifications of and extensions thereto. The Contractor shall visit the site, inspect the installations and ascertain the conditions to be met and the work. Failure to comply with this shall not constitute ground for any additional payments in connection with removing or modifying any part of the existing installations and/or installing any new work under this Division.

1.15 WORKMANSHIP AND INSTALLATION

- A. In no case shall the Contractor provide a class of material, equipment, device or workmanship less than that required by the Contract Documents or applicable codes, regulations, ordinances or standards. All modifications which may be required by a local authority having legal jurisdiction over all or any part of the Work shall be made by the Contractor without any additional charge. In all cases where such authority requires deviations from the requirements of the Drawings or Specifications, the Contractor shall

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

GENERAL PROVISIONS
- MECHANICAL

report same to the Owner's Representative and shall secure his approval before the Work is started.

- B. The Work shall be performed by properly licensed technicians skilled in their respective trades. All materials, equipment and devices shall be installed in accordance with the recommendations of the manufacturer and in the best standard practice to bring about results of a first class condition.

1.16 WARRANTY

- A. All materials, equipment, devices and workmanship shall be warranted for a period of one year from the date of acceptance by the Owner's Representative for beneficial use by the Owner, except that where specific equipment is noted to have extended warranties. The warranty shall be in accordance with Division 1. The Contractor shall be responsible for the proper registration of these warranties so that the Owner can make all proper claims should future need develop.
- B. The Contractor shall furnish to the Owner's Representative for transmittal to the Owner, the name, address and telephone number of those persons responsible for service on systems and equipment covered by the warranty.

1.17 OPERATION PRIOR TO ACCEPTANCE

- A. When any equipment is operable, and it is to the advantage of the Contractor to operate the equipment, the Contractor may do so provided that he properly supervises the operation, and retains full responsibility for the equipment operated. Regardless of whether or not the equipment is operating properly, make required adjustments and complete punch list items before final acceptance by the Owner.

1.18 INSTRUCTION OF OWNER'S PERSONNEL

- A. Provide the services of competent engineers and/or technicians acceptable to the Owner's Representative to instruct other representatives of the Owner in the complete and detailed operation of each item of equipment or device of all the various electrical systems. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results. Upon completion of these instructions, the Contractor shall obtain a letter of release, acknowledged by the Owner or his authorized representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.
- B. The Contractor shall be fully responsible for proper maintenance of equipment and systems until the instructions have been given the Owner's personnel and the letter of release acknowledged.
- C. In providing the instructions to the Owner's personnel, the written operating and maintenance manuals shall be followed in all instances, and the Owner's personnel shall be familiarized with such manuals. Operating and maintenance manuals used for instructions shall include wiring diagrams, manufacturer's operating and maintenance instructions, parts lists (with sources identified), and other data as appropriate for each system.

1.19 SCHEDULE AND SEQUENCE OF WORK

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

GENERAL PROVISIONS
- MECHANICAL

- A. The Contractor shall meet and cooperate with the Owner and Owner's Representative to schedule and sequence this Work so as to insure meeting scheduled completion dates and avoid delaying other portions of the Work. Work requiring special sequencing shall be at no additional cost to the Owner and shall have no impact on the schedule.

1.20 GENERAL

- A. Bidders shall visually examine the existing conditions at the site. The Contractor shall be responsible for installation of the work as it relates to those conditions.
- B. Review all construction details illustrated on the architectural and structural drawings and be guided thereby.
- C. Except for the layout of the sprinkler system, including heads, test connections, drains, etc., the mechanical Drawings diagrammatically show sizes and locations of outlets and equipment items and the sizes of the major interconnecting pipes and ducts, without delineating exact elevations, offsets, control lines, and other installation details. Carefully lay out work at the site to conform to the architectural and structural conditions, to avoid obstructions, and permit proper grading of lines. In cooperation with other Contractors, determine exact locations of outlets, apparatus and connections thereto by reference to the general, detail, equipment and rough-in drawings, and by measurements at the building; in all cases subject to Architectural approval. Where necessitated by conditions at the site or directed by the Architect, make minor relocations without additional cost to the Owner.
- D. Run all ducts and pipes concealed in suspended ceilings where they occur and in furrings and chases where shown, except for those connections to plumbing fixtures and equipment items which must necessarily be exposed. Wherever conditions exist which would cause any normally concealed materials to be exposed in finished spaces, immediately call the situation to the attention of the Architect and stop work in those areas until the Architect directs the resumption of the work and the procedures to be followed.
 - 1. Install all concealed pipes and ducts as required by the pace of the general construction.
- E. In areas where there are no suspended ceilings, run all ducts and pipes parallel to building surface planes, except grade lines, for proper flow.
- F. These Specifications and the accompanying Drawings are intended to describe and illustrate systems which will not interfere with the building structure and which will fit into the available spaces. Prepare an installation drawing for any critical area, illustrating the installation of the work in this Division as related to the work of all other Divisions, and correct interferences with the other trades or with the building structure before the work proceeds.

1.21 INSTALLATION INSPECTIONS AND CERTIFICATIONS

- A. Obtain timely inspections of the installation by the constituted authorities. Remedy any deficiencies to the satisfaction of the inspecting authority.
- B. Upon final completion of the work, obtain certificates of acceptance from the constituted

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

GENERAL PROVISIONS
- MECHANICAL

authorities. Deliver the certificates to the Architect for transmission to the Owner.

1.22 SUBSTITUTIONS AND SPACE ALLOCATIONS

- A. See the material under the Supplementary General Conditions.
- B. Where the product of a single manufacturer is mentioned by trade name or manufacturer's name in this Division, it has been done in order to establish a standard rather than to discriminate against an equal product made by another manufacturer. Where two or more manufacturers are named, only those manufacturers will be considered or approved.
- C. Manufacturers not listed will be considered for substitution prior to bid only. The substitute manufacturer shall submit a complete copy of the appropriate technical specification section minimum ten (10) business days prior to bid with each sub-paragraph noted with the comment, "compliance", "deviation", "alternate" or "not applicable". In the case of non-primary, vendor-supplied items, the name of the sub-vendor supplying said item, including model number, shall be indicated.
 - 1. By noting the term "compliance" or "C", it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
 - 2. By noting the term "deviation" or "D", it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified. Manufacturer shall indicate all deviations.
 - 3. By noting the term "alternate" or "A", it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner. An alternate shall be fully described as to what the manufacturer proposes to provide.
 - 4. By noting the term "not applicable" or "N/A", it shall be understood that the specified item is not applicable to the project.
- D. Where a single manufacturer is mentioned by trade name or manufacturer's name in addition to listing acceptable substitute manufacturers, it has been previously determined that, though the equipment manufactured by the substitute manufacturers may include some philosophical design differences from that specified their overall design philosophy and equipment quality are acceptable for the intended application. The substitute manufacturer shall submit a complete copy of the appropriate technical specification section with their bid with each sub-paragraph noted with the comment, "compliance", "deviation", "alternate" or "not applicable". In the case of non-primary, vendor-supplied items, the name of the sub-vendor supplying said item, including model number, shall be indicated.
 - 1. By noting the term "compliance" or "C", it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
 - 2. By noting the term "deviation" or "D", it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified. Manufacturer

shall indicate all deviations.

3. By noting the term "alternate" or "A", it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner. An alternate shall be fully described as to what the manufacturer proposes to provide.
 4. By noting the term "not applicable" or "N/A", it shall be understood that the specified item is not applicable to the project.
- E. It shall be understood that space allocations have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer whether indicated or not. If any item of equipment or device is offered in substitution which differs substantially in dimension or configuration from that indicated on the Drawings or specifications, provide as part of the submittal 1/4 inch equals 1 foot scaled drawings showing that the equipment or devices can be installed in the space available without interfering with other portions of the work or with access for operations and maintenance in the completed project.
- F. Where substitute equipment or devices requiring different arrangement or connections from that indicated is accepted by the Owner's Representative, install the equipment or devices to operate properly and in harmony with the intent of the Contract Documents, making all incidental changes in piping, ductwork or wiring resulting from the equipment or device selection without any additional cost to the Owner. The Contractor shall pay all additional costs incurred by other portions of the work in connection with the substituted equipment or device.
- G. The Owner's Representative reserves the right to call for samples of any item of material, equipment or device offered in substitution, together with a sample of the specific item when, in their opinion, the quality of the item and/or the appearance is involved, and it is deemed that an evaluation of the item may be better made by visual inspection.
- H. When any request for a substitution of material, equipment or device is submitted and rejected, the item named in the Contract Documents shall be furnished. Repetitive submittal of substitutions for the same item will not be considered.

1.23 LARGE APPARATUS

- A. Where any piece of apparatus is too large for ingress through normal building openings, it shall be placed in its containing space before the enclosing structure is completed.

1.24 PROTECTION OF APPARATUS

- A. At all times take every precaution to properly protect apparatus from damage. Include erecting temporary shelters to protect apparatus shored at the site, cribbing of apparatus above the floor of the construction, and covering of apparatus in the incomplete building with plastic sheeting or other protective coating. Failure on the part of the Contractor to comply with the above to the satisfaction of the Architect will be sufficient cause for the rejection of the pieces of apparatus in question.
- B. Responsibility for the protection of apparatus shall extend to presently installed apparatus. Erect temporary sheltering structures, provide temporary bracing and

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

GENERAL PROVISIONS
- MECHANICAL
15010 - 11

supports, or cover equipment as required or directed to afford proper protection.

1.25 SCHEDULE OF WORK

- A. Work schedules and completion dates as established must be rigidly adhered to. Cooperate in establishing these schedules and perform the work under this Division at such times as directed so as to insure meeting scheduled dates and avoid delaying any other Contractor.

1.26 CUTTING AND PATCHING

- A. Each Contractor shall, under the Architect's direction, drill or cut openings as required to install a new work or to repair or replace defective work; use core drills or power driven saws. Include channeling in walls as required for the installation of wall mounted material and equipment.
- B. In cutting masonry walls, provide and install lintels and/or other structural members to provide adequate protective support for the remaining masonry. Structural members, supports, etc. shall be of the size and shape and installed as directed by the Architect.
- C. Do not cut any structural member in a way to lessen its strength, without specific permission.
- D. Openings cut in the building to install materials covered by this Division of the Specifications or to repair or replace defects which may appear up to the expiration of the guarantee, or to repair damage to the work of other trades occasioned by those cutting operations, shall be repaired by the trade whose work is disturbed, but payment therefore shall be by the Contractor cutting the opening or causing the damage.
- E. Cut all openings required to install the work or to repair any defective work. Do all of this cutting under the Owner's Representatives direction and exercise due diligence to avoid cutting openings larger than required or in the wrong locations.
- F. No cutting or drilling of any sort will be permitted in the webs of prestressed, precast concrete structural elements. Use core drills or power driven saws to cut openings in the flanges of other such elements; the use of reciprocating drills will not be permitted. The cutting of structural members without first having received written permission from the Owner's Representative is prohibited.
- G. Where openings are cut in fire-rated walls or floors, seal the annular space between the work installed and the fire-rated construction. Sealant, as applied, shall be fire rated to maintain the fire rating of the construction penetrated. Sealant shall be re-enterable (before fire) to alter penetrations. Apply in strict accordance with manufacturer's instructions.

1.27 CONCRETE FOUNDATIONS

- A. Unless otherwise noted, concrete foundations, furnished under this Division of the Specifications, shall be not less than 4 inches high, poured in forms built of new dressed lumber with corners chamfered using sheet metal or triangular wood strips nailed to the form. Use 6x6 No. 3 mesh for reinforcing. Use Decatur Engineering Company's heavy

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

GENERAL PROVISIONS
- MECHANICAL
15010 - 12

duty adjustable anchor bolts, set in the form and positioned using templates, prior to pouring concrete. Allow at least one inch between equipment bases and foundations for alignment, leveling and grouting. Use non-shrinking grout equal to Embecco Pre-Mixed Grout. After grouting, remove the forms and hand-rub the foundation with carborundum.

B. Concrete foundations or pads will be required for all floor mounted equipment.

1.28 CONCRETE WORK

A. Do all concrete work for concrete structures specified to be provided under this Division in strict accordance with the applicable provisions of Division 3, CONCRETE.

1.29 BURIAL DEPTH FOR EXTERIOR PIPING

A. Except as otherwise indicated or required by conditions at the site, the minimum cover from the top of the pipe to the finished grade for underground, exterior piping shall be: 24 inch for storm, sanitary drain and sewer lines; and 48 inch for water and gas lines unless otherwise directed by the Civil Engineer's plans and specifications.

1.30 EXCAVATION AND BACKFILLING

A. Do all excavating and backfilling required in installing the work under this Division; generally use procedures and materials as described in Division 2 under SITE WORK.

B. The Contractor shall be responsible for submitting a site specific trench safety system prepared by a registered engineer which meets OSHA standards and any additional state and local standards.

1.31 EXTERIOR EXCAVATING

A. Perform all exterior excavating of whatever substances encountered and to the depths required.

B. During excavation, stack material suitable for backfilling in an orderly manner a sufficient distance from the banks of the trenches to prevent slides or cave-ins. Remove all excavated material not required or suitable for backfill, or waste as directed.

C. Control grading to prevent surface water from flowing into excavations and remove any water accumulating therein by pumping.

D. Use open cut grading and make trenches the necessary width for proper installation of the line, with banks as nearly vertical as practicable. Provide sheeting and shoring as necessary for the proper protection of the work and the safety of personnel.

E. Use open cut grading except that short sections of a trench may be tunneled if, in the Architect's opinion, the line can be safely and properly installed and the tunnel can be suitably backfilled and tamped. Make trenches the necessary width for proper installation of the line, with banks as nearly vertical as practicable. Provide sheeting and shoring as necessary for the proper protection of the work and the safety of personnel.

F. Dig trenches not less than 12 inches nor more than 16 inches wider than the diameter of

the pipe to be installed and excavate true to line so that the pipe may be centered therein. This trench width applies at and below the level of the top of the pipe. Dig the trench above that level as wide as necessary for proper installation of the work and protection of personnel.

- G. Grade trench bottoms to provide uniform bearing and support for the pipe on undisturbed soil as every point along its length except for lines excavated in rock and in soil incapable of supporting the pipe and except for excavation for bell holes and for proper sealing of pipe joints. Following grading of the trench bottom, create a depression at each joint as required to assemble the joint in accordance with its manufacturer's recommendations and to provide space to physically accommodate the joint. Remove stones to prevent point bearing. Round bottoms of trenches excavated for sewers so that at least 1/3 of the circumference of the pipes will rest firmly on undisturbed soil.
- H. Where rock excavation is required, remove the rock to a minimum overdepth of 8 inches. Backfill the overdepth excavation with sand, 3/4 inch crushed rock, the equivalent in gravel, or other approved backfill material, prior to installing the pipe.
- I. Where trenches are inadvertently over excavated, fill to the bottom level of the pipe with backfill material as specified above, prior to installing the pipe.
- J. Whenever soil is determined to be unstable by the Architect, (incapable of properly supporting the pipe) remove such soil to a depth required and for the lengths and widths designated by the Architect and backfill the trench to bottom grade with backfill material, as specified above, prior to installing the pipe.
- K. Excavation for underground structures shall be sufficient to leave at least 12 inches clear between outer surface and embankment or timber that may be used to hold and protect banks. Any overdepth excavation below that may be used to hold and protect banks. Any overdepth excavation below such appurtenances will be considered unauthorized and shall be refilled with sand, rock, gravel, or concrete, as directed at the expense of the Contractor.

1.32 BRACING, SHORING AND SHEETING

- A. Whenever necessary, support sides and ends of all excavations with braces, sheeting, shores and stringers of quality and character as required. All timbering shall be put in place or driven by men skilled in such work and shall be so arranged that it may be withdrawn as refilling proceeds, without injury to any structures, roadbeds, or property; all shoring and sheeting shall be in accordance with applicable codes and regulations.
- B. Whenever required by soft ground, or for protection of any person, structure, or property, sheeting shall be driven, without extra compensation, to such a depth below bottom of trench as may be required or directed.
- C. Bracing, shoring and sheeting shall be in compliance with the requirements of the State of Texas Safety Code.

1.33 BACKFILLING OF EXTERIOR EXCAVATIONS

- A. Do not backfill a trench until the piping system is installed in conformance with specified requirements and has been tested and accepted.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

GENERAL PROVISIONS
- MECHANICAL
15010 - 14

- B. Except as directed otherwise, bracing, shoring and sheeting shall be removed in a manner to avoid damage or disturbances to work, and excavations shall be free of forms and cleaned of trash. Backfill shall be brought up evenly on each side of a pipe and shall not be placed on surfaces that are muddy, frozen or that contain frost.
- C. Backfill material shall be free from trash, putrescible refuse, ashes, large stones and material. Except as otherwise specified, all backfill shall be uniformly deposited and carefully compacted in layers not exceeding 8 inches in loose thickness by use of vibratory compaction equipment to at least 90% of maximum density at a moisture content within 2% of optimum in accordance with AASHO Standard T99.
- D. Trenches Under Pavement: All trenches beneath existing or proposed roadways, shoulders, parking areas, curbs, sidewalks or similar use pavements shall be backfilled as specified above, except that all backfill material shall be compacted to at 95% of maximum density at a moisture content within 2% of optimum in accordance with AASHO Standard T99.
- E. The top 6 inches of backfill in areas outside of pavements shall be topsoil that is free of weeds and other unwanted materials.
- F. Settling of granular non-cohesive backfill material with water in trenches lying outside of pavements will be permitted, and will be a requirement when so directed.
- G. Trenches improperly backfilled, or where settlement occurs, shall be reopened to depth required for proper compaction, then refilled and compacted as specified, or otherwise corrected as permitted by the Architect.

1.34 OPENING AND RECLOSING PAVEMENT

- A. Where excavation requires the opening of existing walks, streets, drives or other existing pavement, including "black topping", cut the pavement as required to install new lines and to make new connections to existing lines. Hold the size of the cut to a minimum consistent with the work to be accomplished. After completing the piping installation, backfill the excavation as hereinbefore specified; replace both the base and surface courses using materials to match those removed, both in degree of compaction and kind of material; replace any reinforcing and splice to existing reinforcing. New finished surfaces shall be level with the original surfaces and thoroughly bond with them.

1.35 INTERIOR TRENCHES AND BACKFILLING

- A. For trenches of lines installed below a floor to be poured on grade, follow in general the procedures set out for exterior lines except install with a minimum amount of cover. Backfill with a suitable material and compact to no less than 95% Standard Proctor density immediately prior to the pouring of the floor.
- B. Dispose of all surplus materials occasioned by these trenching operations as directed by the Architect.
- C. Scoop out trenches in the underhouse areas as required to accommodate all equipment lines, ducts and piping, except waste, drain and sewer lines. Make these trenches adequate in width and depth to keep any such lines or duct a minimum of 6 inches from finished earth grade, and slope the sides of such trenches so that there will be no

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

GENERAL PROVISIONS
- MECHANICAL
15010 - 15

possibility of the trench walls caving or appreciably sloughing.

- D. Waste, drain and sewer lines run in crawl spaces below the floor, may either be suspended from the construction above or supported by the ground in trenches, using procedures set out for exterior lines.
- E. Sub-soil drain lines installed in underhouse areas shall be laid true to grade and shall be backfilled using crushed rock completely surrounding the lines as indicated.

1.36 PIPE SLEEVES

- A. Where a pipe passes through a floor in a pipe chase which is not a slab on grade, use a galvanized steel pipe sleeve, extending to a height of 2 inches above the floor slab and cemented watertight; make the inside diameter of the sleeve at least 1/2 inch greater than the outside diameter of either the insulation on a covered pipe or of any bare pipe.
- B. Except where a pipe passes through a floor on grade or where noted to the contrary, provide a pipe passing through a floor and exposed in any space with a standard weight galvanized steel pipe sleeve set to extend to a height of 3 inches above the floor. Make the inside diameter of the sleeve at least 1/2 inch greater than the outside diameter of either the insulation on a covered line or of any bare pipe.
- C. Where a line penetrates a floor that is provided with a waterproof membrane, provide a two piece standard weight galvanized steel pipe and a cast iron riser sleeve with anchor lugs, flashing clamping device and inside threads on both ends. The riser sleeve shall be set in the lower part of the floor and clamped onto the membrane. The steel sleeve members shall extend through the floor, finishing flush with the underside of any floor above grade and extending to a height of 3 inches above the floor.
 - 1. The inside diameter of the above sleeve shall be 1/2 inch greater than the outside diameter of the pipe. Following installation of the pipe, fill the annular space between the sleeve and the pipe using a packing and then filling the sleeve with a mastic which shall set and form a watertight seal under normal use conditions.
- D. Provide a pipe passing through an interior concrete beam or wall with a standard weight galvanized steel pipe sleeve. Make the inside diameter of the sleeve at least 1/2 inch greater than the outside diameter of either the insulation on a covered line or of any bare pipe.
- E. Provide a pipe passing through an exterior wall with a standard weight galvanized pipe having an inside diameter 2 inches larger than the outside diameter of the carrier pipe. Fill the annular space between the pipe and its sleeve with a synthetic rubber mechanical seal; Thunderline "Link-Seal" or Mason-Dallas "InnerLinx". Stainless steel bolts should be used.

1.37 FLOOR AND CEILING PLATES

- A. Except as otherwise noted, provide and install a concealed hinge, chrome plated steel floor and ceiling plate with a spring catch around each pipe passing exposed through any wall, floor or ceiling in any space, except in mechanical rooms and except where steel pipe sleeves extend above the floor line. Size the plate to fit snugly against the outside of

the pipe or against the outside of insulation on an insulated line.

1.38 ACCESS PANELS

- A. Furnish an access panel for each location where mechanical equipment such as a manual valve, automatic control valve, automatic damper mechanism, (fire damper, etc. is installed behind a furring, chase, or non-removable suspended ceiling). These panels will be installed in the walls or ceilings by the trade involved under the applicable Division of the general specifications. Size and position each access panel so that the concealed equipment can be properly serviced, with the exact location subject to Architectural approval.
- B. Access panels shall be Milcor, Elmdor or equivalent steel access panels with hinged doors with latching devices. In fire rated location UL 1-1/2 hour B labeled door; minimum size to 12 inch by 12 inch. In unrated surfaces they shall be in accordance with the following:

<u>BUILDING SURFACE</u>	<u>MILCOR STYLE</u>	<u>MINIMUM SIZE INCHES</u>
Masonry & Ceramic Tile walls	M	16 x 20
Metal Lath & Plaster Walls		
Gypsum Board Walls	K	16 x 20
Plaster Ceilings	DW	14 x 14
Acoustical Tile Ceilings	K	12 x 12
Gypsum Board Ceilings	AT	12 x 12
	DW	14 x 14]

- C. For ceiling access, through non-accessible ceilings, to terminal boxes, humidifiers, filters, heating coils and other similar equipment, provide a minimum of one 24" X 24" access door suitable for accessing, servicing and removal of the largest section of the equipment.

1.39 PAINTING

- A. Where machinery and equipment has been shipped with an enameled factory finish, touch up to repair any damage to the finish.
- B. Suitably prepare all surfaces before painting. Remove all oil, rust, scale, dirt and other foreign materials. Make surfaces smooth by grinding, filling, brushing or other approved method.
- C. Clean all uninsulated steel lines, support and hangers in underfloor spaces and apply two coats of asphalt varnish. Clean copper and cast iron lines in these areas but do not paint.
- D. For painting of insulated lines in underfloor spaces, see the INSULATION Section of these Specifications.
- E. All other finish painting will be accomplished under Division 9 of the Specifications.

- F. Ceiling and wall grilles, diffusers and registers shall be factory painted as scheduled. If field painting is necessary it shall be in a color directed by the Architect and Owner.
- G. All rooftop equipment shall be factory painted.
- H. All exterior bare ferrous piping shall be painted.

1.40 IDENTIFICATION

- A. Identify each run of piping exposed in any space, including machinery space, attic areas, and underfloor areas, by means of Seton, or equivalent Brady or Westline plastic markers with pressure sensitive backing. Identify each system using black or white lettering with an arrow to indicate direction of flow on a background color coded to conform to ANSI A13.1. Use legends designed for parallel marking along length of pipe and sized as follows:

<u>O.D. OF LINE OR COVERING (INCHES)</u>	<u>LENGTH OF COLOR BAND (INCHES)</u>	<u>HEIGHT OF LETTERS (INCHES)</u>
Less than 3/4	8	1/2
3/4 to 2	8	3/4
2 1/2 thru 6	12	1 1/2
Over 6	24	2 1/2

- B. Legends shall be installed following completion of all painting of piping and insulation finishes.
- C. Place pipe legends on piping at each connection to an item of equipment, on each drop to an outlet, and on each run of piping at intervals not exceeding 50 feet, except that in no case shall an exposed line enter a room without being identified as specified herein. Locate markers so as to be readily visible.
- D. Secure identification markers to piping by firmly pressing markers in place, following removal of protective covering. Additionally secure by banding ends of markers in place using 1/2 inch wide aluminum bands of the type normally used to secure insulation in place.
- E. Provide a nameplate for each motor starter and each piece of equipment (pump, fan, AHU, Fan-Coil Unit, RTU, boiler, water heater, chiller, expansion tank, heat exchanger, etc.) furnished under this Division, identifying its specific function and the area it serves. Fabricate nameplates of laminated phenolic plastic with black surface and white core with beveled edges and with machine engraved lettering not less than 1/2 inch high cut through the black surface to the white core. Fasten nameplate to starter enclosures with epoxy resin glue or stainless steel screws. Punched plastic tape will not be acceptable.
- F. Provide identification for all fire damper or smoke damper access openings; stencil the words "FIRE DAMPER" or "SMOKE DAMPER" on access doors that are in sheet metal ducts; engrave the words "FIRE DAMPER" or "SMOKE DAMPER" on plastic plates with letters not less than 1/2 inch high and secure the plates using an epoxy resin glue on access doors that are in walls or ceiling where such doors conceal fire damper access plates, or on the T-bars of removable ceilings immediately below the location of fire damper access openings above. Fabricate these plates of laminated phenolic plastic with a brown simulated wood grain finish exterior surface, a white core and beveled

edges.

- G. All valves shall be equipped with a 1" diameter brass tag with indented numerals. Tags shall be provided with adequate link chain with which to secure them to the valves. Provide a valve number chart suitable for framing relating to the valve tags within a plastic sheet protector.
- H. All ductwork, including supply, return, and exhaust; within mechanical rooms shall be labeled as such and shall include direction of airflow arrows.

1.41 ELECTRIC WIRING

- A. All electric wiring will be done under Division 16, except for such equipment items as are prewired at their point of manufacture and so delivered to the project, and except for the following:
 - 1. Fire pump annunciator wiring provided by Fire Protection contractor.
- B. Prepare and submit for review wiring diagrams for all equipment furnished under this Division. Show on these diagrams all power, interlock, and control circuits. When the Architect takes no exception to these drawings, they shall become installation drawings for the Contractor.
- C. All domestic cold and hot water piping, and wet fire protection system shall be heat traced when routed external to the building or in areas susceptible to freezing conditions.

1.42 MOTORS

- A. Furnish motors as required for all equipment provided under this Division. Motors shall conform to the following requirements unless noted or specified otherwise.
 - 1. Capacity: Be able to start and operate the driven equipment without exceeding full load current nameplate rating at speed specified, or at the speed and load imposed by the drive actually furnished. In the case of a hermetic motor with water or refrigerant cooling, actual motor running current may exceed nameplate full load current by not more than 25% at specified operating conditions.
 - 2. Motor 3/4 Horsepower and Larger: 3-phase, drip-proof, squirrel cage induction type; suitable for the current characteristics scheduled; NEMA Design B.
 - 3. Motor Less than 3/4 Horsepower: Single-phase, unless scheduled different, drip-proof; of the type normally used for the intended service, except where capacitor type is called for; suitable for current characteristics scheduled.
 - 4. Design and Service Factors: In accordance with current NEMA, IEEE, ANSI and Anti-Friction Bearing Manufacturers Association Codes, Standards and Specifications; rated for continuous duty at 40°C ambient temperature at a standard service factor of 1.15.
 - 5. Motors 1 HP and greater shall be of the premium efficiency type and shall conform to the following minimum full load efficiencies:

<u>MOTOR SIZE HP</u>	<u>PERCENT EFFICIENCY</u>
1	84.0
1 1/2	85.0
2	86.0
3 to 5	89.5
7 1/2 to 15	91.0
20 to 30	93.5
40 to 60	94.5
75 to 100	95.0
Above 100	95.4

- B. Where a motor is mounted integrally with an item of mechanical equipment, erect the entire assembly. Where a motor is separately delivered, provide the motor foundation, set the foundation bolts and make all other provisions for installing the motor, and the final motor setting will be under this Division 15.
- C. Motors shall be manufactured by Baldor, Magnetek (Century), General Electric or Reliance.
- D. Any motor installed to operate on a variable frequency drive (inverter) shall meet the requirements of NEMA MG-1 Part 31.40.4.2. These motors shall be designed to handle voltage spikes due to IGBT switching.
- E. Motor enclosures as a minimum shall be open drip proof type indoors and TEFC type outdoors. As a minimum the motor enclosure shall be as recommended by the manufacturer for the application. For fan motors installed in the air stream by the fan manufacturer the motor enclosure shall be TEAO unless otherwise recommended by the manufacturer. For NEC hazardous locations motor enclosures shall be rated for the division, class and group indicated or required.

1.43 STARTER AND MOTOR CONTROLS

- A. Provide a suitable NEMA rated starter, one per motor, for control of each motor furnished under this Division. All motors 3/4 horsepower and larger require magnetic or electronic starters, no exceptions. All motors of any size that are automatically controlled require "Hand-Auto" or "Hand-off-Auto" magnetic or electronic starters, no exceptions. All magnetic and electronic starters shall have H-O-A switches.
- B. Provide each motor that does not require a starter, a manual starting switch with thermal overload protection with identifying nameplate, green pilot light and stainless steel cover plate equal to Westinghouse Type MS. Switches installed on finished walls shall be flush type.
- C. Starter shall have overload protection on all phases. This will require three overload relays for three phase motors and one overload relay for one phase/line voltage motor. Provide NEMA 1B control voltage transformer, "on" green pilot light, and 1-normally open and 2-normally closed auxiliary contacts on each starter, unless otherwise noted.
- D. Certain starters and motor controls for motors furnished under this Division are scheduled on the Drawings to be elements of motor control centers provided under Division 16. Except for those scheduled starters, provide a suitable starter for control of each motor furnished under this Division.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

GENERAL PROVISIONS
- MECHANICAL
15010 - 20

- E. Each starter shall have a capacity rating within the required limits of the motor which it serves; it shall have overload elements selected to provide protection for the motor.
- F. Where a combination starter and disconnect switch or starter and circuit breaker in a common enclosure is scheduled, provide auxiliary contacts on the switch or breaker as required to assure that, when the disconnecting means is open, there are no "live" contact points on the starter.
- G. Where a holding coil voltage differs from line voltage, install a transformer with secondary fusing in the starter enclosure.
- H. Unless otherwise indicated, furnish starters mounted indoors with NEMA Type 1 enclosures; and furnish those exposed to the weather with NEMA Type 3R enclosures.
- I. Where starters are not installed in heated and cooled spaces, the heater elements shall be of the ambient temperature-compensated, bimetallic type.
- J. All motor starters and control devices shall be of one make and manufactured by one of the following: General Electric, Square D, Siemens or Westinghouse.

1.44 SAFETY GUARDS

- A. Provide and install a belt guard covering the entire drive assembly for each belt drive equipment item provided under this Contract. Use factory assembled belt guards when they are available. Where a guard must be fabricated, rigidly construct it with a sheet metal rim and aside panel of sheet metal or 2 inch metal hardware cloth, with openings for tachometer insertion. Size each guard to permit full travel of the motor slide rails for belt tightening and install each guard so as to permit removal for servicing the drive.
- B. Guards shall also be installed to protect all projecting shafts and all rotating shafts, couplings, keyways, etc. Generally, these shall be formed of not lighter than 18-gauge galvanized steel bent to the proper shape and secured in place using removable fastening devices.

1.45 OPERATING INSTRUCTIONS

- A. Instruct the Owner's Representative in the proper operation of all equipment items of systems.

1.46 OPERATION PRIOR TO COMPLETION

- A. When any piece of mechanical or electrical equipment is operable and it is to the advantage of the contractor to operate the equipment, he may do so with permission of Owner, providing that he properly supervises the operation and protects against dirt accumulations during operation. The warranty period shall, however, not commence until such time as the equipment is operated for the beneficial use of the Owner or until final acceptance by the Owner.
- B. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, install clean filter media, and properly adjust the operation of the equipment before final acceptance by the Owner.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

GENERAL PROVISIONS
- MECHANICAL
15010 - 21

1.47 MANUALS

- A. Upon completion of the work, provide to the Architect for delivery to the Owner, 2 copies of a bound manual or manuals of equipment, machinery and/or apparatus furnished under this Division of the Specifications. This shall include revised material from shop drawing submittals showing numbers, sizes and ratings of equipment actually installed together with any descriptions as to methods of installation. It shall also include manufacturer's service and maintenance data, warranties, guarantees, etc.
- B. Bind data in loose leaf, hardback ring binders sized for 8 1/2 by 11 inch sheets. Provide sufficient binders to that no binder will be over 3 1/2 inches thick and no more than 67% full.

1.48 RECORD DRAWINGS

- A. The Contractor shall obtain at his own expense a complete set of blue-line prints on which to keep an accurate record of the installation of all materials, equipment and devices covered by the Contract. The Contractor shall record up to date information at least once a week and retain the set of prints on site for periodic review by the Engineer. The record drawings shall indicate the location of all equipment and devices, and the routing of all systems. If the Contractor prepared large scale installation drawings or reproducible sepia's there from shall be revised as required to accurately illustrate the actual installation. All pipe buried below concrete slab, walls and below grade shall be located by dimension; both horizontally and by vertical elevation.
 - 1. Should the Contractor prepare large scale installation drawings of mechanical rooms, these drawings or reproducible sepia's therefrom shall be revised as required to accurately illustrate the actual installation.
 - 2. All pipes buried in the ground or beneath floors on grade shall be accurately located both by horizontally and vertical elevations.
 - 3. Upon completion of the work, the record drawings shall be delivered to the Architect.
- B. Upon anticipated completion of the job, the Contractor shall accumulate and compile in duplicate hard copies of all construction related documentation and in triplicate an electronic copy of all construction related documentation.
 - 1. The hard copy shall consist of the following:
 - a. One (1) complete reproducible set of the original drawings on which to neatly, legibly and accurately transfer from the working set of blue-lines described above all project related notations to accurately reflect the as-built condition. The second, and any subsequent copies, may be made from the reproducible copy. These record drawings shall be delivered to the Engineer for the review and subsequent delivery to the Owner at job completion. This information shall be delivered prior final acceptance and final payment.
 - b. Two (2) indexed 3-ring looseleaf, hard-back sets of binders sized for 8 1/2 inch by 11 inch (and folded 11 inch by 17 inch) sheets. No binder shall

exceed 3 ½ inches thick. The data shall be turned over to the Engineer for review and subsequent delivery to the Owner. The information shall be delivered prior to final acceptance and final payment. The data within the binder shall include the following:

- 1) Warranties, guarantees and manufacturer's directions on material, equipment and devices covered by the Contract.
- 2) Approved wiring diagrams and control diagrams.
- 3) Copies of approved submittals and shop drawings.
- 4) Operating instructions and recommended maintenance procedures for major apparatus.
- 5) Copies of all other data and/or drawings required during construction.
- 6) Repair parts list of major apparatus, including name, address and telephone number of local supplier or representative.
- 7) Tag charts and diagrams hereinbefore specified.

2. The electronic copy shall consist of the following:

- a. Three (3) electronic copies (in AutoCAD format) of the original drawings on which all project related notations have been accurately transferred from the working set of blueprints described above reflecting the as-built condition. These electronic record drawings shall be delivered to the Engineer for review and subsequent delivery to the Owner at job completion. The Engineer will retain one (1) electronic copy for their records and forward two (2) electronic copies to the Owner. This information shall be delivered prior to final acceptance and final payment.
- b. Three (3) electronic copies (on compact disc (CD) in PDF format) of all project data presented in a 8 ½ by 11 inch (or folded 11 inch by 17 inch) format. The data shall be turned over to the Engineer for review and subsequent delivery to the Owner. The Engineer will retain one (1) electronic copy of their records and forward two (2) electronic copies to the Owner. The information shall be delivered prior to final acceptance and final payment. The data on the CD shall include the following:
 - 1) Warranties, guarantees and manufacturer's directions on material, equipment and devices covered by the Contract.
 - 2) Approved lighting fixture brochures, wiring diagrams and control diagrams.
 - 3) Copies of approved submittals and shop drawings.
 - 4) Operating instructions and recommended maintenance procedures for major apparatus.
 - 5) Copies of all other data and/or drawings required during construction.
 - 6) Repair parts list of major apparatus, including name, address and telephone number of local supplier or representative.
 - 7) Tag charts and diagrams hereinbefore specified.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

GENERAL PROVISIONS
- MECHANICAL
15010 - 23

END OF SECTION

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

PSP #407480

CONSTRUCTION DOCUMENTS – 2 MAY 2008

GENERAL PROVISIONS
- MECHANICAL
15010 - 24

SECTION 15050 - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 EXTENT OF WORK

- A. Refer to other Sections and Divisions of these Specifications for related work, materials and procedures that are applicable hereunder.
- B. This Section is pertinent to labor, material, equipment and service involved in the installation of basic materials.
- C. Each piping system shall be complete with pipe, fittings, joining materials, valves, cocks, hangers, supports and other accessories; prove tight under test; repair leaks; clean.
- D. All items shall be suitable for the pertinent system's pressures and temperatures and the fluid within including chemical treatments.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. The following tabulation describes the basic materials and standards for the piping, fittings, and specials which shall be provided for this section and the other sections of these specifications and where they are indicated by note on the drawings. These materials shall be used only where specified in this section and other sections of these specifications and only where they are indicated by note on the drawings. Any accessory deemed necessary by the manufacturer to make a complete installation shall be provided regardless of whether it has been mentioned in these specifications. This tabulation is NOT a "shopping List" of materials, and thus, the contractor shall NOT substitute materials from this tabulation for the materials specifically required in this section and other sections of these specifications and on the drawings for a particular piping system or its components:

DESCRIPTION

STANDARD

Ductile iron water pipe for 250 PSI internal pressure, thickness per ANSI A21.50 for laying condition "B" with 8 feet of cover.

ANSI A21.51

Cast iron water pipe for 250 PSI internal pressure, thickness per ANSI A21.50 for laying condition "B" with ANSI A21.6 or 8 feet of cover.

ANSI A21.8

Cast or ductile iron water pipe fittings Class 250

ANSI A21.10

Cement mortar lining for cast or ductile iron water lines

ANSI A21.4

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

BASIC MATERIALS AND
METHODS
15050 - 1

Rubber gaskets for joining cast or ductile iron water lines	ANSI A21.11
Non-reinforced concrete sewer pipe and fittings	ASTM C-14
Reinforced concrete pipe and fittings	ASTM C-76
Rubber gaskets for joining bell and spigot concrete lines	ASTM C-443
Vitreous clay tile sewer pipe and fittings, extra strength	ASTM C-200
Compression joints for clay tile sewer lines	ASTM C-425
Polyethylene (PE) pipe and fittings for gas pressure pipe and fittings	ASTM D-2513
Perforated vitrified clay tile drain pipe and fittings, extra strength	ASTM C-211
Porous concrete pipe and fittings	ASTM A-76
Perforated plastic drainage tubing and fittings	ASTM A-74
Cast iron bell and spigot or bell and plain end soil pipe and fittings	ASTM A-74
No-hub cast iron soil pipe and fittings	CISPI Std. 301
No-hub stainless steel couplings	CISPI Std. 310
Rubber gaskets for joining cast iron soil pipe and fittings	ASTM C-564
High silicon iron alloy bell and spigot or mechanical joint pipe and fittings	ASTM A-518
Reinforced thermosetting pipe	ASTM D-2105
Polypropylene (PP) pipe and fittings, Type II Schedule 40 weight, flame retardant in accordance with ASTM D-635 test method; DWV pattern fittings; for acid resulting service	ASTM D-2146
Steel pipe, black and galvanized	ASTM A-120

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

Steel welding fittings	ANSI B16.9
Cast iron flanged fittings, Class 125	ANSI B16.1
Cast iron flanged fittings, Class 250	ANSI B16.2
Fiberglass Pipe 2" through 6"	ASTM D-2296
Fiberglass Pipe 8" through 16"	ASTM D-2310
PVC, SDR-26, Class 160 & SDR-21, Class 200	ASTM D-2241 & ASTM D-1784
PVC Sch. 40, DWV	ASTM D-2665
Steel flanges (150 and 300 pounds)	ASTM A-181
Cast iron drainage fittings, threaded	ANSI B16.12
Cast iron screwed pressure fittings (125 & 250 pounds)	ANSI B16.4
Malleable iron screwed fittings	ANSI B16.3
Malleable iron grooved end fittings	ASTM A-47
Red brass pipe, IPS	ASTM B-43
Brass or bronze screwed fittings (125 & 300 pounds)	ANSI B16.15
Brass or bronze flanges and flanged fittings (150 & 300 pounds)	ANSI B16.24
Seamless copper water tube, Type K, L & M	ASTM B-88
Seamless copper drainage tube, Type DWV	ASTM B-306
Cast bronze solder joint pressure fittings	ANSI B16.18
Cast bronze solder joint drainage fittings	ANSI B16.23
Wrought copper solder joint pressure fittings	ANSI B16.22
Wrought copper solder joint drainage fittings	ANSI B16.29

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

2.2 UNIONS

- A. Malleable Iron: 150 lb. black, screwed, ground joint with brass to iron seats in lines assembled with screwed fittings at points of connection to equipment for proper equipment removal.
- B. Brass: Screwed, ground joint.
- C. Dielectric Type: Zurn Model QHWD for ½" through 2".

2.3 FLANGES

- A. In cold water lines flanges shall be flanged nipples with 125 pound cast iron flanges. Provide 250 pound flanges where required.
- B. In piping assembled using screwed joints, use 125 pound screwed-on cast iron flanges. Provide 250 pound flanges where required.
- C. In welded piping systems, flanges shall be 125 pound forged steel welding neck pattern. Provide 250 pound flanges where required.
- D. Where the above flanges connect to flat faced flanges on valves, items of equipment, etc., the companion flange shall be flat faced and where the flanges on items of equipment are raised face flanges, the companion flanges shall have raised faces.
- E. Flanges in copper lines shall be solder-joint type brass flanges.
- F. Flange bolts and nuts shall conform to the applicable requirements of the Code for Pressure Piping, ANSI B31.1-1955 (or later editions).

2.4 GASKETING

- A. Rubber: Garlock No. 24 Wire Insertion Red Rubber Sheet; 1/16" thick.
- B. Non-Asbestos: Johns-Manville compressed sheet; 1/16" thick.
- C. Dielectric: As furnished with the flange for this application.
- D. Other Material: As provided and/or recommended for the duty.

2.5 MECHANICAL COUPLINGS (WASTE PIPING)

- A. Joints for Hubless Cast Iron Pipe & Fittings Above Grade
 - 1. Couplings for joining hubless cast iron soil pipe and fittings conforming to ASTM A-888, or CISPI-301, shall be 3 inches wide for nominal pipe sizes 1-1/2 to 4 inches in diameter, 4 inches wide for nominal pipe sizes 5 to 10 inches in diameter, and 5-5/8 inches wide for couplings 12 and 15 inches in diameter. Shields shall have a minimum thickness of .015 inches, (28 gage) type 304

stainless steel. Worm drive clamps shall be type 304 stainless steel with a minimum clamp torque of 80 in/lbs. Sealing Gasket shall be neoprene conforming to ASTM C-564. Couplings shall conform to Factory Mutual Standard 1680, Class 1, or ASTM C-1540, as manufactured by Clamp-All Products Models HI-TORQ 125 and HI-TORQ 80; or Husky Technologies Model SD-4000.

- a. Alternative to above, cast iron split clamps secured by stainless steel bolts and nuts with neoprene gasket conforming to ASTM C-564; as manufactured by MG Coupling Company.
- b. Factory Mutual Approved Couplings may be hung with one hanger per length of pipe for 10 foot lengths and at every third fitting where they are contiguous in conformance with manufacturers installation and instructions.

B. Joints for Hubless Cast Iron Pipe & Fittings Below Grade

1. Couplings for joining hubless cast iron soil pipe and fitting conforming to ASTM A-888, shall be 3 inches wide for nominal pipe sizes 1-1/2 to 4 inches in diameter, 4 inches wide for nominal pipe sizes 5 to 10 inches in diameter, and 5-5/8 inches wide for couplings 12 and 15 inches in diameter. Sealing Gasket shall be neoprene conforming to ASTM C-564. Shields shall have a minimum thickness of .024 inches (24 gage) type 304 stainless steel. Worm drive clamps shall be type 304 stainless steel, with a minimum clamp torque of 125 in/lbs, as manufactured by Clamp-All Products, Model HI-TORQ 125.

- a. Alternative to above, cast iron split clamps secured by stainless steel bolts and nuts with neoprene gasket conforming to ASTM C-564; as manufactured by MG Coupling Company.

2.6 MECHANICAL COUPLINGS (PRESSURE TYPE)

- A. High Silicon Iron Pipe Joint: Duriron with Teflon inner and neoprene outer sleeves, stainless steel clamp with dual bolts and nuts.
- B. Grooved End Steel Pipe Joint: Victaulic Style 77 Coupling with Grade H gasket.

2.7 PIPE SEALS

- A. Mason-Dallas "Pipe Linx" or Thunderline "Link-Seal", mechanical type.

2.8 PIPE FLASHING FOR BUILT-UP ROOFS

- A. Sheet lead; minimum weight of 4 pounds per square foot.
- B. Reference to architectural roof flashing details for penetration flashings.

2.9 PITCH PAN FOR BUILT-UP ROOFS

- A. Form of not lighter than 24-gauge, galvanized steel with solder, watertight joints; 3" minimum depth; minimum width and length, 3" larger than the outside diameter of a penetrating pipe or 3" larger than the outside dimensions of a support member.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

BASIC MATERIALS AND
METHODS
15050 - 5

2.10 VALVES

- A. Manufacturer's names and numbers used below are to set standards.
- B. Butterfly Valves: Valves shall be Nibco LD 2000 Series full lug or grooved body style manufactured in accordance with MSS-SP67 rated at least 200 psig non shock cold water working pressure. Nibco, Stockham, LG-712-BS3-E-M (Lever – full lug); LG-722-BS3-E-M (Gear – full lug), Keystone, or Grinnell are acceptable manufacturers. Body to have 2" extended neck for insulating and to be cast iron or ductile iron. Valve to have aluminum bronze alloy disc with EPDM rubber seat and seal; or EPDM rubber encapsulated disc with polymer-coated body. Stem shall be 400 series stainless steel. Sizes 2 ½" - 4" shall be lever operated with 10-position throttling plate; sizes 6" and larger shall have gear operators. All valves larger than 4" and 8 feet and higher above the floor shall have chain operators with chains. Lug-style and grooved style shall be capable for use as isolation valves and recommended by manufacturer for dead-end service at full pressure without the need for downstream flanges.
- C. Rising Stem Gate Valves: All valves shall be suitable for 150 psig steam - 300 psig W.O.G. working pressure. Bronze Nibco No. T-134, Stockham B-120, screwed ends and No. S-134, Stockham B-124 solder joint ends for valves 2" and smaller; iron body Nibco No. F-617-0, Stockham G-623 for 2½" and larger gate valves; flanged ends for larger steam lines. Valves for 125 psig steam - 250 psig W.O.G. service shall be Nibco No. F-637-31 and have B-61 bronze trim and seat with a ductile iron body and valves shall be Class 150, suitable for 125 psig steam and 250 psig W.O.G.; Stockham, Nibco, and Watts are acceptable.
- D. Globe Valves: Bronze with stainless steel trim Nibco No. T-256AP, Stockham B-62 suitable for 200 psig steam - 400 psig W.O.G. threaded ends and No. S-235Y, Stockham B-20T solder joint ends. Iron body valves for steam service shall be Nibco No. F-738-31 and have B-61 bronze trim and seat with a ductile iron body and valves shall be Class 150, suitable for 125 psig steam and 250 psig W.O.G.; Stockham, Nibco, and Watts are acceptable. Bronze valves with more than 15% zinc are not acceptable.
- E. Ball Valves: Valves 2½" and smaller shall be Nibco T-585-70-66, Stockham T-285-BR-R-70 chrome-plated bronze ball, T-285-BR-R-66 stainless steel ball and stem screwed ends; No. S-585-70-66, solder joint ends. 3" and 4" valves shall be Nibco F-515 CSF-66, Stockham S-285-BR-R-70 chrome-plated bronze ball, S-285-BR-66 stainless steel ball and stem flanged ends. Apollo Series 88 or Watts CF-1800-150 Series are also acceptable. Valves shall be full port with chrome-plated stainless steel ball and stem and rated for 150 psig steam and 600 psig w.o.g. working pressure. Stockham, Nibco, and Watts are acceptable manufacturers. Bronze valves with more than 15% zinc are not acceptable.
- F. Non-Slam Check Valves: Combination Pump Valve Company No. 10B for 20B or Watts equal for 2½" and larger with iron body, bronze trim and stainless steel spring; combination pump valve company No. 36 for 2" and smaller with bronze body, nylon disc and stainless steel guide, retainer and spring. Valves shall be bolted lug pattern type and suitable for 200 psig W.O.G. working pressure.
- G. Swing Check Valve 2½" and Larger: Nibco, Watts, or Stockham, and equal to Nibco F-918-31, Stockham G-931 cast iron body, bronze trimmed and flanged ends. Valves shall

be suitable for 125 psig steam and 250 psig w.o.g. working pressure. Stockham and Watts are also acceptable. (Cast iron rated at 200 psig w.o.g.)

- H. Swing Check Valve 2" and Smaller: Nibco, Watts, or Stockham, and equal to Nibco T453-B, Stockham B-345 bronze, screwed ends. Valves shall be suitable for 200 psig steam and 400 psig w.o.g. working pressure. Nibco S-433-Y, bronze, solder ends; suitable for 150 psig steam - 300 psig w.o.g.
- I. Fire Protection Line Valves: UL listed, FM approved, 175 psig cold water, non-shock. Gate valves 2½" and larger: Nibco, Crane, or Stockham, and equal to Nibco No. F-607-RW, Stockham G-610 OS&Y iron body, bronze fitted, screwed pattern. Check valves 2½" and larger: Nibco, Crane, or Stockham, and equal to Nibco No. F-908-W Stockham 939 iron body, bronze fitted, flanged pattern. Ball drip ½": brass, screwed pattern.
- J. For control applications, ball valves shall be used to a maximum of 4" with butterfly valves on 6" and above. For service applications, ball valves shall be used on lines 4" and smaller, rising-stem gate valves or butterfly valve with gear operator on 6" and larger. Valves shall be Delta.
- K. All valves shall be equipped with a 1" diameter brass tags with indented numerals. Tags shall be provided with adequate link chain with which to secure them to valves. Contractor shall provide a chart with valve numbers and reference service.

2.11 COCKS

- A. Manufacturer's names and numbers are to set standards. Valves to be suitable for 150 psig steam and 600 psig W.O.G.
- B. Plug Cocks

<u>PLUG TYPE</u>	<u>SIZE (INCHES)</u>	<u>MAKE AND NUMBER</u>
Screwed Ends	¾" and smaller	Crane 254
Lubricated, Screwed Ends	1 thru 2	Rockwell 142
Lubricated, Flanged Ends	2 ½" & larger	Rockwell 143

 - 1. Fill lubricated plug cocks with proper lubricant for application and furnish with wrench with setscrew.
- C. Pet Cocks: Crane No. 702 bronze, lever handle.
- D. Gauge Cocks: Jomar ¼" Model 82 ball valves. Nibco, Victaulic or Crane also acceptable.

2.12 STRAINERS

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

BASIC MATERIALS AND
METHODS
15050 - 7

- A. Full flow, Wye type; minimum 150 PSIG working pressure; iron body with blow-off; 2" and smaller threaded and 2½" and larger flanged; stainless steel with perforation sizes for the duty as listed in Table below. Also acceptable are Victaulic T-Strainer.

SERVICE DUTY	PIPE SIZE	STRAINER PERFORATIONS
Fire Protection Water	¼" To 2"	0.033"
	2 ½" To 4"	0.057"
	5" Up	1/8"

2.13 SIPHON FITTING

- A. Weksler Type AO3B or Miljoco No. 1300, threaded brass pipe with full loop, 150 psig working pressure.

2.14 PRESSURE GAUGES

- A. Phosphor bronze, seamless Bourdon spring type with phosphor bronze brushed rotary movement and link; 4½" dial, ring and cast aluminum case; equipped with micrometer adjustable pointer; Weksler "Regal" Type BA1; Type I, free standing. U.S. Gauge and Miljoco Corp. are also acceptable. Minimum 150 psig working pressure.

2.15 THERMOMETER WELLS

- A. Separable Socket: Moeller Type of 304 stainless steel.
- B. Thermometer Test well: The units shall be a Moeller non-adjustable type with fitted well of stainless steel with keep plug and chain; length to suit line size. Taylor and Duro are also acceptable. Minimum 150 psig working pressure.

2.16 THERMOMETERS

- A. Thermometers shall be of the industrial type, bronze enameled aluminum case, glass front and 9" scale. Taylor, U.S. Gauge, Weksler, Miljoco Corp., Trerice and Duro are acceptable. Minimum 150 psig working pressure.

2.17 EXPANSION JOINTS

- A. Expansion joints shall be Metraflex, or Hyspan flexible metal connectors, or bellows pump connectors, self equalizing type stainless steel joints with stainless steel liners and monel sleeves.

2.18 AIR VENTS

- A. Automatic or manual as called for on the drawings shall be as manufactured by Armstrong. Minimum 150 psig working pressure.

2.19 HEAT TRACE CABLE (FREEZE PROTECTION)

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

BASIC MATERIALS AND
METHODS
15050 - 8

- A. Where called for provide heat trace cable consisting of self regulating polymer core that varies its power output to respond to temperature along its length. The heater shall be covered by a radiation cross-linked modified polyolefin dielectric jacket.
- B. The heat trace cable shall operate on [120 volt][208 volt] and shall be 5 watts per foot for piping 4 inch in size and less and 8 watts per foot for piping 6 inch and larger, unless noted otherwise.
- C. The heat trace cable shall be as manufactured by Thermon or Raychem equal to Thermon FIX. Provide a line sensing thermostat with variable set point, equal to Thermon N4X-40.

2.20 FLEXIBLE PIPE CONNECTIONS

- A. Flexible pipe connections shall be equivalent to metraplex metrasphere style R suitable for 225 PSI and 240°F. Flexible connector shall be constructed of neoprene and nylon with cadmium plated solid plated steel flanges.
- B. Connectors in pipes 8" and larger shall be provided with rods.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING

- A. Piping shall be installed by skilled mechanics using designated basic materials plus any required supplementary materials.
- B. Run each line straight and true; minimum grade noted (or required by code); where exposed run parallel to building planes grading for proper drainage and venting.
- C. Install each run essentially as indicated as to location, direction and size. Cut to measurements established at the site and work into place without forcing or springing.
- D. Anchor lines to the building where indicated or required to prevent excessive movement or vibrations.
- E. Provide each piping system with loops, bends, expansion joints and/or flexible connections as required to compensate for expansion and/or contraction in that piping system, and in the building.
- F. All valves to be installed with stems vertically; if not possible, the stems may be 45 degrees off the vertical position.

3.2 JOINING PIPING

- A. Use manufacturer's recommended procedures and follow all code requirements in joining piping materials. Make square end cuts using proper tools and aligning devices. Ream and deburr pipe ends; smooth rough surfaces; clean mating parts.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

BASIC MATERIALS AND
METHODS
15050 - 9

- B. Change sizes using properly sized fittings and/or reducers (or increasers); use no long screws or bushings. Change materials using suitable connectors or adapters.
- C. Joining mitered pipe ends to form an elbow or connecting into a notched opening in a pipe run to form a tee will not be permitted.
- D. Threaded Joints: Full cut threads; assemble using an approved compound applied to male threads only; not more than 3 threads shall remain exposed when the joint is completed.
- E. Welded Joints: All joints shall be fusion welded by a metallic arc or gas welding process. Pipe ends shall be beveled $37\frac{1}{2}^{\circ}$. All welding operations shall conform to the latest recommendations of the American Welding Society or to the applicable provisions of the Code for Pressure Piping, ANSI B31.1, latest edition, amended to date.
 - 1. Weld rods shall be of the proper type for each application to match the line materials.
 - 2. The Contractor shall provide written certification that every welder employed on the job has passed qualification tests as prescribed by the National Pipe Welding Bureau or other reputable testing laboratory using qualification procedures as set forth in the ASME Boiler Construction Code, Section IX, or American Welding Society Standard B3.0-41T. If the Engineer so requests, the Contractor shall have each of his welders prepare test coupons which shall be tested in an approved independent testing laboratory and any defects found shall be cause for dismissal of the welder from the project. All cost of such tests shall be borne by the Contractor.
 - 3. Branch takeoffs not larger than $\frac{2}{3}$ of the main may be made using shaped nipples, Weldolets, or Thredolets to match branch line fabrication methods.
- F. Bolted Joints: Pull up evenly all around on bolts or nuts to secure uniform tightening; use torque wrenches where recommended.
- G. Mechanical Joint in Underground Water Line: Force neoprene gasket into place. Use stainless steel or Cor-Ten bolts and nuts to assemble.
- H. Rubber Gasket Joint: Force gasket in place.
- I. Tongue and Groove Pipe: Apply a primer, then apply Ram-Nek or equivalent plastic joint sealing compound and press tongue and groove joint ends together; alternatively prime with Talcote No. 041 primer and seal with Talcote No. 052 cold plastic and press together per American Petrofina recommendations.
- J. Clay Tile Pipe: Force spigot end into bell to make a full, tight compression joint.
- K. Polyethylene Pipe: Measure socket insertion depth and attach a cold ring. Heat pipe and fitting the prescribed time; stab ends together and hold until initial set occurs. Route trace cable next to pipe.

- L. No-Hub Cast Iron: Join using a neoprene sealing sleeve, stainless steel corrugated shield, and stainless steel bands with tightening device for each band; bands fastened to shield, and equal to Husky 4000 or Clamp-All HI-TORQ 80. Joint fabrication to comply with CISPI Standard 301.
- M. Polypropylene Pipe: For fuse seal pipe and fittings, install fusion coil on pipe and set with coil against the shoulder in the mating socket; apply a compression clamp; connect power unit to coil and apply power as recommended with intermediate clamp tightening.
 - 1. For Lab-Line/Enfield pipe and fittings the mechanical joints shall be fabricated using the proper tests as provided by the manufacturer and the complete installation shall be as recommended by the Lab-Line/Enfield Corp.
- N. Mechanical Coupling on Grooved End Steel Pipe: File or grind surfaces to form leak tight seat; lightly coat mating ends with grease or graphite paste. Pre-assemble any large diameter multi-segment clamp and install as half housing.
- O. Perforated Clay Tile or Porous Concrete Pipe: Press spigot of one terminal into hub of adjacent, without sealant.
- P. Soldered and Brazed Joints: Use solder joint fittings in copper tubing lines; take care not to anneal tubing and fittings.
 - 1. Copper Tubing Joints shall be made with solder-joint fittings. Tubing shall be cut square, and burrs shall be removed. Insides of fittings and outsides of tubing shall be well cleaned with steel wool, steel brushes, and/or emery cloth before assembly. Care shall be taken to prevent annealing or fittings and hard drawn tubing. Installation shall be made by skilled mechanics in accordance with the material manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs for tees will not be permitted. All joints shall be made with solid string or wire solder. Fluxes shall be non-corrosive pastes of the proper type. Solder shall be lead free. No cored solder will be permitted.
- Q. [Sink Tailpiece to Acid Waste: Join sink tailpiece to acid waste line using special jointing procedures recommended by the piping material manufacturers. Use poured joints, compression fittings, and other required materials.]
- R. Miscellaneous Joints: Make special joints as recommended by the manufacturer of pipe and fittings to connect dissimilar materials, to connect to items of equipment, etc.
- S. Concrete Bell and Spigot Pipe Joints: The insides of bells, ends of spigots and neoprene gaskets shall be wiped clean, the end of the spigot seated in the bell and the neoprene gasket forced in place using proper lubricants and special tools.
- T. Joints in Tongue and Groove Concrete Pipe: Clean both joining surfaces, apply a primer recommended by the gasket joint sealer, apply Ram-Nek, or other acceptable preformed plastic joint sealing compound, in the manner recommended by its manufacturer and press the tongue and groove joint firmly together.

3.3 PIPING MATERIALS

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

BASIC MATERIALS AND
METHODS
15050 - 11

- A. Materials to be utilized in each piping system shall conform to the standards established in this Section, but the particular application shall generally be as described in other Sections.
- B. Materials and applications that may be used in multiple disciplines may also be described herein and apply to more than one subsequent section.

3.4 COPPER FITTINGS

- A. Use wrought copper solder joint type in all patterns and sizes available. Use long radius copper elbows wherever available and space will permit.

3.5 WELDING FITTINGS

- A. Welding Fittings: All fittings in welded lines shall be factory-fabricated welding fittings. They shall be of the same material and the same weight or Schedule as the piping. All elbow tees, caps and special fittings including connections into headers shall be standard butt welding fittings, conforming to ANSI B16.9, with the following exception: Branch take-offs from lines 2½" and larger and where the size of the takeoff does not exceed 2/3 of the normal diameter of the mains to which connected, may be made with shaped nipples or with Bonney Weldolets or Threadolets as required by the class of fabrication. Mitering of pipe to form elbows, notching of straight runs to form tees, or any similar construction will not be permitted.

3.6 FLANGES

- A. At connections to flanged valves and equipment outlets in steel piping systems using welding neck, slip on welding flanges, screwed steel, or cast iron companion flanges.
 - 1. It will be permissible to use cast iron flanged fittings at connections to equipment items.
- B. In grooved end piping systems use matching flanged adapter nipples.
- C. In copper lines use brass flanges.
- D. Connecting flanges shall have matching flat or raised faces. Faces shall be free of imperfections that would prevent proper seating.
- E. Tighten bolts uniformly all around to prevent any stress.

3.7 GASKETS

- A. Cut from proper materials as hereinafter listed, full-faced type for flat-faced flanges and ring type for raised-faced flanges.
 - 1. Water Lines: Red rubber sheeting.
 - 2. Dielectric Flanges: As provided with the flanges.
 - 3. Other Lines: As recommended for the duty.

3.8 UNIONS

- A. Provide in ferrous and brass screwed piping systems where indicated and/or as required to permit installation and removal of equipment, valves, specialties, etc. In copper lines, install only where shown or specified.

3.9 SECURING UNDERGROUND LINES

- A. Install pipe clamps and braces using poured in place concrete blocks, or other anchors and supports required to insure stability of all underground lines to prevent joint separation either during tests or thereafter when lines are in service.
 - 1. Pipe Braces and nuts installed in the ground shall be fabricated of stainless steel to resist corrosion.

3.10 PIPE GRADING

- A. General: Grade each system in accordance with good established practice to avoid air pockets, to relieve liquids and vent gases. Grade uniformly between indicated elevations or at indicated slope. Slopes shown on plans shall take precedence over any listed herein.
- B. Above Ground Fire Protection Piping: Grade to drain in accordance with NFPA standards.
- C. Fuel Oil Supply, Return and Vent Lines: Drain to slope back to tank and/or down to pump.
- D. Domestic Water Lines: Grade so that systems can be drained through fixtures or to valved drains at low points.
- E. Sanitary Waste and Drain Lines: Grade down in the direction of flow with a uniform grade conforming to the requirements of the Plumbing Code, but not less than 1/8" per foot. All Thermoplastic piping shall be installed to meet ASTM-D2321 for underground installations of thermoplastic pipe for sewers and other gravity flow applications.
- F. [Acid Waste and Drain Lines: Grade down in the direction of flow conforming to the requirements of the Plumbing Code, but not less than 1/8" per foot.]
- G. Vent Lines: Grade each up to a terminal, but not less than 10" above the roof and as indicated.
- H. Sanitary [and Acid] Vent Lines: Grade each up to a terminal, but not less than 10" above the roof.
- I. Downspout and Storm Water Drain Lines: Grade down in the direction of flow, but not less than 1/8" per foot.

- J. Sub-Soil Drain Lines: Grade uniformly in a length of run; line may be laid dead level.
- K. Gas Lines: Run in accordance with the requirements of the Plumbing Code and Gas Company.
- L. Gas Relief and Vent Lines: Grade up from the device to the point of discharge.
- M. Compressed Air Lines: Grade downward to the system receiver and outlets wherever possible. Where another slope must be used, grade down to a scale pocket and drain at low point.
- N. [Oxygen and Nitrous Oxide Lines: Lay as level as possible; elevation changes are permissible.]
- O. [Clinical Vacuum Lines: Grade back to receiver wherever possible. Where another slope must be used, drain down to a valved drip leg discharging open site.]
- P. [Nitrogen Lines: Lay as level as possible; elevation changes are permissible.]
- Q. [Carbon Dioxide: Lay as level as possible; elevation changes are permissible.]
- R. Equipment Drains: Each line from a relief valve, air vent valve, separator or a boiler, drip pan elbow, exhaust head, heat exchanger, compression tank, receiver, pump base, air conditioning unit pan, air washer overflow and drain, evaporator pan, and similar drain shall grade down to a point of open sight discharge and/or as indicated on the drawings.

3.11 TESTING

- A. All test results shall be submitted to the Owner and Architect. Provide all tests required by acceptable codes.
- B. Test piping prior to backfilling, concealing, insulating or painting; isolate pressure sensitive equipment from tests.
 - 1. Test portions as required by construction schedule. When previously tested sections are expanded, retest at connections.
 - 2. Test new portions as required by construction schedule; test new connections into existing lines.
- C. If pressure losses occur during tests, use suitable procedures to discover leaks, correct and retest. Repeat until system is tight.
- D. Test oxygen, nitrous oxide, clinical compressed air and carbon dioxide with nitrogen in accordance with NFPA No. 99-1993.
- E. Test nitrogen lines using nitrogen.
- F. Test fuel oil lines using fuel oil.
- G. All other systems shall be tested hydraulically using water as the fluid for a 4 hour period.

- H. Furnish all compressed air, vacuum and water pumps; tanks of compressed air, nitrogen, carbon dioxide, refrigerant, gauges, plugs, seals, etc., as required to obtain, maintain and measure pressures during tests.
- I. Pressure tests shall be applied to the various systems per governing codes, or if not addressed in the codes, shall be as scheduled below:

<u>PIPING SYSTEM</u>	<u>TEST PRESSURE (PSIG)</u> <u>(Minimum 1½ times Working Pressure)</u>
Fire Protection	200
Domestic Water	150
Clinical Vacuum	150
Nitrogen	300
Fuel Oil	150
Gas, Between Gas Co's & Owners Regulators	50
Compressed Air	150
Gas, On Load Side of Owner's Regulator	15
Pumped Drain	150
Storm Drain Piping	60
Gravity Waste Drain & Vent	5
Pumped Steam Condensate Return	200
Refrigerant	450
Oxygen, Nitrous Oxide & Carbon Dioxide & Clinical Compressed Air	1½ times working pressure. Minimum: 150 PSIG. See NFPA No. 99F.

3.12 REPAIRS

- A. Effect repairs as recommended by the manufacturer of the pipe and fittings materials; replace any defective materials. When procedures involve additional work on a joint and they fail, remake the joint. Repair operations shall include:
 1. Screwed Joints: Additionally tighten.
 2. Caulked Joints: Additionally caulk.
 3. Welded Joints: Chip out old weld metal and reweld.
 4. Compression Joints: Reclean; replace seal, compression rings, couplings, etc.
 5. Mechanical Joints: Reclean; additionally tighten.
 6. Fused Joints: Additionally fuse, with clamping.
 7. Soldered or Brazed Joints: Remake joint, no additional soldering or brazing allowed.
 8. Solvent Weld Joints: Cut out material and replace entirely.

3.13 CLEANING

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

BASIC MATERIALS AND
METHODS
15050 - 15

- A. Clean all new piping systems and components prior to putting into service.
- B. Blow off all strainers.
- C. Domestic Water Lines: Flush with fresh water, opening and closing flush valves and faucets until water runs clear. Refer to Section 15401 for sterilization procedures.
- D. Waste and Drain Lines: Swab out lines; flush with fresh water.
- E. Gas, Fuel Oil, Compressed Air and Clinical Vacuum: Swab out when installing where size and arrangements will permit; blow clean using nitrogen or oil free compressed air.
- F. Oxygen, Nitrous Oxide, Clinical Compressed Air, Nitrogen and Carbon Dioxide: Swab out when installing, where size and arrangements will permit; blow clean using nitrogen.
- G. Repetition: Repeat the above procedures until all parts of each piping system is thoroughly cleaned of all foreign materials.

3.14 PURGING

- A. When systems for medical gases, natural gas, and compressed air have been tested and proven tight, disconnect sources of test gases and connect proper sources. Proceeding from the nearest to the most remote outlet on each system, open the outlets until the proper gas flows, then close the outlet.
- B. Run tests on each outlet to confirm the presence of the desired gas; use an oxygen analyzer to confirm proper purity in the oxygen system.

3.15 GAUGE COCKS

- A. Valved pressure gauge connections shall be installed in each location indicated on the Drawings and/or specified elsewhere herein.
- B. Install each gauge cock on a nipple of sufficient length so that the cock handle will be free of the pipe insulation. Position each cock so that a 4½" diameter dial gauge may be easily read and screwed into and out of the cock.
- C. Install gauge cocks at each pump as close to pump suction and discharge connections as practicable. Use any gauge connections provided in the pump casing.

3.16 SNUBBERS

- A. Install a snubber at each permanently installed gauge in a water line.

3.17 GAUGES

- A. Furnish and install suitably calibrated pressure gauges at the following locations:
 - 1. At the suction and discharge of each water pump.

2. At each additional location indicated on the Drawings, specified elsewhere herein, and/or as a standard.

3.18 THERMOMETER WELLS

- A. Furnish and install separable thermometer wells for thermometer and controller bulbs designed for liquid measurements. Test wells shall have plugs and keep chains.
- B. Each well for a bulb, either local or remote temperature indication or control, shall be surrounded by flowing fluid. The locations shown are diagrammatic; the Contractor shall install them for maximum effectiveness and easy readability. At each well installed in a 2½" and smaller line the pipe size shall be increased to such an extent that the free area around the well is not less than the free area of the line sizes indicated at that point.
- C. Install each well vertically or at an angle not greater than 45° from the vertical and fill with oil.
- D. Install test wells, filled with oil, at each location indicated on the Drawings, and/or specified elsewhere herein.
- E. Install wells for sensing elements of control devices, remote sensing and reporting devices, and various regulating functions at each location indicated on the Drawings, as specified elsewhere herein, and/or as required to accomplish the various control sequences specified.
- F. Adequate space shall be left between the well and insulation. The well shall not be obstructed by a valve handle, etc.

3.19 THERMOMETERS

- A. Provide and install thermometers in separable sockets in the following locations:
 1. In the inlet and discharge water line at each water pump.
 2. In the water line at the inlet and outlet to each heat exchanger.
 3. In the inlet and outlet water line to each air handler and fan-coil water coil.
 4. In the inlet and outlet of chilled and condenser water lines at each chiller.
- B. Also provide and install thermometers in separable sockets at each additional location indicated on the Drawings or specified elsewhere herein.
- C. Thermometers for installation in chilled and condenser water lines shall be calibrated for 20-180°F and those in heating and domestic hot water lines shall be calibrated for 30-240°F.

3.20 FLEXIBLE PIPE CONNECTORS

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

BASIC MATERIALS AND
METHODS
15050 - 17

- A. Provide where shown on the drawings but generally in suction and discharge lines to all base mounted pumps, at supply and return connections to all cooling and heating coils and at all chillers.

3.21 HEAT TRACE CABLE

- A. Contractor shall test the cable upon receipt at the site prior to installation to ensure cable is in complete working order. Testing shall consist of “megging” the cable with a megohmmeter at a minimum voltage of 500 Vdc. The minimum acceptable level for the “megger” readings is 20 megohms, regardless of circuit length. These tests should be performed a minimum of three times:
 - 1. While the cable is still on reels prior to installation.
 - 2. After installation of heating cable and completion of circuit fabrication kits (including any splice kits) but prior to installation of insulation.
 - 3. After installation of thermal insulation but prior to connection to power.
- B. Cable to be taped along pipe at the “5 o’clock” position on the pipe – not spiraled.
- C. Mark all heat traced piping on the exterior of the insulated pipe with manufacturer’s identification number for traceability.
- D. All cabling and terminations shall be installed per manufacturer’s recommendations and in strict conformance with the NEC and all other applicable codes.
- E. All insulation for pipe that is heat traced shall not be installed with staples. Use adhesive to avoid damaging heat trace.

END OF SECTION

SECTION 15180 - INSULATION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. The General Provisions, Supplementary General Provisions, Special Provisions and Division 1 Specification Sections apply to Work covered by this Section.
- B. Comply with Section 15010 and other Division 15 Sections, as applicable. Refer to other Divisions for coordination of work.

1.2 SCOPE OF WORK

- A. Provide labor, materials, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of insulation, including all related systems and accessories.

1.3 SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 1 for products specified under PART 2 - PRODUCTS.
- B. Submit for review the types and thicknesses of insulation proposed for use on the various piping systems, vessels and equipment items specified to be covered. Include substantiation of the various thicknesses offered and manufacturer's data sheets on insulating materials, jackets, facings, finishes and accessories indicating compliance with specified composite and component fire and smoke hazard ratings.

1.4 REFERENCE STANDARDS

- A. Insulation, jackets, coatings, etc., shall be manufactured in accordance with the following standards:
 - 1. All insulation systems (insulation, mastic, jacket or facing, finishes and adhesive) shall have composite fire and smoke hazard ratings as tested by Procedure ASTM E-84, NFPA 255 and UL 723 not exceeding the indices: Flame Spread of 25 and Smoke Developed of 50. Accessories, such as adhesives, plastics and cements, shall be UL listed, non-flammable when wet with component fire and smoke hazard ratings not exceeding the above indices.
 - 2. Insulation thickness and values shall be in compliance with all applicable Energy Code.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Owens-Corning
- B. Johns-Manville

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

- C. Pittsburg-Corning
- D. Manson (Certain Teed)
- E. Knauf Fiberglass
- F. Aerocel EPDM

2.2 BASIC INSULATION MATERIALS, FITTINGS, FINISHES

A. Insulation materials shall conform to the following requirements:

Type	Maximum K Factor @ 75°F	Temp. Limit - °F	Density Lb. Per Cubic Foot	Federal Spec. Compliance
1. Calcium Silicate	0.38	1200	14	HH-I-523C
2. Fiberglass (Rigid)	0.23	450	3	ASTM C 547 Type 1
3. Fiberglass Flexible Duct Wrap	0.25	250	1.5	
4. Foamed Glass (Cellular)	0.36	850	9	HH-I-1751/3A
5. Foamed Plastic (Flexible)	0.25	220	5	HH-I-573
6. High Temperature Fiberglass	0.23	850	3	HH-1-558B
7. Insulating Cement	0.70	1700		SS-C-160
8. Mineral Wool Rigid Wrap w/ASJ (Paroc Basalt)		1050		
9. Flexible Elastomeric	0.27	220		ASTM C 177 or C518

B. Fittings & Valves (Types)

1. Preformed P.V.C. fitting covers with rigid one piece (half-shell) preformed fiberglass fitting of the same or greater material type and thickness, density and conductivity as the adjoining pipe covering equal to Pro-Tec-T-Kote or equal fittings. Blanket inserts will not be allowed.
2. Field fabricated fitting covers of same or similar material as pipe covering with preformed rigid inserts as specified in paragraph 1 above.

C. Finishes (Types)

1. 8-ounce glass cloth.

2. Insulation cement.
3. 0.016 aluminum, plain, up through 12" pipe size; 0.016 aluminum, corrugated, for pipe sizes 14" and larger.
4. 15-mil PVC.
5. Foil/reinforced/kraft jacket (vapor barrier).
6. 1/4-inch weatherproof mastic with glass mesh reinforcement.
7. 1/16" vapor barrier mastic (0.05 perm rating) with glass mesh reinforcement.
8. White all-service jacket (vapor barrier) with self-sealing lap, or taped joints.
9. Two coats vinyl lacquer type white paint.
10. Canvas jacketing of 6 oz. Minimum, 100% cotton woven fabric with 25/50 flame/smoke rating and equal to Fattal's Thermocanvas Recovery jacket.

2.3 MISCELLANEOUS MATERIALS

- A. Adhesives: Benjamin Foster 85-6 water base, Insul-Coustic I-C 201, or equivalent.
- B. Linear Attaching Devices: Graham weld pins or Stic-clips and sheet metal clips.
- C. Mastic: Benjamin Foster 30-80 water base, Insul-Coustic 110 or equivalent.
- D. Sealants for foamglas insulation to be equal to Pittseal 444 N or 727 sealants.

2.4 LAVATORY PIPING ADA PROVISIONS

- A. Exposed piping for ADA compliant lavatories shall be provided with TrueBro "LavGuard" or McGuire "ProWrap" piping covers for P-traps, waste piping and angle stop valves. The pipe covers to be molded from soft, resilient, antimicrobial, white vinyl assembled with snap clip fasteners.

2.5 STORM DRAINAGE PIPING

- A. Insulate all horizontal storm drainage and overflow drain piping with 1/2" thick fiberglass pipe insulation with vapor barriers as specified for domestic cold water.
- B. Insulate roof drain and overflow drain bodies and supports with 1" insulation A vapor sealed.
- C. Insulation shall cover exposed portion of the roof drain and over flow drain within the building and all piping to and including the elbow where piping changes from horizontal to vertical.

2.6 DOMESTIC WATER STORAGE TANK

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

- A. The vertical domestic water tank shall be insulated to prevent condensation forming and/or heating of the stored domestic water via temperature transmission from an unconditioned area.
- B. The insulation shall be specifically manufactured and installed for the cylindrical tank. It shall be 2" thick, rigid fiberglass with an all service jacket and vapor barrier. All joints and seams of the insulation shall be sealed with a vapor barrier tape.
- C. The entire tank including the vertical, top and bottom surfaces shall be insulated.

PART 3 - EXECUTION

3.1 GENERAL

- A. Materials shall be applied by a qualified insulation applicator/workman skilled in this trade. Insulation shall be installed in accordance with the manufacturers written instructions and in accordance with recognized industry standards. Mechanical fasteners shall be used whenever possible to assure permanent construction. Unskilled work shall be cause for rejection.
- B. Materials shall be applied only after surfaces have been tested and cleaned.
- C. Non-compressible insulation material shall be installed at hanger supports on cold piping to prevent damage to insulation and vapor barrier. All wet duct and pipe insulation shall be replaced.
- D. Insulation of cold surfaces shall be vapor-sealed to prevent condensation.
- E. Minimum thickness of insulation shall be as scheduled; however, sufficient insulation shall be provided to eliminate condensation on the cold surfaces, and to maintain a maximum exterior insulation surface temperature of 125°F on the hot surfaces.
- F. Where piping system insulation is specified, cover valves, strainers, unions, flanges, and fittings, except for terminal unit hot water valve train and piping may be uninsulated as long as it is within 4 feet of the coil. The heating coil including the U-tubes shall be insulated.
- G. Install protective metal shields where pipe hangers bear on the outside of insulation. Provide O.C. Kaylo (minimum 24" long) to prevent crushing of the insulation (Refer to Section 15090, 2.8, B.).
- H. Extend piping insulation without interruption through walls, floors and similar piping penetrations, there shall be no exceptions.
- I. Prior to installation of any insulation materials to ferrous piping systems, the piping surfaces shall be thoroughly cleaned of all mill scale, grease and dirt.
- J. Duct insulation shall terminate at fire/smoke damper sleeves. A separate strip of insulation shall be provided around the sleeve and sealed at the wall.
- K. Insulation for condensate drains from AHU's and Fan Coil Units may be Aerocel or Armaflex AP flexible elastomeric insulation.

L. Miscellaneous Applications

1. Refrigerant suction lines within air cooled condensing units, heat pumps and chillers.
2. Any equipment or piping surface greater than 130°F shall be insulated to decrease the temperature below 130°F.
3. All refrigerant suction lines to be insulated. All refrigerant liquid lines located on the roof and in direct sunlight shall be insulated. If Armaflex insulation is used, their shall be two coats of Armaflex Finish applied.

3.2 APPLICATION TYPES

A. Equipment

E1: Cut insulation to fit contour of equipment, and secure by means of bands, stick-clips, weld-pins and lugs or adhesives as required for each individual piece of equipment. Provide vapor barrier and finish as required for each specific application. Provide new cold surfaces of pumps with accessible boxes that easily separate coincidental with parting line of evaporator heads and pump casings. Resulting insulation joints shall be covered with a self-sealing, vapor-barrier tape. Seal all laps and penetrations in vapor barrier jacket with an approved vapor barrier mastic.

B. Piping

P1: Butt insulation together and securely staple in place with outward-clinching staples on 3" centers. Install factory-furnished laps at the butt joints. Neatly bevel and finish insulation where it terminates. Use of double tape self-sealing adhesives systems will negate requirements for staples.

P2: Butt insulation together and securely staple in place with outward-clinching staples on 3" centers. Install factory-furnished laps at the butt joints. Neatly bevel and finish insulation where it terminates. Seal all laps and penetrations in vapor barrier jacket with an approved vapor barrier mastic. Use of double tape self-sealing adhesive systems will negate requirement for staples.

P3: Butt insulation together and secure with mechanical fasteners. Fill joints with insulation cement prior to insulation finish.

P4: Same as P2, except install insulation over heat trace tape. Finish with metal jacket.

P5: Same as P4, except there is no heat trace tape.

PIPES

	INSULATION TYPE	THICKNESS	APPLICATION TYPE	INSULATION FINISH		
				INDOOR CONCEALED	INDOOR EXPOSED	OUTDOOR
Domestic cold water; bottom of roof drains and overflow drains; horizontal storm drains and overflow drains within building; waste piping conveying cooling coil condensate; cooling condensation drains; waste from chilled drinking water fountains.						
Indoor:	2	½"	P2	8	8	--
Outdoor:	2	1	P4	--	--	8 & 3
Domestic hot water supply & recirculation.	2	·N ₁	P1	8	8	8 & 3
Heating water supply and return; steam condensate return and pumped return piping.						
Indoor:	2	·N ₂	P1	8	8	--
Outdoor:	2	·N ₂	P1	--	--	8 & 3
Runouts for chilled water supply and return.	2	·N ₃	P2	8	8	--
Mains and branches for chilled water supply and return.						
Indoor:	4	·N ₃	P2	8	8	--
Outdoor:	4	·N ₃	P4	--	--	8 & 3
Condenser water supply and return.						
Outdoor:	2	·N ₃	P4	--	--	8 & 3
Refrigerant suction piping.						
Indoor:	2	·N ₃	P2	8	8	--
Outdoor:	2	·N ₃	P5	--	--	8 & 3

* See "Schedule Notes", this Section.

** Provide insulation where piping is heat traced.

PIPE FITTINGS

	FITTING TYPE			FITTING FINISH TYPE		
	INDOOR CONCEALED	INDOOR EXPOSED	OUTDOOR	INDOOR CONCEALED	INDOOR EXPOSED	OUTDOOR
Domestic cold water; bottom of roof drains and overflow drains; horizontal storm drains and overflow drains within building; waste piping conveying cooling coil condensate; cooling condensation drains; waste from chilled drinking water fountains.	1	1	1	8	8	8 & 3
Domestic hot water supply and recirculation.	1	1	1	8	8	8 & 3
Heating water supply and return; steam, condensate return, pumped return.	1 or 2	1 or 2	1 or 2	8	8	8 & 3
Runouts for chilled water supply and return.	1	1	1	8	8	8 & 3
Mains and branches for chilled water supply and return; condenser water supply and return; refrigerant suction piping.						
Indoor:	4	4	4	8	8	--
Outdoor:	4	4	4	--	--	8 & 3
H/C lavatory and sink tailpiece, offset trap and trap arm.	1	1	1	--	4	--

EQUIPMENT

	INSULATION TYPE	THICKNESS	APPLICATION TYPE	INSULATION FINISH	
				INDOOR	OUTDOOR
Boiler breeching (plate steel)	1	4"	E1	2 & 1	8 & 3
Steam-to-water heat exchanger; heating water-to-water heat exchanger; steam system surge tank, deaerator, blowdown heat recovery unit, blowdown separator flash tanks.	1	4"	E1	2 & 1	8 & 3
Hot water or chilled water tank or expansion/compression tank, domestic water storage tank.	2	1 ½"	E1	2 & 1	8 & 3
Chillers; chilled water pumps.	[2] [4] [5]	2" 2" 2"	E1 E1 E1	[2 & 1] [2 & 3] [9]	[3] [9]
Generator field fabricated exhaust piping & muffler.	8	3"	E1	2 & 1	3
Laundry equipment exhaust ducts.	6	2"	D1	6 & 3	6 & 3
Humidifiers	6	2"	E1	10	--

3.3 PIPE INSULATION THICKNESS SCHEDULES:

DOMESTIC HOT WATER SYSTEMS (N₁)

SUPPLY WATER TEMPERATURE	NON-CIRCULATING RUNOUTS UP TO 1"	CIRCULATING MAINS AND BRANCHES		
		UP TO 1 ¼"	1 ½" & 2"	OVER 2"
170 - 180°F	1"	1"	1 ½"	2"
140 - 160°F	1"	1"	1"	1 ½"
100 - 130°F	1"	1"	1"	1"

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

PSP #407480

CONSTRUCTION DOCUMENTS – 2 MAY 2008

INSULATION
15180 - 8

COOLING SYSTEMS (N₃)

INSULATION THICKNESS FOR PIPE SIZES					
FLUID TEMPERATURE	RUNOUTS UP TO 2"	1 1/2" & LESS	2" TO 4"	5" & 6"	8" AND LARGER
Chilled Water or Refrigerant.					
40 and above.	1.0"	1.0"	1.5"	2.0"	2.0"
Below 40°F.	1.0"	1.0"	1.5"	2.0"	2.0"

* Runouts to individual units, less than 48" in length.

3.4 INSTALLATION OF PRE-FABRICATED HANGER SHIELDS

- A. Refer to Section 15090, which provides for metal-jacketed insulation inserts at the various locations described.
- B. Provide the following insulation work: Coat butt ends of insulation and inset with a vapor barrier adhesive; cover butt joints with vapor barrier jacket butt strips; and, apply vapor barrier tape on longitudinal overlap of metal jacket for insulation insert.

END OF SECTION

SECTION 15401 - DOMESTIC WATER SUPPLY SYSTEM

PART 1 - GENERAL

1.1 EXTENT OF WORK

- A. Related work and materials are specified under Section 15010, General Provisions; Section 15050, Basic Materials and Methods, and other appropriate Sections of this Division.
- B. This Section of the Specifications pertains to all other labor, material equipment and service necessary for and incidental to the domestic water supply system as shown on the Drawings and/or specified herein.
- C. Install piping as shown on the Drawings and as described in Section 15050, Basic Materials and Methods, using methods of fabrication, grading, testing, repairing, cleaning and other procedures as established therein, but the particular material application shall be as described in this Section.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. The materials as scheduled and/or hereinafter listed shall be used in fabricating piping systems. Where material changes occur install suitable adapters to provide tight sealing joints. Where multiple choices of materials are listed, only one shall be used, except by special permission. All pipe and fittings shall be American Manufactured.
- B. An exterior water line shall include piping to the building wall penetration, where a change in material can be made within the building.
- C. Exterior Water Lines 4-inch and Larger: Cast iron or ductile iron water pipe and fittings, cement lined, assembled using mechanical joints, or bell and grooved spigot end push-on joints with rubber gaskets.
- D. Exterior Water Lines 3-inch and Smaller: Type "K" soft or hard drawn copper tubing assembled using solder joint pressure fittings.
- E. Interior Domestic Hot and Cold Water Lines: Type "L" hard drawn copper tubing assembled using solder joint pressure fittings. However, exposed connections to plumbing fixtures shall be chrome plated red brass pipe assembled using chrome plated red brass, and screwed fittings. As an alternate to the solder joining method, the Victaulic "No Sweat" or Rigid ProPress Systems may be used. As an alternate, roll grooved pipe and Victaulic and/or Gruvlok couplings and fittings may be used.
- F. An acceptable substitute for the above specified copper pipe/tubing/fittings, may be Type 304L stainless steel, ASTM A778, Schedule 10 pipe for exterior piping 3" and smaller, and for interior piping 1/2" and larger. The method of joining the pipe and fittings will be by socket weld type, stainless steel couplings and fittings.
- G. Connections between ferrous pipe or equipment and non-ferrous pipe or equipment shall be made with bronze valves or dielectric unions.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

2.2 REDUCED PRESSURE BACKFLOW PREVENTERS

- A. Reduced Pressure Backflow Preventers: Double check and relief valve assemblies, each consisting of a strainer, a gate valve, dual check valves with an intermediate differential pressure relief valve and a gate valve. There shall be 3 test cocks on the valve body to permit measuring pressures in each of the 3 compartments. The backflow preventers shall be from the state approved list and bronze or cast iron bodies with integral epoxy coating and bronze trim.

2.3 WATER PRESSURE BOOSTER SYSTEM

- A. Provide and install a new constant speed water pressure booster pump system, complete with all interconnecting piping and controls. The complete system shall be the product of a single manufacturer who assumes undivided responsibility for proper system operation. The system shall be factory tested and the results certified for specification compliance. System shall be Grundfos Boosterpag or approved equal as manufactured by Bell & Gossett Tigerflow or Syncroflo Armstrong or Peerless and, as scheduled on the Drawings, factory assembled. The packaged pump system shall be purchased through and serviced by a system company "approved sales and service" representative located within a 50 mile radius of the project site.
- B. Pumps: Shall be constant speed end-suction design of cast iron bronze fitted construction equipped with mechanical shaft seal. Each pump shall have vibration-isolation mounts and be fitted with 4 separate pre-wired temperature probe and approved electrical purge valve installed immediately upstream of each PRV.
 - 1. Published performance curves shall be furnished for evaluation and approval.
- C. Motors: Motors shall be as scheduled and each pump motor shall meet NEMA standards and operate within the available service factor at any point on the pump capacity-head curve.
- D. Pressure Regulating Valves: System pressure shall be maintained by a Watts ACV pilot operated diaphragm type combination pressure regulating and non-slam check valve, complete with stainless steel cover bolting and fully fused epoxy coating inside and out. The valve body shall be suitable for operation.
- E. Pressure sequencing shall be panel mounted and have a single set point with a fixed differential to start additional pumps if system design pressure cannot be maintained.
- F. Energy Option: System shall be designed for continuous run operation with provisions to allow provisions of a HydroCumulator for complete system shutdown during no-flow conditions if they are present. The control panel shall be provided with extra terminals to permit easy installation of HydroCumulator pressure switch and necessary controls for on-off operation. Provisions shall be made on system piping to allow future connection to HydroCumulator without disturbing piping connections.
- G. Provide a factory precharged, ASME code & NB stamped and labeled HydroCumulator tank. Construction features shall include an air fill valve, an air pressure gauge, a drain valve, and a replaceable FDA approved flexible membrane to separate air and water. No water shall come in contact with the metal walls of the tank. In addition the HydroCumulator tank shall be bottom fed and capable of 100% draw down. Tank shall be shipped precharged to the proper design conditions. Provide a pressure switch, and a time delay relay to automatically control lead pump on-off operation. These controls shall

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

DOMESTIC WATER
SUPPLY SYSTEM

operate in such a way as to prevent high flow rate shutdowns and lead pump short cycling while maximizing the amount of stored water available from the HydroCumulator.

- H. The tank shall be located with the pumps and the feedline connection(s) from the tank shall be between the pump check valve(s) and pressure regulating valve(s) to assure constant system pressure and prevent leaks back to suction.
- I. Power and Control Panel: Furnish a single enclosure SyncroFlow power and control panel NEMA 1 to house all pump sequencing controls, PID speed controller, disconnect switches and drive by-pass circuits. Enclosure shall be steel and furnished with oven-baked enamel. The panel shall include for each pump a fused disconnect switch with external operating handle, starter with 3-leg overload protection, running light and multiple position motor control switch. It shall also house all control components and include 115-volt control transformer with control power switch, indicating lights, relays, audio-visual alarm system and other necessary controls. All of the above shall be factory internally pre-wired and tested in accordance with the provisions of the National Electrical Code. Panel shall have the UL listing mark for industrial control panels.
- J. Instrumentation and Emergency Controls: System shall include individual pressure gauges or pumps and for indicating system and suction pressures system mounted. Controls shall shut down the pump system and activate a visual alarm if incoming water pressure is lost.
- K. Pressure Transmitter: Pressure transmitter shall be 2 wire, 4-20 mA output transmitter with the following characteristics:
 - 1. Stainless steel diaphragm.
 - 2. Zero and Span adjustments.
- L. Digital Receiver/Controller: The receiver/controller shall be microprocessor-based with the following characteristics:
 - 1. Continuous automatic tuning of PID tuning parameters during operation with the ability to manually adjust tuning parameters if desired. Controller shall continually tune itself to compensate for changes in the system during operation. Tuning at start-up shall not be required.
 - 2. On line diagnostics.
 - 3. Adjustable High and low deviation alarm limits.
 - 4. Multilevel (3) security codes to prevent tampering with tuning parameters, set points, etc.
 - 5. A 10 segment multi-color bar graph display of deviation from the set point.
 - 6. 4 Digit continuous display of either process, set point, or percent output. The process shall be displayed in engineering units.
 - 7. 8 character alphanumeric message display for variable identification, alarm messages, and help messages during setup.

8. 5 segment LED bar graph representing controller output (speed signal).
 9. 4-20 mA input, 4-20 mA output.
 10. The controller will not need resetting upon power failure.
 11. The controller shall be capable of receiving a remote set point adjustment signal.
 12. Accuracy of 0.1% of full scale.
 13. Noise rejection:

CMRR = 120 dB @ 60 Hz. (max. CM voltage 600 VAC)

NMRR = 80 dB @ 60 Hz.

RFI immunity meets SAMA specification.
 14. Optional RS232 communications capability.
 15. If the controller fails, it shall maintain its previous output level until the failure is acknowledged.
 16. The front end of the controller shall be field replaceable while the unit maintains a preset output level.
- M. Factory Pre-fabrication: The entire booster system shall be factory pre-fabricated on a common structural steel stand with all interconnecting piping and wiring completed and operationally tested prior to shipment. Complete package shall also include isolation valves on the suction and discharge of each pump. Type L copper suction and discharge pipe manifolds, as well as copper tubing with shut-off cocks for gauges and pressure switches, will be furnished assembled. The only field connections required will be system suction and discharge and power connection at the control panel.
- N. Factory Test and Certification: The factory shall certify in writing that the water pressure booster system and its component parts have undergone a complete electric and hydraulic operating test prior to shipment. Test shall include a SYSTEM operating flow test from 0-100% design flow rate under specified suction and net delivery pressure conditions. Certification shall include copies of the test data as recorded by X-Y plotter, and there shall be a permanently attached ETL Testing Laboratories, Inc. certification label. System test may be witnessed by Owner, Architect or consulting engineer by reporting intent to do so to the factory.
- O. The submittal data for the pumping system shall include a letter from the system manufacturer stating place of assembly and who will be responsible for design, product liability, service and all system and component guarantees. The submittal shall include pump curves, complete description of control panel with wiring diagrams and sequence of operation, cut-sheets on major items and a copy of the manufacturers certificate of \$1,000,000.00 minimum liability insurance. Provide four complete manuals with a list of recommended spare parts to ensure continuous system operation.

- P. Guarantee: The Syncroflow Constant Speed Pumping System shall be guaranteed in writing by the manufacturer for a period of one year from date of shipment against defects in design, materials or construction.
- Q. Start-Up Service: The service of a factory trained representative shall be made available on the job-site to check installation and start-up and instruct operating personnel.
- R. Refer to the Drawings for capacities.

2.4 GAS FIRED STORAGE TYPE WATER HEARTER

- A. Two automatic, forced draft, gas-fired, horizontal combination recovery and storage type water heaters see schedule for capacity requirements.
- B. Heater emissions shall not exceed 30 PPM NOx, referenced at 3% O2. In addition, heater shall be certified with the TCEQ and the manufacturer and model number shall be listed as an approved unit with the TCEQ.
- C. Epoxy lines, welded steel tank ASME rated for 125 psig maximum working pressure.; (2) magnesium sacrificial anodes, (5) 3 1/2" x 4 1/2" tank opening, thermally insulated with 2 inch thick glass fiber; encased in corrosion-resistant steel segmented jacket; baked-on enamel finish; and structural skid type base.
- D. Automatic water thermostat, separate high limit temperature cut-off with manual reset both with externally adjustable temperature range; low water cutoff with manual reset. Pre and post purge cycle before and after firing. NEMA 1 control panel with six indicating lights and control on/off switch. Panel shall include; Honeywell RM7800 microprocessor based burner control with keyboard display module, control stepdown transformer, motor starter, terminal strip and wiring diagram.
- E. Factory installed main burner and independent pilot burner. Main gas train shall include but not be limited to; (1) gas pressure regulator sized for 5 PSIG natural gas inlet conditions, (2) motorized gas valves, low gas pressure switch and a manual gas adjustment valve. Pilot train shall include but not be limited to; (1) gas pressure regulator sized for 5 PSIG inlet gas conditions, (1) solenoid gas valve. Gas train and controls shall be in accordance to U.L. and IRI/GE Gap requirements.
- F. ASME temperature and pressure relief valve sized for input.
- G. The heater shall be factory fire tested, completely packaged, U.L. listed, comply with U.L. and will satisfy ASHRAE 90.
- H. Meet all applicable energy codes.
- I. Dial thermometer and pressure gauge.
- J. Provide a ASME rated tank. Gasketed openings shall be limited to only handhole plates.
- K. Provide a factory installed and wired intra tank circulation pump across the heater, sized per recovery rate.
- L. Install on housekeeping pad and in accordance with manufacturer's instructions.

- M. Route regulator vents and low gas pressure switch vents to the outside. Turn vents down to prevent water collection in lines and install insect screen.
- N. Provide dielectric fittings on piping to heater including the drain line piping.
- O. Provide drain valve and route drain valve, T&P valve and condensate line to floor drain.
- P. Provide electrical disconnect located in sight of heater and in same room as heater.
- Q. Heater shall have a factory authorized start up to check combustion, controls and safeties.
- R. Acceptable Manufacturer:
 - 1. Sellers Engineering Company – Immersion Fired
 - 2. Or approved equal.
- S. Water heater manufacturer shall provide 1) a ten year warranty guaranteeing the pressure vessel, heads, stays and combustion chamber against leakage for a period of 10 years. The first five years shall be non-prorated, 2) five year warranty guaranteeing the burner assembly for a period of 5 years.

2.5 HOSE BIBBS

- A. (HB "-1") Single, Pipe Mounted Faucets: 3/4-inch copper plated brass, male inlet, tee handle, hose threaded faucets equivalent to Woodford Model 24.

2.6 WALL HYDRANTS

- A. Non-freeze type, cast brass with brass wall casing, Nikaloy face, loose T-handle, wall clamp; equivalent to Woodford Model B65 Series, with deep box and approved vacuum breaker.

2.7 VACUUM BREAKER

- A. Watts No. 9D, or equivalent, chrome plated vacuum breaker with intermediate atmospheric vent for continuous pressure service, or Watts No. 800, anti-siphon pressure type (for continuous pressure) with test cocks and gate valves on each side, as required by the drawings or service required.

2.8 TRAP PRIMERS

- A. Precision Plumbing Products, Inc. (PPP), Sioux Chief, and Watts are accepted manufacturers.
- B. TP-1: For applications that require a pressure change of 5 psi or more for water discharge, connect to 1 ½" and smaller cold water branches with daily use, and feed one or two traps. Primer shall be machined of corrosion resistant brass and have no springs or diaphragms. Primer shall be adjustable for high or low pressure. Accepted PPP models are Type P-1 and P-2 with distribution units as required.

- C. TP-2: For applications that do not require nor use pressure changes for water discharge. Water discharge is through a 120 volt timer that opens a solenoid valve that feeds cold water to manifolded outlets connected to traps with no intermediate trap primers. Accepted PPP models are Prime Time PT-4 through PT-30 with all necessary accessories, electrical, housing, distribution tubing, and adaptors.

2.9 SHOCK ARRESTERS

- A. Shock Arresters (SA-A): Sioux Chief Mfg. Co. Hydra-Rester copper tube construction with double o-ring piston, factory charged to 60 psi, P.D.I. WH-201 certified, ASSE 1010 approved for installation in wall without access panel. (A) indicates P.D.I. size. Acceptable manufacturers include Precision Plumbing Products (PPP).
- B. Shock Arrestors (SA-B): Sioux Chief Mfg. Co. Mini-Rester for single fixture water hammer arrester shall be used for sinks, lavatories, tub/shower, laundry, etc. connections.
- C. Air chambers are not acceptable.

2.10 CIRCULATING PUMPS

- A. Domestic Hot Water Circulators: Hot water pumps shall be manufactured by Bell and Gossett, Taco or Grundfos and shall have capabilities as scheduled on the drawings. The pumps shall be bronze construction and shall be furnished complete with a manual motor starter.

2.11 POINT-OF-USE SCALE PREVENTOR

- A. Provide a point-of-use scale preventor equal to SCALESAFE Model SS, as manufactured by Webb and Company, Madison, GA, to facilitate the prevention and removal of scale, prevention of corrosion and prevent mineral staining.
- B. The SCALESAFE may be designated for make-up water and to be provided for the following:
 - 1. Autoclaves
 - 2. Boilers
 - 3. Chillers
 - 4. Cooling Tower
 - 5. Dishwashers
 - 6. Evaporative Pads
 - 7. Heat Exchangers
 - 8. Ice Machines
 - 9. Laundry Equipment

10. Steam Tables

11. Water Heaters

C. The unit shall be USDA, EPA and NSF approved and suitable for a maximum pressure of 125 psig and a maximum temperature of 100°F.

D. Provide a line size pre-filter in series ahead of the SCALESAFE.

2.12 THERMOSTATIC MIXING VALVE ASSEMBLY

A. Provide a triflow mixing valve assembly consisting of dual high flow and low flow mixing valves including pressure reducing valves. Mixing valves shall have bimetal thermostat, lock type temperature regulator and line size check/stop valves on inlets. Assembly shall be installed as per manufacturers recommendations. Thermostatic mixing valves shall be Armstrong RADA, Lawler, or Leonard and similar to those indicated on the drawings.

2.13 FLOW CONTROL VALVE

A. Provide Flow Design, Inc. Model AC, or equal, combination flow control ball valve/flow regulator/port section/union in the hot water return system where indicated on the drawings. All flow control internal components shall be nickel plated brass.

2.14 EXPANSION TANKS

A. Expansion tanks shall be AMTROL Therm-X-Trol pre-charged hydropneumatic steel expansion tank with an internal butyl diaphragm to isolate air charge from water.

B. Tank construction shall be in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code, with all welds conforming to ASME Section IX. The tank must be stamped with a maximum working pressure of 150 psi and a maximum working temperature of 200°F. All internal wetted parts must comply with FDA regulations and approvals.

2.15 ELECTRIC CONTRACT WATER METER

A. The meter is to register gpm and provide interface with the building energy management system and shall be equal to Carlon Electrical Contact Water Meters by G.E. Betz.

B. The Carlon meter is a positive displacement, oscillating piston water meter with accumulating register.

C. In addition to totalizing water use, these meters provide an electrical contact each time a preset number of gallons passes through the meter. This contact can be used to actuate the water treatment cycle. The sizes, model numbers, and range of contact settings for Carlon electric contact meters are shown on the following selection table

D. These meters can be connected through a timer to pumps, valves, softeners, or other elements in the water treatment system. The timer provides a means of varying the length of the operating cycle. Carlon controls, equipped with predetermining counters, can also be used to vary the number of gallons needed to actuate the water treatment equipment desired.

- E. Features:
 - 1. Available in 3/4 to 2 in. sizes.
 - 2. Easy serviceability, warranty.
 - 3. Includes companion pipe couplings.
 - 4. Meets AWWA standards.
 - 5. Not suitable for outdoor.
 - 6. Maximum operating pressure: 150 psig (10.3 bar)
 - 7. Maximum temperature: 110°F (43°C)

PART 3 - EXECUTION

3.1 PIPING

- A. Install all piping as described in Section 15050, using methods of fabrication, grading and other procedures described therein.
- B. Install all exterior and interior piping as shown and/or as required. Make all connections to backflow preventers, booster pump assembly, hot water generator, plumbing fixtures, laboratory furniture and equipment, etc.
- C. Balance domestic hot water recirculation, to ensure proper flow through all mains and branches.
- D. Any exposed copper piping within finished rooms and areas that provide water to coffee makers, dishwashers, refrigerators, ice makers, RPBF devices, sinks, etc. shall be painted with "chrome" paint.

3.2 BACKFLOW PREVENTERS

- A. Install reduced pressure backflow preventers in each makeup water line as indicated on the Drawings and as required by the City Inspection Department.
- B. Install the scheduled backflow preventer in the main domestic water service to the building.
- C. Install reduced pressure backflow preventers in water lines to film processors, ice machines, dishwashers, humidifiers etc. as required by code.
- D. Pipe full size drain from reduced pressure backflow preventer air gap fitting to nearest floor drain to other suitable receptor.

3.3 WATER PRESSURE BOOSTER SYSTEM

- A. Mount on a 6-inch concrete pad. Make all connections and all adjustments and test to prove proper operations.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

- B. Locate pressure sensors in the domestic water piping system as recommended by the manufacturer. Sensors, wiring, conduit, installation to the sensors shall be included in this bid.

3.4 HOT WATER-GENERATOR/WATER HEATERS

- A. Mount on a 6-inch concrete base, together with its boiler water circulating pump. Make all connections and all adjustments and test to prove proper operation.
- B. All units shall be installed with adequate clearances for manufacturer's service requirements and the State boiler code requirements.
- C. The water heater will be completely factory packaged, requiring only job site hookup to utilities and domestic water piping. The heater will be insulated to meet current ASHRAE standards, jacketed in dent resistant PVC and mounted on heavy-duty stand or wall bracket. The heater will fit properly in the space provided and installation will conform to all local, state, and national codes.
- D. Start up on the unit will be performed by factory trained and authorized personnel. A copy of the start up report will be provided to the owner.
- E. The water heaters will be manufactured by a company that has achieved certification to the ISO 9001 International Quality System, which requires regular external auditing of all order entry, engineering design, and product manufacturing processes.

3.5 HOSE BIBBS

- A. Mount on face of wall where indicated on Drawings.

3.6 WALL HYDRANTS

- A. Mount with the face of the valve box flush with the wall surface.

3.7 VACUUM BREAKERS

- A. Provide and install an approved vacuum breaker on each water supply serving a plumbing fixture, item of equipment or other device having a water supply below the rim of the fixture or as shown on the Drawings. Vacuum breakers shall be designed to prevent any possible backflow through them. Where required, install drain discharge to the nearest open-site drain.

3.8 STERILIZATION

- A. After completion of the installation and testing of the domestic water supply system, thoroughly sterilize the system and its attached equipment with a solution containing not less than 50 PPM of available chlorine. Introduce into the system either liquid chlorine conforming to U.S. Army Specification No. 4-1 or calcium hypochlorite or chlorinated lime conforming to the requirements of Federal Specification O-C-114. Allow the sterilizing solution to remain in the system for a period of 8 hours, during which time all valves and faucets shall be opened and closed several times. After sterilization, flush the solution from the system with clean water until the residual chlorine content is not greater than 0.2 PPM.

3.9 SHOCK ARRESTERS

- A. Install shock (water hammer) arresters on water supplies to plumbing fixtures and items of equipment with quick closing valves including solenoid valves, two position control valves, ball valves flush valves, etc. All quick closing valves must have a shock arrester installed. The symbols, if indicated, correspond with P.D.I. arrester size symbols. Where the actual piping may be made differently, the size and position of the arresters shall be revised to conform to "Standard P.D.1 -WH 201".

3.10 EXPANSION TANKS

- A. Water heaters shall be provided with expansion tanks to meet code requirements for thermal expansion control.

END OF SECTION

SECTION 15405 - DRAINAGE SYSTEMS

PART 1 - GENERAL

1.1 EXTENT OF WORK

- A. Related work and materials are specified under Section 15010, General Provisions - Mechanical; Section 15050, Basic Materials & Methods, and other appropriate Sections of this Division.
- B. This Section of the Specifications pertains to all other labor, material, equipment and service necessary for and incidental to the sanitary, grease waste, acid, and storm water drainage systems as shown on the drawings and/or specified herein.
- C. Collect all acid waste outlets within the building. Extend and connect to the neutralizing basin as shown. Collect all sanitary sewer outlets, including the outfall of the neutralizing basin, extend and connect to the City sanitary sewer as indicated.
- D. Collect all storm water outlets within the building, extend to and discharge where and as indicated.
- E. Subsoil drainage piping shall be collected and discharged where and as indicated.
- F. Install piping as shown on the drawings and as described in Section 15050, Basic Materials & Methods, using methods of fabrication, grading, testing, repairing, cleaning and other procedures as established therein. But the particular material application shall be as described in this Section.
- G. Acceptable Drain Manufacturers:
 - 1. Josam
 - 2. Zurn
 - 3. J.R. Smith
 - 4. Wade

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. The materials as scheduled and/or hereinafter listed shall be used in fabricating piping systems. Where material changes occur, install suitable adapters to provide tight sealing joints. Where multiple choices of materials are listed, only one shall be used, except by special permission. All pipe and fittings shall be American manufactured.
- B. Exterior waste, drain and sewer lines shall be those more than 5' feet beyond wall lines of a building, interceptor or basin, except that the same material used in building shall be continued on into and out of exterior interceptors and basins. Small diameter pipe, not available in material - indicated for exterior lines, shall be the same material used in interior lines for the same service.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

- C. Building wall lines shall mean future building limits as established by the plans. Vehicle traffic ways shall include future drives and roads as indicated.
- D. Grease Waste: Service weight bell and spigot soil pipe and fittings ASTM-A-74 and having the manufacturer's mark or name and the date of manufacture cast on it. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or receive prior approval of the engineer. Acceptable manufacturers of Cast Iron Soil Pipe and Fittings are AB&I, Charlotte Pipe, or Tyler Pipe. Pipe and fittings shall be joined with neoprene gaskets. This piping shall continue to the grease trap.
- E. Sanitary Fixture Waste Arms: Use materials as specifically designated and do not intermix; use approved fittings provided with carrier mounted fixtures; connect drains, floor mounted sinks and other designated fixtures and equipment using deep seal cast iron –P-traps; connect other fixtures and drain using cast iron, red brass, Type L hard copper or lead pipe conforming to Plumbing Code requirements.
- F. Fittings in copper waste lines shall be drainage pattern, fixtures to risers or stacks, except that, where space conditions absolutely prevent the use of sanitary type fittings, tapped tees may be used.
- G. Sanitary tees or sanitary crosses shall be used in connecting fixtures to risers or stacks, except that, where space conditions absolutely prevent the use of sanitary type fittings, tapped tees may be used. Sanitary tees or laterals for connection of acid waste lines shall be of the acid-resistant material.
- H. Interior Sanitary Waste and Drain Lines: Service weight bell and spigot ASTM A-74, (no-hub) cast iron soil pipe and fittings ASTM-A-888 or CISPI-301 having the manufacturer's mark or name and the date of manufacture cast on it. Piping run below floor on grade shall be bell and spigot or bell and plain end ASTM-A-74; no hub CISPI-301 or ASTM-A-888 is not permitted. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or receive prior approval of the engineer. Acceptable manufacturers of Cast Iron Soil Pipe and Fittings are AB&I, Charlotte Pipe, or Tyler Pipe.
- I. Interior Storm Drainage: 2" and larger shall be ASTM-A-74 service weight bell and spigot or ASTM-A-888 or CISPI-301 (no-hub) cast iron soil pipe and fittings, heavily coated and having the manufacturer's mark or name and the date of manufacture cast on it. Piping run below floor on grade shall be bell and spigot ASTM-A-74; no hub CISPI-301 or ASTM-A-888 is not permitted. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or receive prior approval of the engineer. Acceptable manufacturers of Cast Iron Soil Pipe and Fittings are AB&I, Charlotte Pipe, or Tyler Pipe.
- J. Sanitary Vent Lines: Materials in Plumbing Code compliance; service weight soil pipe and fittings as described above for Sanitary Waste and Drain Lines and standard Type L copper with wrought copper or cast brass solder joint fittings, red brass pipe and screwed red brass fittings for lines smaller than 2-inch; do not intermix materials.
- K. Pumped Interior Drain Lines of 2-inches in Size and Smaller: Where under pressure, Schedule 40 galvanized steel pipe assembled using galvanized, drainage pattern, cast iron fittings; where change to gravity flow occurs, material shall be specified for Interior Sanitary Waste and Drain Lines.

- L. Pumped Interior Drain Lines of 3-Inches and Larger: Where under pressure, flanged pattern, cast iron water pipe and 150-pound drainage pattern fittings.
- M. Acid Waste and Vent Lines: Schedule 40 polypropylene piping and fittings with mechanical joints as manufactured by Enfield Industries, Orion or R & G Sloane.
- N. Overflow and Drain from Hot Water Relief Valve, Drip Pan Drains and Other Plumbing Equipment Item: Type L hard drawn copper tubing with wrought copper solder joint, drainage fittings.
- O. Condensate and "Open Site" Drains: DWV copper piping and drainage type fittings.
- P. Miscellaneous Lines: Pilot, bleed control, sampling, equalizer, and similar auxiliary lines shall be fabricated of the material used in the system to which they are connected in each case. Drains from appurtenances installed in steel piping system shall be Schedule 40 black steel pipe with black, malleable iron screwed fittings.
- Q. See other Sections of this Specification for other classes of piping materials.

2.2 FLASHINGS

- A. Flashings shall be 4-pound per square foot or heavier weight sheet lead.

2.3 DRAINS

- A. Size as noted; equivalent to manufacturer's type listed; Josam, J.R. Smith, Wade, or Zurn.
 1. Provide each floor, shower, hub drain, or floor sink, with a cast iron deep seal P-trap; provide each acid-resisting drain with an acid resisting deep seal P-trap. Provide drains with flashing clamping device where membrane waterproofing or metal pans occur.
 2. Each drain which requires a trap primer shall be provided with a trap primer connection tap.
 3. Provide each roof drain with an extension ring selected to conform to the thickness of the roof insulation at the point of installation.
- B. Drains shall be as scheduled on plumbing fixture schedule. Equivalent drains to those scheduled are acceptable.

2.4 DOWNSPOUT COVER

- A. For opening downspouts of storm and overflow drainage, provide Zurn Z199-DC downspout cover, round fabricated 304 stainless steel frame with fabricated secured perforated 304 stainless steel hinged strainer.

2.5 CLEANOUT FERRULES AND CLEANOUTS

- A. Ferrules shall be of materials and thicknesses to match the piping system in which they are installed.

- B. Cleanout Plugs
 - 1. In Cast Iron Soil, Waste and Drain -Lines: Heavy brass with raised nuts or recessed sockets.
 - 2. Acid Waste Lines: Material to match piping system.
- C. Both cleanout ferrules and plugs shall have American Standard Tapered Pipe Threads.
- D. Size of cleanout shall be the same as the piping to which it is connected up to 4-inch. On piping larger than 4-inch the cleanout shall be 4-inch in size. The following schedule shall apply.
 - 1. Linoleum Floors: J.R. Smith Series 4140 - round top with insert
 - 2. Carpeted Floors: J.R. Smith Series 4240-Y - round with carpet marker
 - 3. Exterior: J. R. Smith 4240 - round with cast iron cover
 - 4. Wall: J.R. Smith Series 4710
 - 5. Quarry Floor: J.R. Smith Series 4053-PB - square bronze top
 - 6. Ceramic Floor: J.R. Smith Series 4053-NB - square nickel bronze top
 - 7. Concrete Floors: J. R. Smith Series 4100 – round galvanized cast iron top.
 - 8. Truck/Loading Dock Areas: J. R. Smith Series 4231 – ductile iron top.

2.6 ACID NEUTRALIZATION BASIN

- A. Provide an acid dilution basin constructed of virgin polyolefin of the capacity scheduled on the drawings.
- B. Polyolefin materials used shall conform to ASTM D-1248-70. Unit shall be as manufactured by Town and Country Plastics, Inc.
- C. Contractor shall fill tank with limestone and water to the appropriate level upon completion of work. Provide additional limestone for 2 tank fillings.

2.7 SHOWER PANS

- A. Furnished under Section 15450 "Plumbing Fixtures".

2.8 DRIP PANS

- A. Of not less than 14-gauge galvanized steel with raised sides and galvanized steel pipe nipple drains welded in place at low points.

2.9 ELEVATOR PIT SUMP PUMP

- A. The sump pump shall be equal to an Aurora Model SD25/33 and shall feature a heavy duty cast iron construction that provides the durability for a long service life, as well as assisting in dissipating heat from the motor for cooler operation.
- B. The pump impeller shall be of the anti-clog, vortex design made from a tough non-corrosive, thermoplastic material capable of providing long, trouble-free service.
- C. The motor is to be an oil-filled type that provides superior cooling characteristics and provides permanent lubrication of the shaft bearings.
- D. Manual operation shall be provided by a wall mounted switch. A high water alarm system will be installed as shown on detail sheet.
- E. The capacity characteristics shall be as scheduled on the drawings.

2.10 DRAINAGE PIPE COUPLINGS

- A. For pipe and fittings above grade, the couplings for joining hubless cast iron soil pipe and fittings conforming to ASTM A-888, shall be heavy duty couplings. Approved manufacturers, Husky SD 4000, Clamp All 125.
 - 1. Alternative to above, cast iron split clamps secured by stainless steel bolts and nuts with neoprene gasket conforming to ASTM C-564; as manufactured by MG Coupling Company.
 - 2. Factory Mutual Approved Couplings may be hung with one hanger per length of pipe for 10 foot lengths and at every third fitting where they are contiguous in conformance with manufacturers installation instructions.

PART 3 - EXECUTION

3.1 PIPING

- A. Install piping as described in Section 15050, using methods of fabrication, grading and other procedures described therein.
- B. Any exposed copper piping within finished rooms and areas that provide water to coffee makers, dishwashers, refrigerators, ice makers, RPBF devices, sinks, etc. shall be painted with "chrome" paint.

3.2 VENTING SYSTEMS

- A. Vent fixtures generally as indicated on the Drawings. From plumbing fixtures use vent lines same as fixture traps except where Plumbing Code permits smaller vents for water closets, drains and service sinks. Size vents for equipment items, drains, etc. as shown or in accordance with the Plumbing Code where not shown. Connect each back vent from a fixture as close to the fixture trap as possible. Run end vented lines to serve equipment items, drains, etc. as shown and as required.
- B. Connect each vent stack into its waste stack with wye and 1/8-bends immediately below the line of the lowest fixture connection to the waste stack. Make such vent stacks of the maximum required vent size throughout their length.

- C. Install offset vents where shown on riser diagrams.
- D. Locate vent terminals at heights required by the Plumbing Code, but not less than 10-inches above finished roof line.

3.3 DRAINS

- A. Take care to locate bodies of drains at proper elevations to permit sloping of floors or roofs to secure proper drainage.
- B. All condensate and "open site" drains to discharge with a 2" air gap into a hub drain, floor drain, or floor sink.

3.4 CONCRETE STRUCTURES

- A. Do all necessary form work, removal of forms, installation of reinforcing, installation of cast iron steps and manhole frames at proper stages of construction.
- B. Concrete shall be 3000 pound test.

3.5 DRIP PANS

- A. Provide drip pans under waste lines concealed above operating, cysto and delivery rooms, cath labs, nurseries, food preparation centers, food serving facilities, food storage areas, central services, electronic data processing areas, electric and telecommunication closets, and other sensitive areas, or as shown on the plans. Pans shall be of galvanized steel, arranged to drain outside these areas, or as noted on Drawings.

3.6 CLEANOUTS

- A. Set exterior cleanouts in an 18-inch by 18-inch by 6-inch deep reinforced concrete pad except in concrete paved drives or walkways.
- B. All interior cleanouts shall be turned up to terminate flush with the floor above.

END OF SECTION

SECTION 15500 - FIRE PROTECTION SYSTEMS

PART 1 - GENERAL

1.1 GENERAL

- A. Related work and materials are specified under Section 15010, General Provisions - Mechanical; Section 15050, Basic Materials and Methods, and other appropriate Sections of this Division.
- B. This Section of the Specifications pertains to all other labor, material, equipment, and service necessary for and incidental to the fire protection systems as shown on the Drawings and/or specified herein.
- C. All devices and equipment shall be listed for fire protection service by Underwriter's Laboratories, Inc. or other recognized testing laboratory, and components, valves and thread type shall be in accordance with local Fire Department requirements.
- D. All hanging of pipe to be in accordance with NFPA.

1.2 SCOPE OF WORK

- A. It is the intent of these Specifications to cover the engineering, hydraulic calculations, design and complete installation of the wet type automatic sprinkler, pre-action sprinkler and standpipe system. The sprinkler contractor shall furnish and install the entire fire protection system, from the connection to the site water supply to the final installation of each sprinkler head.
- B. It shall be a specific requirement that insofar as possible, all sprinkler system mains and branches shall be installed as close as possible to the structural steel members.
- C. All piping for all systems shall be coordinated with lighting fixtures, air conditioning ducts, piping and air handling unit. Sprinkler heads shall be located as closely as possible to the center of the ceiling tiles aligned with adjacent light fixtures. Final exact locations shall be verified with the Architect upon shop drawing submittal, and immediately prior to installation. Any head installed closer than 3" to the ceiling grid will be relocated at no additional cost to the Owner. All mains, branches, etc., shall be hydraulically designed and sized such that an additional 20% heads may be added without increasing the sizes of the mains and branch lines.
- D. The system shall be designed to provide the densities per NFPA 13, or as scheduled on the drawings.
- F. The system shall be designed and installed in accordance with the requirements of NFPA 13, NFPA 14, NFPA 24, NFPA 231C, NFPA 20, City of Webster, Texas Building Codes, and the shop drawings and calculations must be reviewed and approved by all governing authorities, City of Webster, Texas Fire Department and Building Department before any work is commenced at the jobsite.
- G. The contractor shall provide and install quick response sprinkler heads in the smoke compartments, as required by the State of Texas Hospital Code. The installation shall be in accordance with NFPA 101-1991 Edition and NFPA 13 Applicable Edition and other

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

appropriate NFPA Standards. Contractors shall prepare a drawing showing the areas in which the quick response sprinkler heads will be installed for review and approval before any work is commenced.

- H. The shop drawings shall show the existing system sprinkler head locations, piping sizes and elevations, the adding of sprinkler heads, elbows, piping and those items listed in NFPA Chapter 6 pertaining to the design of the system.
- I. Sprinkler piping and all components including, fittings, couplings, valves, alarm devices, etc. are specified to meet minimum pressure requirements or 175 PSI. Where system pressure will exceed 175 psi provide pressure reducing valves or material, which are listed for pressures higher than 175 psi.
- J. Sprinkler contractor shall provide sprinkler protection in elevator machine rooms, hoistways and pits conforming to State of Texas Elevator Code and local building code requirements. The sprinkler heads within the elevator machine room and hoistways shall be supplied from a common sprinkler branch line that will serve only these spaces. A shutoff valve with tamper switch shall be provided on sprinkler branch line in accessible locations outside these spaces. For shutdown of power to the elevator upon or prior to the applications of water in the machine room or hoistways, a detection system shall be provided. Coordinate the type of detection system to be used with electrical contractor for compatibility.
- K. The sprinkler contractor shall design a hydraulically automatic sprinkler system to provide a density for the following areas:
 - 1. Light Hazard Areas, 0.15 gpm/sq. ft. over the most remote 2000 sq. ft., using 165 degree F rated sprinkler heads.
 - 2. Ordinary Hazard Areas, 0.20 gpm/sq. ft. over the most remote 2000 sq. ft.,

1.3 WORK EXCLUDED

- A. Painting of exposed sprinkler system piping, controls, valves, etc., shall be accomplished under the work of the Painting Section.
- B. Caulking and sealing of sleeves for piping through floors and walls shall be included under the scope of the work of Caulking and Sealing. The installation of all sleeves, regardless of location, and the insulation of sprinkler system lines passing through insulated walls and partitions shall be in this section of the work as specified hereinafter.

1.4 CODE REQUIREMENTS AND STANDARDS

- A. All aspects of design, installation and equipment shall conform in all respects to the rules, regulations and requirements of the current standards of National Fire Protection Association (NFPA), Underwriter's Laboratories, the City of Webster, Texas codes.

1.5 SHOP DRAWINGS AND APPROVALS

- A. The fire protection subcontractor shall prepare complete shop drawings and submittal data shall be submitted specifically for, but not limited to, the following items: sprinkler heads, valves, pipe, pipe hangers and couplings, hose valves and accessories, and fire department connections with dimensional working drawings for the entire installation. Shop drawings and

working drawings shall indicate all ductwork and shall be coordinated with the mechanical contractor to prevent conflicts.

- B. Provide submittal data for sprinklers, valves, pipe, pipe hangers, couplings, siamese connections, water flow switchers, tamper switches, hose valves, roof manifold, fire pump, flow meter system, jockey pump and test header.
- C. The automatic sprinkler subcontractor shall first submit to the Architect for approval of the basic agreement and layout, hydraulic calculations and such submittal will be noted for corrections or changes if required, submit in four (4) copies. The corrected drawings shall then be submitted by the subcontractor to the above listed code authorities, agencies and the City of Webster, Texas. Upon securing written approval of these agencies, submit to the Architect five (5) copies of all drawings, stamped as approved, by each of the agencies.

1.6 APPROVED MANUFACTURERS

- A. All materials and equipment furnished under this Section shall be new, manufactured in the United States and listed by Underwriter's Laboratories, Inc. (UL), Factory Mutual (FM). Approved manufacturer for fire department hose valve, fire department siamese connection, roof manifolds and similar fire protection equipment shall be Elkhart, Potter Roemer, Viking and other approved equal.
- B. Approved manufacturers for other valves and appurtenances shall be Crane Company, Milwaukee, Kennedy, Grinnell, Nibco and Stockham or other approved equal.
- C. Approved manufacturers for sprinkler heads, alarm valves, water motor gongs and related equipment shall be Tyco and Viking or other approved equal
- D. Approved manufacturers for tamper switches and signaling devices shall be Notifier, Potter, and other approved equal.

1.7 WET PIPE SYSTEM

- A. Connect the fire service line as indicated on the Drawings and extend piping as shown.
- B. Secure the services of a skilled and experienced Sprinkler System Contractor, licensed in this field, to prepare complete Drawings for the sprinkler and standpipe systems; to secure the approval of the Architect, before starting work; and finally to make the installation.

1.8 PRE-ACTION PIPE SYSTEM

- A. Provide a double interlocked pre-action system in the building as indicated on the drawings. The double interlocked pre-action system shall utilize a heat sensor detector system and smoke detector system.
- B. All work shall conform with all applicable provisions of NFPA Standard 13

1.9 WATER SUPPLY

- A. For the purpose of system design obtain a current (within the last twelve months) flow test.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. The materials as scheduled and/or herein- after listed shall be used in fabricating piping systems. Where material changes occur, install suitable adapters to provide tight sealing joints. Where multiple choices of materials are listed, only one shall be used, except by special permission.
- B. Interior Fire Protection Lines: All pipe used for fire protection standpipe and sprinkler systems shall be Schedule 40 black steel pipe. This pipe shall, in every detail, conform to Standard Specifications for Welded and Seamless Steel Pipe ASTM Designation: A-53. Grooved coupling and fittings shall be rated at 300 PSI as manufactured by Victaulic Company of America. Contractor shall not mix manufacturer of grooved products.
- C. Exterior Fire Protection Lines: Cast iron or ductile iron water pipe and fittings, cement lined, assembled using mechanical joints, or bell and grooved spigot end push-on joints with rubber gaskets in accordance with NFPA.

2.2 FIRE HOSE VALVES

- A. Fire hose valves shall be a 2-1/2-inch angle valve with 2 ½" x 1 ½" reducer, cap and chain. Potter-Roemer Fig. 4065.
 - 1. Where valve is installed without a cabinet, it shall be mounted on a stub out from the fire protection riser.
 - 2. Where valve is installed in a cabinet, the cabinet shall be for recessed installation. Potter-Roemer Fig. 1810 series, style and door as selected by the Architect.
- B. Identification: Laminated plastic plate with legend "FIRE DEPT. VALVE" incised through one color into a second color background shall be attached to exterior of cabinet door containing valve, and in the case of exposed valves, to adjacent wall.

2.3 SIAMESE FITTINGS (FREE STANDING)

- A. The sidewalk siamese fittings shall be equal to Potter-Roemer 5760 Series Four Way 2-1/2-inch x 2-1/2-inch x 2-1/2-inch x 2-1/2-inch x 4-inch size, chrome plated, 18-inch upright chrome plated tubular sleeve with escutcheon, front plate with raised lettering, and chrome plated caps attached with substantial chains. Lettering on head shall read "STANDPIPE AND AUTO. SPRKR."
- B. Threads shall be per the local fire department standard.

2.4 SIAMESE FITTINGS (FLUSH TYPE)

- A. The wall siamese fittings shall be equal to Potter-Roemer 5020 series Four Way 2-1/2-inch x 2-1/2-inch x 2-1/2-inch x 6-inch size, chrome plated, flush type and escutcheon, front plate with raised lettering, and chrome plated caps attached with substantial chains. Lettering on head shall read "STANDPIPE AND AUTO. SPRKR."

- B. Threads shall be per the local fire department standard.

2.5 ELECTRIC FIRE PUMP

- A. Where scheduled, the fire pump shall be a horizontally split-case bronze-fitted centrifugal pump mounted on the same baseplate with and driven through a flexible coupling by a squirrel cage induction motor. Unit shall be complete with all controls, valves and accessories such as splash guard, suction and discharge pressure gauges, air relief, casing relief valve, and closed loop fire pump test meter assembly. In addition to the above listed trim, all other trim shall be provided as necessary to comply with UL and associated Factory Mutual requirements, as well as NFPA Pamphlet 20.
- B. The unit shall be as scheduled on the Drawings. Total dynamic head at shutoff shall not exceed 120% of total dynamic head at rating point. Power input shall not exceed the nominal motor nameplate horsepower at any condition of loading. Provide a "power failure" alarm.
- C. Pump casing shall be designed for 250 PSIG working pressure. Impeller shall be hydraulically balanced. Renewable bronze casing and impeller wearing rings and stainless steel shaft sleeves shall be provided. Packing glands shall be bronze with stainless steel gland bolts.
- D. Fittings: Provide the following accessory fittings or pressure rating matching suction or discharge ratings as scheduled:
 - 1. Eccentric tapered suction reducer.
 - 2. Concentric tapered discharge increaser.
 - 3. Hose valve test head.
 - 4. Hose valves with caps and chairs.
 - 5. Pump casing relief valve.
 - 6. Automatic air release valve.
 - 7. Ball drip valve.
 - 8. Suction and discharge pressure gauges.
- E. Motor shall be open drip-proof, NEC Code Letter D, 480-volt, 3-phase, 60-Hertz. Motor shall utilize Y-Delta reduced voltage starter. Provide motor with phase reversal alarm.
- F. Provide in the pump discharge line connections for 2 pump pressure control lines. Run from these connections Type L hard copper control lines to the pressure controls.
- G. Provide on the pumping assembly an Ellison or equivalent, Factory Mutual approved closed loop fire pump test meter assembly for testing performance of the pump. It shall be arranged as shown and as recommended by its manufacturer. It shall essentially consist of a venturi and mercury manometer or dial pressure gauge, together with all required valves, and shall be equipped with a pump discharge thermometer.

- H. Provide a fire pump controller, UL listed, for both automatic and manual starting and stopping of the fire pump. The fire pump controller shall be complete with an automatic transfer switch, which shall have a mechanically held double throw switch. The switch shall be energized electrically and mechanically to prevent both services from simultaneously feeding the load. The transfer switch shall be capable of manual operation. The controller shall be equal to Metron Model No. M300 or M435 coordinate with starter type, with a Metron MTS automatic transfer switch or approved equal to Firetrol, Master Control System, Inc. or Sylvania.
- I. Pump shall be as scheduled on the Drawings, approved equal of Aurora Pump, or Peerless make.
- J. Provide a remote alarm panel in the Fire Command Room for the fire pump, similar to the Metron 1701B, and as per NFPA 20.
- K. Fire pump controller shall be microprocessor type Wye-Delta open transition start type.

2.6 ALARM VALVE ASSEMBLY

- A. The alarm valve assembly shall consist of a service shutoff valve, a clapper type main check valve, an auxiliary seat (alarm outlet), a retarding chamber, an electric circuit closer, gauges, check valves, gate valves, globe or angle valves, cocks, etc.

2.7 SPRINKLER HEADS

- A. All heads in areas provided with suspended ceilings shall be adjustable royal flush concealed with white cover plates similar to Tyco arranged insofar as possible to pattern with air diffusers, grilles and lights. Where practicable they shall be centered in lay-in ceiling panels.
- B. Sprinkler heads non-finished areas such as elevator shafts, mechanical equipment rooms, electrical rooms, janitors closet, etc. shall be chrome plated brass pendent or upright, similar to Tyco heads in areas without ceilings shall be of the upright type.
- C. Sidewall type heads shall be chrome plated brass similar to Tyco
- D. Furnish a wall mounted cabinet, where directed, containing a supply of sprinkler heads of the same types installed and suitable sprinkler head wrenches. Provide a separate cabinet for each style sprinkler head (six) min. on the project.
- E. Sprinkler heads shall be of the temperature rating as required by NFPA and in elevator equipment rooms at the top of hoistways shall have a temperature rating of 200°F, based on power shutdown by a 175°F. heat detector. Coordinate with the fire alarm system.

2.11 PUMP TEST FLOW METERS

- A. General: Provide pressure differential type designed for insertion into the pipeline.
- B. Meter: Unit shall be furnished complete with required valves, manifolds, flow indicators and conversion charts. Capacity shall be equal to a minimum of 150% of rated pump capacity.

- C. Manufacturer: Subject to compliance with requirements, provide pump test flow meters of one of the following or approved equal.
 - 1. General Signal Fire Flow
 - 2. Eagle Eye by Dieterich Standard
 - 3. Gerand

2.12 IDENTIFICATION TAGS

- A. General: All controls, drain, test alarms and alarm valves shall be provided with identification signs as required by NFPA.

2.13 ELECTRIC ALARM GONG

- A. Electric alarm bell on exterior minimum 8 ft above grade, connected to flow switch on incoming water.

2.14 FLOW SWITCHES

- A. Provide an approved flow switch in each sprinkler system connection serving each sprinkler zone. Switches shall be suitable for connection into the fire alarm system.

2.15 MONITOR SWITCHES

- A. Each manual sectionalizing valve and/or shutoff valve in the standpipe and sprinkler system shall be provided with an approved valve monitoring switch to indicate whether the valve is open or closed. Wiring from switches to the fire alarm system will be done under Division 16. The switch shall give a tamper indication if removed from its mounting or the housing cover is removed; it shall signal an alarm when the valve position is altered.

2.16 ROOF MANIFOLD

- A. Potter-Roemer 5875 Series cast brass horizontal roof manifold complete with 3 No. 17OU 2-1/2-inch UL listed angle valves or for low roofs No. 177U pressure restricting angle valve. Threads to meet local fire department specifications shall be 2-1/2-inch by 2-1/2-inch by 2-1/2-inch by 4-inch.
- B. In addition to each location, provide a monitored indicating valve in the conditioned space below and extend an operator up through the roof. Provide a separate valve to drain down the water trapped in the piping in the unconditioned space.

2.17 SPECIAL VALVES

- A. General: Provide valves, UL listed/FM approved, in accordance with the following. Provide sizes and types which mate and match, piping and equipment connections.
- B. Alarm Check Valve: Provide cast-iron water flow alarm check valve, 175 psi working pressure.

- C. Fire Hose Valve: Hose valve for Fire Department use where pressure is 100 psi or higher shall be Zurn Z-3000 pressure - Tru valve, bronze body, UL listed, 2-1/2" male outlet reducer with cap and chain. Thread to fit Fire Department.
- D. Floor Control Valve: Valve for sprinkler service (where pressure is less than 100 psi) shall be equal to Milwaukee #BB-SC100 bronze body, stainless steel disc and stem with temperature -30EF to 350EF rating UL listed.
- E. Drains: The sprinkler system shall be provided with complete drainage facilities as indicated and in accordance with NFPA No. 13.

2.18 PRE-ACTION VALVE

- A. Provide a double interlocked pre-action system for vertical installation, the reaction valve shall be equipped to give a local low air pressure signal at 65 percent of the normal air pressure carried in the system.
- B. Provide standard trimmings including priming connection, water and air pressure gauges, pressure switches, low pressure alarm switch, priming water level test facilities, alarm testing by-pass, acceleration and all necessary pipe, fittings, pre-action control panel, electric release system, and accessories required to provide a complete installation.

2.19 AIR SUPPLY

- A. Air supply shall be provided for each dry pipe valve from an air compressor as required to meet the requirements of NFPA-13.
- B. The air supply shall be automatically maintained by a restriction plate with a 1/8 inch orifice installed in the air supply line near each dry pipe valve, and a 1/2 inch by-pass, installed around the restriction plate. Component parts required shall be interconnected by using such pipe, fittings, valves, gauges and equipment as are necessary to provide a complete and operating system.
- C. The compressor shall be single stage, air cooled type, designed to maintain the required pressure on the dry pipe system, similar to ITT.
- D. The motor shall be capable of operating the compressor at rated capacity continuously without exceeding the nameplate rating, and shall be provided with thermal overload protection.
- E. Drum drips shall be installed in accordance with NFPA-13.

PART 3 - EXECUTION

3.1 PUMPS AND STARTERS

- A. Each pump and the starter for the Fire Pump shall be mounted on a 6-inch high base. The starter for the jockey pump shall be wall mounted.

3.2 PIPE SYSTEMS

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

- A. The location of major supply mains, risers, fire pump, siamese fittings, fire hose valve cabinets, etc., are shown on the Drawings.
- B. Except for piping in Mechanical Equipment Rooms and unfinished spaces, run all piping concealed where possible. Coordinate locations of piping in ceiling spaces with the work of all other trades.
- C. In the line to the siamese provide a check valve with automatic ball drip, discharge to nearest floor drain.
- D. In the discharge from the fire pump install the Alarm Valve Assemblies.
- E. On the exterior of the building, where noted, install the alarm gong.
- F. All valves shall be supervised.
- G. The sprinkler lines shall be connected into the fire protection main and/or to standpipe risers serving fire department valves as indicated. Each line shall have a pressure restricting isolating valve and a flow switch.
- H. The location of each sectionalizing valve, where the valve is above the ceiling, shall be identified by an incised legend "FIRE PROTECTION VALVE" cut into a laminated plastic plate. The plate shall be affixed to the underside of the ceiling assembly as near as possible to the valve.
- I. Provide all sleeves, regardless of location. Insulate sprinkler piping that passes through insulated walls or partitions.
- J. Install freestanding siamese connection on a concrete pad.
- K. Installation of piping and supports shall be as described in Section 15050, including methods of fabrications, grading and other procedures described therein. The installation shall also be in conformity with the requirements of NFPA Standard No. 13, the requirements of the International Fire Code and City of Webster, Texas Codes and Ordinances.
- L. Where possible, drains shall be piped to floor drains or hub drains and discharged into the drainage system. Drains, which must discharge through the side of the building, shall be located so as not to strain the building or cause water damage. Obtain approval from the Architect before installing any drain piping through exterior walls.

END OF SECTION

SECTION 15705 - REFRIGERANT PIPING SYSTEMS

PART 1 - GENERAL

1.1 EXTENT OF WORK

- A. Related work and materials are specified under Section 15010, General Provisions; Section 15050, Basic Materials and Methods, and other appropriate sections of this Division.
- B. This Section of the Specifications pertains to all other labor, material, equipment, and service necessary for and incidental to the refrigerant piping systems as shown on the Drawings and/or specified herein.

PART 2 - MATERIALS

2.1 PIPING

- A. Refrigerant piping shall be American manufactured type "ACR" copper pipe manufactured in accordance with ASTM B88 and ANSI BP.1 refrigeration industry standards. Fittings shall be wrought copper pressure type and elbows shall be long radius type. Pipe and fittings shall be assembled with silver brazing and purged with nitrogen during brazing. Piping shall be installed to allow for expansion and contraction; using offsets, swing joints, etc. as shown and/or required to prevent undue strain on the piping.
- B. Utilize Anaconda metal hose vibration eliminators as required and/or as indicated on the drawings. Use synthetic covered vibration eliminators when condensation and/or freezing of the moisture on the outside can be a problem.
- C. Utilize Hydra-Zorb cushion clamp assemblies for fastening the pipes to brackets or supports.
- D. All suction piping to be insulated, and liquid piping exposed to the sunlight shall be insulated. If Armaflex insulation is used, two coats of Armaflex Finish is required for combating deterioration due to ultraviolet rays.

2.2 ACCESSORIES

- A. Solenoid and valve shall be R/S Flo-Con Sporlan.
- B. Filter-driers shall be Sporlan replaceable core "catch-alls".
- C. Sight glass shall be Sporlan "see-all".
- D. Auxiliary side connections shall be required for hot gas bypass and shall be Sporlan, and installed between the orifice and the distributor.
- E. Thermostatic expansion valves with 10 degrees superheat shall be Sporlan and sized and selected for use with the evaporator served at the design operating pressure.
- F. Suction line accumulators shall be equal to Model S-7400 as manufactured by AC&R

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

Components, Inc. Provide heating elements for low ambient temperatures or in low temperature applications.

- G. Shut-off, check, solenoid and relief valves shall be as manufactured by the Henry Valve Company.
- H. Oil separators shall be energy conserving, high efficiency type as manufactured by AC&R Components. Provide heating elements for low ambient temperatures or in low temperature applications.
- I. Discharge line mufflers for eliminating pulsations in the compressor discharge lines shall be as manufactured by AC&R Components.

PART 3 - EXECUTION

3.1 PIPING

- A. Piping shall be installed as described in Section 15050.
- B. Piping shall be provided with vibration eliminators to eliminate vibration and noise transmission to the structure.
- C. Refrigerant piping systems shall be properly tested to a nitrogen pressure of 450 psig per square inch gauge for a period of not less than 8 hours. During this test period, all leaks in the system being tested shall be stopped and the pressure test shall be applied again. Repeat tests until there are no leaks. After leak tests, dehydrate system by "pulling a vacuum" on the system. Use a manometer and "pull" the system to at least 500 micron for approximately eight (8) hours.

END OF SECTION

SECTION 15803 - AIR COOLED DX EQUIPMENT

PART 1 – GENERAL

1.1 EXTENT OF WORK

- A. Related work and materials are specified under Section 15010, General Provisions; Section 15050, Basic Materials and Methods, and other appropriate Sections of this Division.
- B. This Section of the Specifications pertains to all other labor, material, equipment, and service necessary for and incidental to the equipment as scheduled and/or shown on the Drawings and/or specified herein.
- C. Furnish and install air treating and handling equipment as shown and scheduled. Included shall be air conditioning units, fans, compressors, heating sections, coils, filters, motors and drivers, mounting bases and supports and other materials.

PART 2 – PRODUCTS

2.1 FAN COIL UNITS (DX/ELECTRIC)

- A. Cabinet shall be fabricated of galvanized steel with removable panels for installation and maintenance. The entire interior of the cabinet shall be insulated with one (1) inch thick glass fiber neoprene insulation.
- B. The coils shall be copper tubes with aluminum fins.
- C. The drain pan shall be galvanized metal and fully insulated to eliminate condensate from forming.
- D. Fan wheels shall be of the forward curved blade centrifugal type with double inlet and mounted on a solid steel shaft. Motors shall be equipped with PSC and multi-speed taps.
- E. Fan-coils shall be furnished with 2" thick Farr 30/30 filters. (Refer to paragraph 2.1.)
- F. Capacity and locations shall be indicated on the drawings.
- G. Provide electric heating coil as scheduled and in accordance with paragraph 2.2 of this Section.
- H. Units shall be McQuay, Carrier, Trane, York or Enviro-Tec.

2.2 AIR COOLED CONDENSING UNIT

- A. Furnish and install where indicated on plans air-cooled condensing units. The unit shall contain sufficient refrigerant for complete system and be equipped with refrigerant line fittings which permit mechanical or sweat connection. Brass service valves with fittings and gauge ports shall be located on exterior of unit.
- B. Compressor shall be of the welded hermetic type with internal vibration isolation and be located in an isolated section of unit. Warranty shall be standard one year and labor and

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

extended warranty of four years for the compressor.

- C. Controls shall be factory wired and placed in a location readily accessible from top of unit. Compressor motor shall have both thermal and current sensitive overload devices.
- D. Condenser shall be constructed with aluminum fins mechanically bonded to nonferrous tubing. Condenser fan shall be propeller type, direct driven, and arranged for vertical air discharge. Fan motor shall be factory lubricated, totally enclosed and inherently protected.
- E. Units shall include crankcase heater, low ambient control 0°F, anti-cycle time delay relay, Indoor Fan Relay, Thermostat with auto mode changeover and Subbase, Low-Voltage Transformer, Liquid-Line Filter Drier, Suction Accumulator, and Suction Line Connection Adapter.
- F. Compressor discharge line to be fitted with "T" stub fitting for the hot gas by-pass valve factory or field installation.
- G. Capacity of units shall be as scheduled on the drawings. Units shall be Carrier, Trane, York, Lennox, or McQuay.

PART 3 – EXECUTION

- 3.1 Horizontal fan-coil and heat pump units to be hung from the structure above utilizing threaded steel rods attached to unit brackets or angle iron trapeze member. See section 15161 for Vibration Isolation Requirements.

END OF SECTION

SECTION 15990 - TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General Conditions, Amendments to the General Conditions, and Division-1 Specification sections, apply to work of this section.
- B. Section 15050 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. Scope of Work: Contractor shall balance adjust, and test air moving equipment herein specified.
- B. Work Included:
 - 1. Adjusting blower, fans, and ducts to deliver, relief or exhaust design CFM.
 - 2. Adjusting blowers and fans to design rpm.
 - 3. .

1.3 CONDITIONS

- A. System Operation: Heating, ventilating, air conditioning equipment including filters, shall be completely installed and in continuous operation as required to accomplish the adjusting and balance work specified.

1.4 SUBMITTALS

- A. Data Sheets: Submit typewritten data sheets on each item of testing equipment to be used. Included name of devices, manufacturer's name, model number, latest date of calibration, and correction factors.
- B. Report Forms: Submit specimen copies of report forms. Forms shall be 8-1/2" - 11" paper for loose-leaf binding, with blanks for listing of the required test ratings and for certification of report.
- C. Final Report: Upon completion, all information shall be neatly typed and five (5) copies submitted to the Owner with accompanying schematic diagrams of systems tested. All test reports shall be assembled, indexed, and submitted in vinyl covered loose-leaf notebooks with project name and balancing Contractor's name permanently printed thereon.

1.5 MEASUREMENTS

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

- A. Readjustments: Should corrective measures caused by faulty installation require retesting, adjusting and balancing, such work shall be at no additional expense. Corrective measures, other than those already listed, shall be made only as directed by the Architect/Engineer and Owner in writing and shall be covered by Change Order at an agreed amount before corrective work is done.

PART 2 - PRODUCTS

2.1 INSTRUMENTS

- A. Quality: The minimum instrumentation for testing, adjusting, and balancing shall be the "AABC Approved Minimum Field Instrumentation." Instruments used for testing and balancing must have been calibrated within a period of six (6) months and checked for accuracy prior to start of work. Instruments must be maintained and carried in such manner to protect them from excessive vibration and moisture conditions.
- B. Approval: All products and instrumentation used shall be subject to approval of the Architect/Engineer.

PART 3 - EXECUTION

3.1 PROCEDURES

- A. Performing, Testing, Adjusting, and Balancing. The specified systems shall be reviewed and inspected for conformance to design documents. Perform testing and balancing on each system identified, in accordance with the detailed Procedures developed by AABC. The accuracy of measurements shall be in accordance with AABC National Standards and Procedures. Adjustment tolerance shall be $\pm 10\%$ unless otherwise stated.
- B. Utilize minimum openings necessary to allow adequate performance of procedures. Air test drilled duct openings shall be sealed with plugs to allow future access. Mark equipment settings, including manual damper quadrant positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with waterproof marker or other suitable, permanent identification materials.

3.2 PREPARATION

- A. Air Systems: Prior to system testing and balancing:
 - 1. Verify that the appropriate Contractor has:
 - a. Checked all systems and placed them into a fully operational status.
 - b. Cleaned all air filters or installed new ones as required.
 - c. Checked temperature and system controls for proper operation.
 - d. Checked fan rotation for proper operation.

3.3 SYSTEM BALANCE

- A. Air Systems: Perform the following minimum tests and balance:

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

1. Test and adjust supply, return, and exhaust fans to within $\pm 10\%$ of design requirements. Change sheaves and belts as required to obtain design air quantities. Sheaves and belts to be furnished by others.
2. Test and record motor electrical characteristics, R.P.M., service factor, measured voltage, full load amperes and connected load amperage. Check and record starter heater (s) sizes and rating, replacing belts sizes, etc.
3. Test and adjust system for design CFM recirculated air.
4. Test and record entering air temperatures. (D.B. heating and cooling).
5. Test and record entering air temperatures. (W.B. cooling).
6. Test and record leaving air temperatures. (D.B. heating and cooling).
7. Test and record leaving air temperatures. (W.B. cooling).

3.4 RECORD DATA

- A. Air Systems: Record the following minimum data:
1. CFM delivery and RPM of blowers and fans.
 2. All equipment nameplate data.
 3. Actual running current and voltage of fan motors.

END OF SECTION

SECTION 16051 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

- A. The requirements contained in this Section apply to all Section of this Division.
- B. Section Includes:
 - 1. Common terminology and requirements used throughout this Division.
 - 2. Requirements for Acceptance Testing Agency.
 - 3. Requirements for Manufacturer Seismic Qualification Certification.
 - 4. Requirements for Professional Engineers responsible for Delegated Design.
 - 5. Electrical equipment coordination and installation.
 - 6. Sleeves for raceways and cables.
 - 7. Sleeve seals.
 - 8. Grout.
 - 9. Common electrical installation requirements.

1.2 DEFINITIONS

- A. AHJ: Authorities Having Jurisdiction.
- B. ANSI GRAY: Where this Section and other Sections of this Division use the term "ANSI GRAY" it shall mean the manufacturer's standard ANSI Gray.
- C. Bound Material: Bound refers to materials permanently bound, as by stitching or glue, or materials securely fastened in their covers by multiple fasteners that penetrate all papers. Ring binders, spiral binders, brads and screw posts are acceptable fasteners. Loose papers clipped together or stapled at one corner are not acceptable.
- D. Business Day: Where this Section and other Sections of this Division use the term "Business Day" it shall mean Monday thru Friday, excluding Holidays recognized by Federal, State and Local government.
- E. EPDM: Ethylene-propylene-diene terpolymer rubber.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

COMMON WORK RESULTS
FOR ELECTRICAL

- F. NETA ATS: Acceptance Testing Specification, as published by InterNational Electrical Testing Association.
- G. NBR: Acrylonitrile-butadiene rubber.
- H. NIST: National Institute of Science and Technology

1.3 PERFORMANCE REQUIREMENTS

- A. The Drawings diagrammatically show the sizes and locations of various equipment and devices, and the sizes of the major interconnecting wires, without showing exact details as to elevations, offsets, control wiring and other installation requirements. Carefully layout the Work at the site to conform to the architectural and structural conditions, to avoid obstructions and to permit proper grading of pipe associated with other portions of the Work. In cooperation with other trades, determine the exact location of equipment and devices and connections thereto by reference to the submittals and rough-in drawings, and by measurements at the site. Make minor relocations necessitated by the conditions at the site, or directed by the Owner, without additional cost to the Owner.

1.4 SUBMITTALS

- A. Common Requirements for Product Data: Where this Section and other Sections of this Division require Product Data to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures". In addition to the requirements of Division 01 comply with the following:
 - 1. Submit hardcopy of Product Data in the quantity as required under Division 01 Section "Submittal Procedures". Hardcopies of product data submittals shall be bound materials as defined above. Separate products under distinct subheadings that correspond to paragraphs in specification text. Divide sections in binder with labeled divider tabs.
 - 2. In addition to hardcopies required by Division 01, submit one copy of product data in electronic format on CD or DVD. Files contained on disc shall be named to correspond to the tabs contained in the hardcopy three-ring binder. All files on disc shall be in Portable Document Format (.pdf).
 - 3. Product Data shall not consist of manufacturer's catalogs or cut sheets that contain no indication of the exact item offered. The submission on individual items shall designate the exact item offered.
- B. Product Data: Submit product data for each of the following.
 - 1. Sleeves.
 - 2. Sleeve seals.
 - 3. Grout.

- C. Common Requirements for Shop Drawings: Where this Section and other Sections of this Division require Shop Drawings to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures". In addition to the requirements of Division 01 comply with the following:
1. Prepare Shop Drawings using computerized drafting software compatible with AutoDesk's AutoCAD®.
 2. Submit hardcopy of Shop Drawings in the quantity as required under Division 01 Section "Submittal Procedures". Hardcopies of Shop Drawings shall have each sheet clearly labeled with a unique sheet identification number.
 3. In addition to hardcopies required by Division 01, submit one copy of Shop Drawings in electronic format on CD or DVD. Files contained on disc shall be named to correspond with the sheet names contained in the hardcopy set. Files on disc shall include both AutoCAD® compatible source files and files printed to Portable Document Format (.pdf).
 4. Shop Drawings shall be of appropriate scale but shall not be smaller than a scale of 1/4-inch equals one foot.
- D. Common Requirements for Coordination Drawings: Where this Section and other Sections of this Division require Coordination Drawings to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures" and Division 01 Section "Project Management and Coordination". In addition to the requirements of Division 01 comply with the following:
1. Prepare Coordination Drawings using computerized drafting software compatible with AutoDesk's AutoCAD®. Drawings files must be composite with multiple distinctive layers for each of the various trades.
 2. Submit hardcopy of Coordination Drawings in the quantity as required under Division 01. Hardcopies of Coordination Drawings shall have each sheet clearly labeled with a unique sheet identification number.
 3. In addition to hardcopies required by Division 01, submit one copy of Shop Drawings in electronic format on CD or DVD. Files contained on disc shall be named to correspond with the sheet names contained in the hardcopy set. Files on disc shall include both AutoCAD® compatible source files and files printed to Portable Document Format (.pdf).
 4. Coordination Drawings shall be of appropriate scale but shall not be smaller than a scale of 1/4-inch equals one foot.
 5. Coordination Drawings shall be multi-color prints with each system printed in a separate and unique color.
- E. Coordination Drawings: Prepare drawings showing dimensioned layout for the following:

1. Penetration and Structural Opening: Floor plans showing sleeves and formed structural penetrations. Show sleeve and formed penetration layouts and relationships between structural components and other adjacent building elements, including but not limited to pre-tensioning and post-tensioning members where used.
2. Reflected Ceiling Plans: ceiling plans, sections, and other necessary details showing dimensioned layouts for equipment located in or on the ceiling plane. Base dimensions on exact dimensioned data obtained from product submittals for products to be included in the Work. Differentiate between field measurements and assumed dimensions. Include the following items coordinated with each other, based on input from installers of the items involved:
 - a. Revise subparagraphs and associated subparagraphs below to suit Project.
 - b. Suspended ceiling components.
 - c. Structural members to which suspension systems for luminaires will be attached.
 - d. Perimeter moldings, decorative ceiling elements, and Architectural features.
 - e. Luminaires.
 - f. HVAC Diffusers, Registers and Grilles.
 - g. Speakers.
 - h. Sprinklers.
 - i. Fire Alarm initiating devices, including but not limited to the following:
 - 1) Smoke detectors.
 - 2) Heat detectors.
 - 3) Flame detectors.
 - j. Fire Alarm notification appliances.
 - k. Occupancy sensors.
 - l. Access panels.
 - m. Security cameras and occupancy detectors.
 - n. Wireless Internet Access Points.
 - o. Nurse Call Zone and Dome Lights.
 - p. Patient Telemetry Receivers and Equipment.
3. Electrical Equipment Layouts: Floor plans, elevations, and other necessary details showing dimensioned layouts for spaces containing electrical equipment. Base electrical equipment dimensions on exact dimensioned data obtained from product submittals for products to be included in the Work. Differentiate between field measurements and assumed dimensions. Include the following items coordinated with each other, based on input from installers of the items involved:
 - a. Electrical equipment layout and relationships between components and adjacent structural and mechanical elements.

- b. Indication of required working clearances and required area above and around electrical equipment where pipes and ducts are prohibited.
 - c. Location of Conduit entry into electrical equipment.
 - d. Location of luminaires, sprinkler piping and heads, ducts, and diffusers.
 - e. Electrical equipment support locations, type of support, and weight on each support.
 - f. Location of structural supports for structure-supported raceways.
 - g. For floor mounted equipment: concrete base dimension, outline of equipment, and required clearances.
 - h. Location of structural supports for seismic bracing.
- F. Common Requirements for Specification Compliance Certification: Where this Section and other Sections of this Division require Specification Compliance Certification to be submitted, meet the requirements defined in Division 01 Section "Submittal Procedures" for "Other Informational Submittals". In addition to the requirements of Division 01 comply with the following:
- 1. Prepare a line-by-line Specification Compliance Certification by marking up a copy of the Contract Document specification section in the left margin. Accompany the markup with a written report explaining all items that are not marked with "Compliance". Submit line-by-line markup, written report of deviations and alternates and a cover letter certified by Manufacturer or Installer that prepared the Specification Compliance Certification. Use the following key for preparing the line-by-line markup.
 - a. "C" for Compliance: By noting the term "compliance" or "C" in the margin, it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
 - b. "D" for Deviation: By noting the term "deviation" or "D" in the margin, it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified.
 - c. "A" for Alternate: By noting the term "alternate" or "A" in the margin, it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner.
 - d. "N/A" for Not Applicable: By noting the term "not applicable" or "N/A" in the margin, it shall be understood that the specified item is not applicable to the project.
- G. Common Requirements For Qualification Data:
- 1. Professional Engineer Qualifications: Where this Section and other Sections of this Division require a Professional Engineer to be responsible for Delegated Design requirements; Submit Qualification data for Professional Engineer including, but not limited to, proof of registration in the Project location.
 - 2. Independent Testing and Inspecting Agency Certification: Where this Section and other Sections of this Division require an Independent Testing and

Inspecting agency to be responsible for Acceptance Testing and Field Quality Control requirements; Submit certification documentation for such agency that demonstrates compliance with the Quality Assurance paragraph of this Section.

3. Manufacturer Seismic Qualification Certification: Where this Section and other Sections of this Division require products to meet seismic requirements; Submit certification that equipment, devices, accessories, and components will withstand seismic forces defined in Division 16 Section "Vibration and Seismic Controls for Electrical Systems" Include the following:
 - a. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 1) The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - 2) The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

H. Qualification Data: For Independent Testing and Inspecting Agency.

1.5 QUALITY ASSURANCE

- A. Common Requirements for Independent Testing and Inspecting Agency Qualifications: Where this Section and other Sections of this Division call for an Independent Testing and Inspecting Agency (Testing Agency); the Testing Agency shall comply with the following requirements:
 1. Have the experience and capability to conduct the testing indicated,
 2. Be a member company of the InterNational Electrical Testing Association (NETA) or a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction and the Engineer-of-Record.
 3. Meet the Requirements of NETA ATS 3.0 including, but not limited to, the following:
 - a. Be an independent, third party entity which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems being evaluated.

- b. Be regularly engaged in the testing of electrical equipment devices, installations, and systems.
 - c. Use technicians who are regularly employed for testing services.
 - d. Have a "Full Membership" classification issued by the InterNational Electrical Testing Association meets the above criteria.
- 4. Testing Agency's Field Personnel: Technicians performing specified electrical tests and inspections shall meet the Requirements of NETA ATS 3.0 including, but not limited to, the following:
 - a. Technicians performing specified electrical tests and inspections shall be trained and experienced concerning the apparatus and systems being evaluated. These individuals shall be capable of conducting the tests in a safe manner and with complete knowledge of the hazards involved. They must evaluate the test data and make a judgment on the serviceability of the specific equipment.
 - b. Technicians shall be certified in accordance with ANSI/NETA ETT-2000, Standard for Certification of Electrical Testing Personnel. Each on-site crew leader shall hold a current certification, Level III or higher, in electrical testing.
- B. Common Requirements for Material Quality: Materials, equipment and devices shall be new and of the quality specified, and shall be free from defects at the time of installation. Materials, equipment and devices damaged in shipment or otherwise damaged or found defective prior to acceptance by the Owner shall be replaced with new materials, equipment or devices identical with those damaged, unless approved otherwise by the Owner in writing.
- C. Common Requirements for Code Compliance: In case where differences occur between building codes, state laws, local ordinances, industry standards, utility company regulations and the Contract Documents, the most stringent shall govern. Perform the following:
 - 1. Promptly notify the Architect in writing of any such difference.
 - 2. Obtain approval from Architect before proceeding with the Work.
 - 3. Should the Contractor perform any work that knowingly does not comply with local codes, laws and ordinances, industry standards, or other governing regulations; the Work shall be corrected at no cost to the Owner.
- D. Common Requirements for Compliance with AHJ Instructions: In cases where the Authority Having Jurisdiction requires deviations from the requirements of the Contract Documents, perform the following:
 - 1. Promptly notify the Architect in writing of any such difference.
 - 2. Obtain approval from Architect before proceeding with the Work.

- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 1. Wherever a UL standard has been established for a particular type of material, equipment or device, each item of such material, equipment or device provided shall meet the requirements of the UL standard.

1.6 PRODUCT SUBSTITUTIONS

- A. Comply with provisions of Division 01 Section "Product Substitution Procedures".
 - 1. If item of equipment or device offered as Substitution differs in dimension or configuration from that indicated in the Contract Documents, provide, as part of the substitution submittal, a drawing that shows that the equipment or devices proposed for Substitution can be installed in the space available without interfering with other trades or with access requirements for operations and maintenance in the completed project. Drawings shall be of appropriate scale but shall not be smaller than a scale of 1/4-inch equals one foot.
 - 2. Where substitute equipment or devices requires different arrangement or connections from that indicated in the Contract Documents, install the equipment or devices to operate properly and in accordance with the requirements of the Contract Documents. Make incidental changes necessary in piping, ductwork or wiring which results from the inclusion of the substitute equipment or device without any additional cost to the Owner. Pay all additional costs incurred by other trades in connection with changes required by the inclusion of the substituted equipment or device in the Work.

1.7 PROJECT CONDITIONS

- A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving large equipment into place. Where any piece of equipment is too large for ingress through normal building openings it shall be placed in its containing space before the enclosing structure is completed.
- B. Temporary Power: Where temporary power is required during the construction period, comply with ANSI/NECA 200 "Recommend Practice for Installing and Maintaining Temporary Power at Construction Sites."

1.8 COORDINATION

- A. In describing various materials, equipment and devices, in general each item may be described singularly, even though there may be a multiplicity of identical items. Also, where the description is general in nature, the exact sizes, duties, space arrangements, horsepower and other requirements must be obtained by reference to other portions of Contract Documents.
- B. Space allocations for materials, equipment and devices have been made on the basis of present and known future requirements and the dimensions of items of equip-

ment or devices of a particular manufacturer. Verify that all materials, equipment and devices proposed for use on this Project are within the constraints of the allocated space.

- C. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
 - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 - 3. To allow right of way for piping, ductwork and conduit installed at required slope.
 - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- D. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- E. Utility Service Coordination:
 - 1. Electrical Service: Coordinate the location of the electrical service entrance with the electric utility company and with other trades. Provide materials and equipment required to connect the electrical service.
 - 2. Telecommunications Services: Coordinate the location of the telephone, data, fiber, cable television and the entrance of other telecommunications services with the respective franchise utility company and with all other trades. Provide materials and equipment required to connect these telecommunications service.
- F. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- G. Coordinate sleeve selection and application with selection and application of fire-stopping specified in Division 07 Section "Penetration Firestopping."
- H. For roof-mounted equipment: Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

COMMON WORK RESULTS
FOR ELECTRICAL

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 3. Pressure Plates: Carbon steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 EXAMINATION

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

COMMON WORK RESULTS
FOR ELECTRICAL

- A. The Drawings do not indicate existing installations other than to identify modifications or extensions thereto. Visit the site and ascertain the existing conditions. Review construction details of the existing portion of the building during the site inspection. Include all work required to remove or modify portions of the existing installation in order to accommodate the new Work. Failure to comply with this will not be considered grounds for additional payment in connection with removing or modifying any part of the existing installation or installing any new or temporary work.

3.2 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. All materials, equipment and devices shall be installed in accordance with the recommendations of their manufacturer.
- B. Comply with NECA 1 - Standard Practices for Good Workmanship in Electrical Construction, as published by the National Electrical Contractors Association.
- C. Use licensed technicians skilled in their respective trades for installation of the Work.
- D. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items, unless otherwise indicated.
- E. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- F. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a manner as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- G. Right of Way: Give to piping systems installed at a required slope.
- H. Access Panels: Provide wall and ceiling access panels for unrestricted access to all concealed electrical equipment items and devices installed behind furrings, chases or non-removable suspended ceilings. Access Panel materials and installation requirements are specified in Division 08 Section "Access Doors and Frames."
- I. Installation Inspections and Certifications
 - 1. Obtain timely inspections of the installation by Authorities Having Jurisdiction. Remedy any deficiencies to the satisfaction of the inspecting official.
 - 2. Upon final completion of the Work, obtain certificates of acceptance from the Authorities Having Jurisdiction. Deliver the certificates to the Owner.

3.3 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

COMMON WORK RESULTS
FOR ELECTRICAL

- B. Concrete Slabs and Walls: Install sleeves where cable or conduit penetrations occur. Install sleeves during erection of slabs and walls.
 - 1. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Exception: Slab-on-grade construction shall not require sleeves or curbed formed openings when conduits or pipes that penetrate the slab-on-grade are installed and properly supported prior to the pouring of the slab.
- C. Masonry Walls: Install sleeves where cable or conduit penetrations occur. Install sleeves during erection of walls.
 - 1. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Coordinate sleeve selection and application with selection and application of fire-stopping specified in Division 07 Section "Penetration Firestopping."
- F. Non Fire-Rated Assemblies: Install sleeves where cable penetrations occur. Install sleeves during erection of walls.
 - 1. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- G. Cut sleeves to length for mounting flush with both surfaces of walls.
- H. Extend sleeves installed in floors a minimum of 2 inches (50 mm) above finished floor level.
- I. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise or unless seismic criteria requires different clearance.
- J. Seal space outside of sleeves with grout for penetrations of concrete and masonry.
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
 - 2. Apply approved joint compound for gypsum board assemblies where masonry or concrete wall is faced on interior side with gypsum board.
- K. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

- L. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- M. Roof-Penetration Sleeves: Seal penetration of individual conduits and cables with flashing units applied in coordination with roofing work. Provide flashing unit as specified in Division 07 Section "Sheet Metal Flashing and Trim".
- N. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- O. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.4 OPTION TO RELOCATE DEVICES

- A. The location of power, data and telephone outlets, wall switches and other similar devices along with their associated connections may be relocated at the Owner's option, at no additional cost to the Owner, to a point within 10 feet of their present location provided the Contractor is notified prior to rough-in or installation.

3.5 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 UTILITIES

- A. The location and voltage of electrical lines and the location of telecommunication lines included within the Work are indicated in the Contract Documents in accordance with information furnished by the Owner. Existing utility lines not indicated in Contract Documents but encountered during construction shall be protected, relocated or capped as directed by the Owner.
- B. Prior to excavation, examine the site and verify the location and elevation of all utilities and their relation to the Work. Identify and label all underground utilities occurring within the bounds of the area to be excavated. Contact the known utilities and engage a certified locator service to assist in this effort.
- C. Prior to excavation, contact the known utilities and inform them of excavation work plan. Proceed with excavation only after receiving approval from Utilities.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

COMMON WORK RESULTS
FOR ELECTRICAL

- D. All precautions shall be exercised to prevent damage to existing lines, but should work become necessary, it must be authorized prior to execution except in an emergency situation.
- E. Should damage result to any utility through the Contractor's negligence or failure to comply with the above directives, the Contractor shall bear the sole responsibility to correct such damage and shall be responsible for all expenses incurred in the expeditious repair or replacement of such damaged Utilities.
- F. Repair of damaged utilities shall be to a condition equal to or better than the adjacent undamaged portion of such utility and to the complete satisfaction of the Owner and respective Utility.

3.7 CONNECTIONS

- A. Mechanical Controls: Provide 120VAC power connections as required to components of Mechanical Control system. Coordinated quantity of circuits, connection requirements and locations between trades and with provisions of Division 15 sections.
- B. HVAC Terminal Boxes: Where the Drawings indicate a 120VAC circuit in a general area and labeled for terminal boxes (VAV, etc.), the intent is for this circuit to be extended and connected to the terminal box in that general area. Coordinate connection requirements and locations between trades and with provisions of Division 15 Sections and Drawings.
- C. Smoke Dampers: Where the Drawings indicate a 120VAC circuit in a general area and labeled for dampers, the intent is for this circuit to be extended and connected to the Smoke and Fire/Smoke dampers in that general area in coordination with the smoke control sequence. Coordinated connection requirements and locations between trades and with provisions of Division 15 Sections and Drawings.
- D. Security and Access Control: Where the Drawings indicate a 120VAC circuit in a general area labeled for security or access control use, the intent is for this circuit to be extended and connected to the security or access control device in that general area in coordination with other trades. Coordinated connection requirements and locations between trades and with Owner's Security vendor prior to installation.
- E. Motors and Motor Connections: Motors for driven equipment are specified in Division 15. Provide connections as follows, unless otherwise indicated:
 - 1. Equipment provided with factory installed disconnecting means: Upon installation of motor and associated equipment, Provide the electrical installation in accordance with approved wiring diagrams and manufacturer's written instructions.
 - 2. Equipment furnished with factory disconnecting means: Upon installation of motor and associated equipment, Install factory furnished disconnecting means and provide the electrical installation in accordance with approved wiring diagrams and manufacturer's written instructions.

3. Equipment not furnished with factory installed disconnecting means: Provide disconnect switch required in accordance with NFPA 70 or as indicated on the Drawings. Provide the electrical installation in accordance with approved wiring diagrams and manufacturer's written instructions.

F. Owner Furnished Equipment: Power Connections and Control wiring required for Owner Furnished Equipment may not be shown on the Drawings. This wiring shall be provided. Coordinated connection requirements and locations with Owner.

1. Request all rough-in documentation required for proper installation of the electrical work in ample time to permit preparation of the installation drawings.

3.8 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION

SECTION 16055 - OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for computer-based, fault-current and overcurrent protective device coordination studies. Protective devices shall be set based on Engineer's review of submitted results of the protective device coordination study.

- 1. Series-rated devices are not permitted.

1.2 PERFORMANCE REQUIREMENTS

- A. Overcurrent Protective Device Coordination: All overcurrent protective devices proposed for inclusion in the Work shall be selected to be selectively coordinated with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the branch circuit panelboard to open. This coordination shall be carried through each level of distribution for all branches of normal and emergency power.

1.3 SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 16 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.
- B. Simultaneous Action Submittals: The following action submittals shall be made in conjunction with the approval process for system protective devices specified in other Division 16 Sections. The following submittals shall be in digital form:
 - 1. Coordination-study input data, including completed computer program input data sheets.
 - 2. Study and Equipment Evaluation Reports.
 - 3. Coordination-Study Report.
- C. Product Data: For computer software program to be used for studies.
- D. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399.
- E. Qualification Data: For coordination-study specialist.

1.4 QUALITY ASSURANCE

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.
- B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
- C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.
- D. Comply with IEEE 399 for general study procedures.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

- A. Computer Software Developers: Subject to compliance with requirements, provide products by the following:
 - 1. SKM Systems Analysis, Inc.

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

- A. Comply with IEEE 399.
- B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate coordination by computer-generated, time-current coordination plots.
 - 1. Features to be included: A bolted faults
 - a. Arcing faults.
 - b. Simultaneous faults.
 - c. Zero-sequence Current.
 - d. Explicit negative sequence.
 - e. Mutual coupling in zero sequence.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

OVERCURRENT PROTECTIVE DEVICE
COORDINATION STUDY
SYSTEMS

1. Proceed with coordination study only after relevant equipment submittals have been assembled, but prior to their submission to the Architect. Coordination study shall accompany submission of relevant equipment submittals.

3.2 POWER SYSTEM DATA

A. Gather and tabulate the following input data to support coordination study:

1. Product Data for overcurrent protective devices specified in other Division 16 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Impedance of utility service entrance.
3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:
 - a. Circuit-breaker and fuse-current ratings and types.
 - b. Relays and associated power and current transformer ratings and ratios.
 - c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
 - d. Generator kilovolt amperes, size, voltage, and source impedance.
 - e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
 - f. Busway ampacity and impedance.
 - g. Motor horsepower and code letter designation according to NEMA MG 1.
4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
 - a. Special load considerations, including starting inrush currents and frequent starting and stopping.
 - b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
 - c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
 - d. Generator thermal-damage curve.
 - e. Ratings, types, and settings of utility company's overcurrent protective devices.
 - f. Special overcurrent protective device settings or types stipulated by utility company.
 - g. Time-current-characteristic curves of devices.
 - h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.

- i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
- j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

3.3 FAULT-CURRENT STUDY

- A. A short-circuit current ratings indicated in the Contract Documents are based on Fault-Current study prepared by the Engineer during design and are based on available information and anticipated feeder lengths. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system based on proposed feeder routing. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:
 1. Switchgear and switchboard bus.
 2. Medium-voltage controller.
 3. Motor-control center.
 4. Distribution panelboard.
 5. Branch circuit panelboard.
 6. Transfer Switch.
 7. Enclosed Fused Switch.
 8. Enclosed Circuit Breaker.
 9. Enclosed Bus Assembly, including at each plug-in unit.
- B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.
- C. Calculate momentary and interrupting duties on the basis of maximum available fault current.
- D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 241 and IEEE 242.
 1. Transformers, as appropriate for transformers included in the Work:
 - a. ANSI C57.12.10.
 - b. ANSI C57.12.22.
 - c. ANSI C57.12.40.
 - d. IEEE C57.12.00.
 - e. IEEE C57.96.
 2. Medium-Voltage Circuit Breakers: IEEE C37.010.
 3. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
 4. Low-Voltage Fuses: IEEE C37.46.
- E. Study Report:

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

OVERCURRENT PROTECTIVE DEVICE
COORDINATION STUDY
SYSTEMS

1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.

F. Equipment Evaluation Report:

1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

3.4 COORDINATION STUDY

A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.

1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
2. Calculate the maximum and minimum ground-fault currents.

B. Comply with IEEE 241 and IEEE 242 recommendations for fault currents and time intervals.

C. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:
 - a. Inrush current when first energized.
 - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
- c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

D. Motors served by voltages more than 600 V shall be protected according to IEEE 620.

E. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

OVERCURRENT PROTECTIVE DEVICE
COORDINATION STUDY
SYSTEMS

- F. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:
1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
 - a. Device tag.
 - b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
 - c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
 - d. Fuse-current rating and type.
 - e. Ground-fault relay-pickup and time-delay settings.
 2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
 - a. Device tag.
 - b. Voltage and current ratio for curves.
 - c. Three-phase and single-phase damage points for each transformer.
 - d. No damage, melting, and clearing curves for fuses.
 - e. Cable damage curves.
 - f. Transformer inrush points.
 - g. Maximum fault-current cutoff point.
- G. Completed data sheets for setting of overcurrent protective devices.
- H. Complete Schedule of breaker settings to summarize information contained on data sheets. Sample schedule has been included at the end of this section for preferred format.
- I. Complete Arc Flash report to be used for the preparation of Arc Flash Warning labels for electrical equipment. Refer to Division 16 Section "Identification for Electrical Systems" for requirements of Arc Flash Study and labels.
- J. Correct Deficiencies, Re-calculate and Report:
1. After Engineer's initial review, correct unsatisfactory conditions and recalculate to demonstrate compliance; resubmit overcurrent protective devices as required to bring system into compliance.
 2. Revise and Resubmit report multiple times as necessary to demonstrate compliance with requirements.

END OF SECTION

SECTION 16060 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. NFPA 70 and IEEE C2 include basic grounding requirements for electrical safety. This Section supplements the minimum safety requirements of the Code with requirements for additional grounding and with optional grounding methods and materials for both power and electronic systems.
- B. This Section includes methods and materials for grounding systems and equipment, plus the following special applications:
 - 1. Grounding utility distribution components.
 - 2. Common ground bonding with lightning protection system.
- C. Related Sections include the following:
 - 1. Division 16 Section "Lighting Protection for Structures" for common ground bonding with lightning protection system.

1.2 SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 16 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.
- B. Product Data: For each type of product indicated.
- C. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
 - 1. Test wells.
 - 2. Ground rods.
 - 3. Ground rings.
 - 4. Grounding arrangements and connections for separately derived systems.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

GROUNDING AND BONDING FOR
ELECTRICAL SYSTEMS

5. Grounding for sensitive electronic equipment.
- D. Field quality-control test reports.
 - E. Operation and Maintenance Data: For grounding, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation And Maintenance Data," include the following:
 1. Manufacturer's routine maintenance requirements for cables, terminations and all installed components.
 2. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems, test wells and ground rings based on NETA MTS.
 - a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
 - b. Include recommended testing intervals.

1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For independent agency as defined in Division 16 Section "Common Work Results for Electrical".
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with UL 467 for grounding and bonding materials and equipment.
- D. Comply with NFPA 70
- E. Comply with NFPA 99
- F. Comply with IEEE C2
- G. Comply with ANSI/EIA/TIA-607

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 1. Solid Conductors: ASTM B 3.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

GROUNDING AND BONDING FOR
ELECTRICAL SYSTEMS

2. Stranded Conductors: ASTM B 8.
 3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 5. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 6. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 7. Main Bonding Jumper: stranded copper conductors sized as indicated on Drawings.
 8. Grounding Electrode Conductor: stranded copper conductors sized as indicated on Drawings.
 9. Common Grounding Electrode Conductor: stranded copper conductors sized as indicated on Drawings.
- C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 4 inches (6 by 100 mm) in cross section, unless otherwise indicated; with insulators. Length as indicated on Drawings.

2.5 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.6 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 5/8 inch (16 mm) diameter by 120 inches (3000 mm) long, unless otherwise indicated.
- B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with non-hazardous electrolytic chemical salts.

1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches (1200 mm) long.
2. Backfill Material: Electrode manufacturers recommended material.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install insulated solid conductor for No. 10 AWG and smaller, and insulated stranded conductors for No. 8 AWG and larger, unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 4/0 AWG minimum.
 1. Bury at least 30 inches (762 mm) below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 1. Install bus on insulated spacers 1 inch (25 mm), minimum, from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
- E. Conductor Terminations and Connections:
 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING UTILITY DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Pad-Mounted Transformers and Switches: Install ground rods and supplemental ground ring at transformer pad and cable tap box as required by utility company instructions, service standards, and service agreement. Install tinned-copper conductor not less than No. 2 AWG for taps to equipment grounding terminals.

3.3 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
 - 1. Bond to each device, box, and luminaire, unless otherwise indicated.
 - 2. Conduction insulation of the same rating as the phase conductors, for all feeders and branch circuits. Install the grounding conductors in the raceway with related phase and neutral conductors.
 - 3. Where parallel conductors in separate raceways occur, provide a grounding conductor in each raceway that meets requirements of NFPA 70.
- B. Dry-Type Transformers: Install an insulated grounding conductor from the common point of connection of the transformer secondary neutral point and the transformer enclosure to the following:
 - 1. The nearest grounding electrode per NFPA 70, including but not limited to building steel where available.
 - 2. The grounding bus of the common electrode grounding system, located in the electrical equipment room.
- C. Enclosures: Install an insulated grounding conductor from grounding bushings to the frame of the enclosure, ground bus, and equipment grounding strap where each occurs. Install grounding bushings on all raceways terminating within electrical enclosures constructed of separate enclosure panels, which are not integrally welded together.
- D. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including but not limited to air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- E. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- F. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway. Terminate at grounding conductor terminal on isolated ground bus of equipment of the applicable derived system or service, unless otherwise indicated.
- G. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway

enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway. Terminate at grounding conductor terminal on isolated ground bus of equipment of the applicable derived system or service, unless otherwise indicated.

- H. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4 -by-38 (6-by-1000) grounding bus. With hole space as required by IT Consultant.
 - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.4 INSTALLATION

- A. Provide permanent service neutral and equipment grounding in accordance with NFPA 70 and subject to the following additional requirements.
- B. Comply with mounting and support requirements specified in Division 16 Section "Hangers and Supports for Electrical Systems."
- C. Connect the service neutral and equipment ground to a common point within the metallic enclosure containing the main service disconnecting means. Equipment grounds and the identified neutral of the wiring system shall not be interconnected beyond this point in the interior wiring system. From the common point of connection of the service neutral and the equipment ground, run in non-magnetic conduit a grounding electrode conductor without joint or splice to the grounding electrode system and connect it with an approved bolted pressure clamp.
- D. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.

3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
 4. Where expansion joints or telescoping joints occur, provide bonding jumpers.
- F. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
- H. Ground Rods: Drive rods until tops are 12 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
1. Interconnect ground rods with grounding electrode conductor a minimum of 30-inches below grade unless otherwise indicated. Make connections without exposing steel or damaging coating, if any.
 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- I. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 16 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.
1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

- J. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.
- K. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each perimeter column extending around the perimeter of building.
 - 1. Install copper conductor not less than No. 4/0 AWG for ground ring and for taps to building steel.
 - 2. Bury ground ring not less than 24 inches (600 mm) from building foundation.

3.5 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components as specified in Division 16 Section "Identification for Electrical Systems."

3.6 CONNECTIONS

- A. Connect wiring according to Division 16 Section "Low-Voltage Electrical Power Conductors and Cables."

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency as defined in Division 16 Section "Common Work Results for Electrical" to perform the following field tests and inspections and prepare certified test reports:
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Test completed grounding system at each location at service disconnect enclosure grounding terminal at ground test wells, at individual ground rods and locations where a ground-resistance level is specified. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 - 3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations.

Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Tests for patient-care areas: In addition to the test listed above, perform additional field tests and inspections for patient care areas.

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements. Perform the following tests:
 - a. Impedance: Measurement shall be made between the reference point and the grounding contact of all receptacles in the patient care room. The maximum limit allowed is 0.1 ohms.
 - b. Voltage: Measurement shall be made under no-fault conditions between a reference point and all exposed fixed electrical equipment with conductive surfaces in the patient care vicinity, including but not limited to: overbed wall-mounted fixtures, ceiling mounted exam lights, sensor faucets, etc. The maximum limit allowed is 20mV.
2. Prepare certified test reports in compliance with NFPA 99 and submit reports in conjunction with field quality control reports required in Division 16 Section "Wiring Devices". Utilize the Patient Care Area Electrical Testing Form in the Appendix of this section for each patient care area.

D. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

1. Report measured ground resistances that exceed the following values:
 - a. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
 - b. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
 - c. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 - d. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
 - e. Pad-Mounted Equipment: 5 ohms.

E. Correct Deficiencies, Retest and Report:

1. Correct unsatisfactory conditions, and retest to demonstrate compliance; replace conductors, units, and rods as required to bring system into compliance.
2. Prepare a report certified by testing agency that identifies components checked and describes results. Include notation of deficiencies detected,

remedial action taken, and observations and test results after remedial action.

END OF SECTION

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

GROUNDING AND BONDING FOR
ELECTRICAL SYSTEMS

PSP #407480

CONSTRUCTION DOCUMENTS – 2 MAY 2008

16060 - 10

APPENDIX

PATIENT CARE AREA ELECTRICAL SYSTEM INSPECTION / TESTING FORM

DATE: _____

ROOM NO: _____

LOCATION: _____

INSPECTED BY: _____

INSTRUMENTATION: _____

Room Rcpt. No.	Mechanical Condition	Wiring / Polarity	Contact Tension			Voltage		GFCI Trip	Ground Potentials (millivolts)	Ground Resistance (Ohms)
			H	N	O	H-N	N-O			

REMARKS: _____

REFERENCE POINTS: _____ (mark on sketch)

ROOM LAYOUT SKETCH

END OF APPENDIX

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
 PARKING GARAGE PACKAGE

GROUNDING AND BONDING FOR
 ELECTRICAL SYSTEMS

SECTION 16073 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.
- B. Related Sections include the following:
 - 1. Division 16 Section "Vibration And Seismic Controls For Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.2 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. RAC: Rigid aluminum conduit.
- E. RMC: Rigid metal conduit.
- F. RNC: Rigid nonmetallic conduit.
- G. RSC: Rigid Steel conduit.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 - 1. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.4 RATED STRENGTH: ADEQUATE IN TENSION, SHEAR, AND PULLOUT FORCE TO RESIST MAXIMUM LOADS CALCULATED OR IMPOSED FOR THIS PROJECT, WITH A MINIMUM STRUCTURAL SAFETY FACTOR OF FIVE TIMES THE APPLIED FORCE.

1.5 SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 16 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.
- B. Product Data: For the following:
 - 1. Steel slotted support systems.
 - 2. Nonmetallic slotted support systems.
- C. Welding certificates.
- D. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Nonmetallic slotted channel systems. Include Product Data for components.
 - 4. Equipment supports.
 - 5. Concrete Based for Equipment.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Allied Tube & Conduit
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. Thomas & Betts Corporation.
 - e. Unistrut; Tyco International, Ltd.
 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 5. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. Fabco Plastics Wholesale Limited.
 - d. Seasafe, Inc.
 2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
 3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
 4. Rated Strength: Selected to suit applicable load criteria.

- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Device Box Mounting Brackets and Stabilizer: Factory-fabricated sheet steel brackets for support of device boxes adjacent to or between studs.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper B-Line, Inc.; a division of Cooper Industries.
 - b. ERICO International Corporation.
- G. Through-Stud Cable and Raceway Support Clips: Factory-fabricated spring steel clip for cables or raceways where run horizontally through metal studs.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper B-Line, Inc.; a division of Cooper Industries.
 - b. ERICO International Corporation.
- H. Roof-mounted Raceway Support Blocking: Factory-fabricated support blocking for use under roof-mounted raceways. Wedge-shaped blocking constructed of 100% recycled UV-resistant Rubber with integral galvanized steel strut to accept raceway support clips.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Cooper B-Line C-Port series components or a comparable product by one of the following:
 - a. Cooper B-Line, Inc.; a division of Cooper Industries.
 - b. ERICO International Corporation.
- I. Tee Bar Grid Box Hanger: Factory-fabricated metal electrical box hanger for supporting boxes at locations between ceiling system t-grid components. Height adjustable for various electrical box depths. Attached to ceiling tee bar with screws or integral clamp for stability. Includes tab for independent support wire attachment.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Cooper B-Line, Inc.; a division of Cooper Industries.
 - b. ERICO International Corporation.
- J. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- K. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
- 1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 - 2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 5. Toggle Bolts: All-steel springhead type.
 - 6. Hanger Rods: Solid, threaded steel.

4)
2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NFPA 70, NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except where requirements of this Section are more stringent.
- B. Maximum Horizontal and Vertical Support Spacing for Raceway(s): Space supports for EMT, IMC, and RMC as required by NFPA 70, but in no case less than listed below:
 - 1. For raceways 1" diameter and larger, provide one hanger at 8'-0" on center.
 - 2. For raceways less than 1" diameter, provide one hanger at 5'-0" on center.
- C. Minimum Hanger Rod Size for Raceway Supports: Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- D. Single Raceways or Cables:
 - 1. For Raceways 1-1/4-inch (32mm) and smaller: Install adjustable steel band hanger suspended on threaded rod.
 - 2. For Raceways larger than 1-1/4-inch (30mm): Install trapeze-type supports fabricated with steel slotted support system suspended on threaded rods. Size trapeze members, including the suspension rods, based on the support required for the size, and loaded weight of the conduits.
 - a. Secure raceway or cable to support with two-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system suspended on threaded rods, where multiple raceways are run vertically or horizontally at the same elevations. Size trapeze members, including the suspension rods, based on the support required for the number, size, and loaded weight of the conduits. Space them as required for the smallest conduit to be supported. Size so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.
- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

- B. Corrosive Areas: Provide non-metallic coated steel slotted support systems for supports installed in corrosive areas. Corrosive areas include, but are not limited to the following:
 - 1. Areas exposed to out doors.
 - 2. Within 25-feet (7.62-m) of Cooling Towers and Air Cooled Chillers.

3.2 SUPPORT INSTALLATION

- A. Comply with NFPA 70, NECA 1 and NECA 101 for installation requirements except where requirements of this Article are more stringent.
- B. Fasten junction, pull and devices boxes securely to the building construction, independent of raceway system.
- C. Install Device Box Mounting Brackets supported between two studs where boxes are not located adjacent to stud or where multiple boxes are located between studs.
- D. Install Device Box Stabilizer where single box is located adjacent to stud.
- E. Install Through-Stud Cable and Raceway Support Clips where cables or raceways run horizontally through metal studs.
- F. Install Tee Bar Grid Box Hanger supported between two ceiling grid tee bars where devices boxes are located flush in recessed suspended ceilings.
 - 1. Install at least one independent support rod from box hanger to structure.
- G. Install Roof-mounted Raceway Support Blocking where raceways run on across roofing.
 - 1. Coordinate installation of roof supports with items specified in Division 07 Section "Roof Accessories." Provide products compatible with rooftop materials included in the Work.
- H. Provide minimum of two lock nuts per threaded support rod except where lock nut tightens against a threaded socket, one locknut may be used.
- I. Support raceways at a distance above suspended ceilings to permit removal of ceiling panels and luminaires.
- J. Locate raceways so as not to hinder access to mechanical equipment.
- K. Do not secure conductors, raceways, or supports to suspended ceiling hanger rods or wires.
- L. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

- M. Mounting and Anchorage of Surface-Mounted or Recessed-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
1. To Wood: Fasten with lag screws or through bolts.
 2. To New Concrete: Bolt to concrete inserts. Where support anchors are required, establish their type and locate in concrete construction before concrete is poured, if possible. Fit each hanger rod with a nut at its upper end, and set nut in a universal concrete insert in the form. Where supported weight exceeds holding strength of a single insert, pass rods through top slot of inserts and interlock with reinforcing steel. Also, where particularly heavy loads are to be supported, suspend hanger rod or rods from a structural angle spanning two or more inserts and securely bolted thereto to distribute the weight.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Existing Concrete: Expansion anchor fasteners.
 5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 or Spring-tension clamps.
 6. To Light Steel: Sheet metal screws.
 7. For Surface-Mounted Items on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to structure by means that meet seismic-restraint strength and anchorage requirements. Attachment to gypsum wall board is not acceptable as sole support means; slotted-channel rack solidly attached to structure or light-gauge metal framing at both ends is required.
 8. For Recessed-Mounted Items in Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices to intermediate light-gauge metal framing members on each side of device or provide slotted-channel racks within hollow wall attached to structure by means that meet seismic-restraint strength and anchorage requirements. Attachment to gypsum wall board is not acceptable as sole support means.
- N. Do not support any items (equipment, piping, conduit, etc.) exceeding 2 inches in diameter from the bottom of slabs. Where intermediate supports are required between structural members, use slotted steel channels support systems attached to beams or joists in order to avoid attachment to slabs.
- O. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars. Verify reinforcing locations with Structural Engineer. X-Ray existing concrete structures as required.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 3 inches (100 mm) larger in all directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

PSP #407480

CONSTRUCTION DOCUMENTS – 2 MAY 2008

HANGERS AND SUPPORTS
FOR ELECTRICAL SYSTEMS

16073 - 10

SECTION 16074 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Delegated Design requirements for system design.
2. Isolation pads.
3. Spring isolators.
4. Restrained spring isolators.
5. Channel support systems.
6. Restraint cables.
7. Hanger rod stiffeners.
8. Anchorage bushings and washers.

B. Related Sections include the following:

1. Division 16 Section "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.2 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for vibration and seismic controls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1. Do not use more than one pre-approved seismic-force resistance system on any single run of pipe, duct or conduit. Mixing of multiple pre-approved systems is not acceptable.

B. Seismic-Restraint Loading: In preparation of Delegated Design, utilize seismic forces as described in ASCE 7-02 "Minimum Design Loads for Buildings and Other

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

VIBRATION AND SEISMIC CONTROLS
FOR ELECTRICAL SYSTEMS

Structures” as published by the American Society of Civil Engineers, unless requirements in this Section are more stringent.

1. Site Class as Defined in the IBC: [A] [B] [C] [D] [E] [F].
 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: [I] [II] [III].
 - a. Component Importance Factor: [1.0] [1.5] <Insert value>.
 - b. Component Response Modification Factor: [1.5] [2.5] [3.5] [5.0] <Insert value>.
 - c. Component Amplification Factor: [1.0] [2.5] <Insert value>.
 3. Design Spectral Response Acceleration at Short Periods (0.2 Second): <Insert percent>.
 4. Design Spectral Response Acceleration at 1.0-Second Period: <Insert percent>.
- C. Submittal Review Conference: At time of Delegated Design Shop Drawing submission, schedule a submittal review conference with the Architect and Structural Engineer-of-Record for the project. The purpose of this conference is to review attachment locations and insure supplementary framing that is needed to resist the loads, maintain stability or to meet other installation requirements of a pre-approved system have been accounted for in the Structural Engineer-of-Record’s design.

1.4 SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 16 Section “Common Work Results for Electrical” for products specified under PART 2 - PRODUCTS
- B. General Submittal Requirements:
 1. Submittals shall be reviewed by Architect and the Structural Engineer-of-Record prior to submitting them to authorities having jurisdiction.
- C. Contractor Statement of Responsibility:
 1. Submit a written statement in accordance with IBC Chapter 17.
 2. Statement shall be submitted on company letterhead.
 3. In instances where trade sub-contractors are responsible for construction and implementation of seismic-force resisting systems, the representatives of these various trade sub-contractors shall sign the Contractor Statement of Responsibility.
- D. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by [an evaluation service member of ICC-ES] [OSHPD] [an agency acceptable to authorities having jurisdiction].
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
 3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.
- E. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.
 - a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other Division 16 Sections for equipment mounted outdoors.
 2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
 3. Field-fabricated supports.
 4. Seismic-Restraint Details:
 - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
 - c. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval tests or calculations.
- F. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

- G. Welding certificates.
- H. Qualification Data: For professional engineer and testing agency.
- I. Field quality-control test reports.
- J. Operation and Maintenance Data: For seismic-force restraint systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Copy of the Delegated Design Shop Drawings, including AHJ approval stamp.
 - 2. Copy of the Delegated Design Submittal, including AHJ approval stamp.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC, unless requirements in this Section are more stringent.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- E. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ace Mountings Co., Inc.
 - 2. Amber/Booth Company, Inc.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

VIBRATION AND SEISMIC CONTROLS
FOR ELECTRICAL SYSTEMS

3. California Dynamics Corporation.
 4. Isolation Technology, Inc.
 5. Kinetics Noise Control.
 6. Mason Industries.
 7. Vibration Eliminator Co., Inc.
 8. Vibration Isolation.
 9. Vibration Mountings & Controls, Inc.
- B. Isolation Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
1. Resilient Material: Oil- and water-resistant pads of neoprene, rubber or hermetically sealed compressed fiberglass minimum 1/4 inch thick.
- C. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch-(6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
 6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch-(6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.

2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.2 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Amber/Booth Company, Inc.
 2. California Dynamics Corporation.
 3. Cooper B-Line, Inc.; a division of Cooper Industries.
 4. Hilti Inc.
 5. Loos & Co.; Seismic Earthquake Division.
 6. Mason Industries.
 7. TOLCO Incorporated; a brand of NIBCO INC.
 8. Unistrut; Tyco International, Ltd.
- B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an evaluation service member of ICC-ES.
 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- D. Restraint Cables: ASTM A 603 galvanized (ASTM A 492 stainless steel where exposed to outdoor conditions) steel cables with end connections made of steel as-

semblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod. Do not weld stiffeners to rods.
- F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.
- G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.
- H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
- J. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.3 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1. Powder coating on springs and housings.
 - 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 - 3. Baked enamel or powder coat for metal components on isolators for interior use.
 - 4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

VIBRATION AND SEISMIC CONTROLS
FOR ELECTRICAL SYSTEMS

- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners as required by delegate design calculations to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 ELECTRICAL VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE SCHEDULE

- A. Supported or Suspended Equipment Type:
- B. Equipment:
 - 1. Emergency Feeders and branch circuits.
 - a. Isolator Type: See specification Section 2.2.
 - b. Component Importance Factor: [1.0] [1.5].
 - c. Component Response Modification Factor: [1.5] [2.5] [3.5] [5.0].
 - d. Component Amplification Factor: [1.0] [2.5].
 - 2. Normal Feeders and branch circuits
 - 3. Cable Trays
 - 4. Lights
 - 5. Low-Voltage Transformers
 - 6. Low-Voltage Switchgear
 - 7. Paralleling Low-Voltage Switchgear
 - 8. Switchboards
 - 9. Panelboards
 - 10. Motor-Control Centers
 - 11. Enclosed Bus Assemblies
 - 12. Power Distribution Units

13. Enclosed Switches And Circuit Breakers
14. Enclosed Controllers
15. Variable-Frequency Motor Controllers
16. Engine Generators
17. Static Uninterruptible Power Supply And Battery Equipment
18. Power Factor Correction Equipment
19. Transfer Switches
20. TVSS For Low-Voltage Electrical Power Circuits

3.4 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment and Hanger Restraints:

1. Install restrained isolators as required by delegate design calculations.
2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

D. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.5 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.6 IDENTIFICATION

- A. Install brass identification tags at all seismic brace locations. Tags to include the following information:
 1. Unique keyed identification number that corresponds to nomenclature used to mark location on shop drawings and calculations.
 2. Specific G-force the system at that location is designed to resist.
 3. Maximum brace reaction to the structure.
 4. For Individually suspended items: Maximum conduit size.
 5. For Trapeze or Multiple pipe hangers: Maximum pounds-per-lineal-foot.
 6. For Suspended Equipment: Maximum weight of equipment.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency as defined in Division 16 Section "Common Work Results for Electrical" to perform the following field tests and inspections and prepare certified test reports:
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following field tests and inspections and prepare certified test reports:
- C. Perform the following field tests and inspections and prepare test reports:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 5. Test to 90 percent of rated proof load of device.
 6. Measure isolator restraint clearance.
 7. Measure isolator deflection.
 8. Verify snubber minimum clearances.
- D. Correct Deficiencies, Retest and Report:
1. Correct unsatisfactory conditions, and retest to demonstrate compliance; replace units and devices as required to bring system into compliance.
 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 3. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
 4. Prepare a report certified by testing agency, that identifies unit components and devices checked and describes results. Include notation of deficiencies detected, remedial action taken, and observations and test results after remedial action.

3.8 ADJUSTING

- A. Adjust isolators after isolated equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

VIBRATION AND SEISMIC CONTROLS
FOR ELECTRICAL SYSTEMS

PSP #407480

CONSTRUCTION DOCUMENTS – 2 MAY 2008

16074 - 12

SECTION 16075 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Identification for raceway.
2. Identification for conductors and communication and control cable.
3. Underground-line warning tape.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

B. Related Sections include the following:

1. Division 16 Section "Wiring Devices" for engraved wall plates and wiring device identification requirements.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Prepare computerized Arc Flash study to obtain information required for Arc Flash Warning and Instructions labels specified under PART 2 of Section 16 "Identification for Electrical Systems". Comprehensive engineering analysis by a qualified professional engineer or personnel trained and employed by the equipment manufacturer in required calculation methodology.

1.3 SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 16 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.
- B. Product Data: For each electrical identification product indicated.
- C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.
- D. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

IDENTIFICATION FOR ELECTRICAL
SYSTEMS
16075 - 1

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Color for Printed Legend:
 - 1. Power Circuits: Black letters on an orange field.
 - 2. Legend: Indicate system or service and voltage, if applicable.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.2 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- C. Brass or Stainless Steel Wraparound Marker Labels: Cut from 0.014-inch- (0.35-mm-) thick, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.
- D. Metal Tags: Brass or Stainless Steel, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking nylon tie fastener.

2.3 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
 - 1. Not less than 6 inches (150 mm) wide by 4 mils (0.102 mm) thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend shall indicate type of underground line.

2.4 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 7 by 10 inches (180 by 250 mm).
- D. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR ## INCHES." Verify work space required for specific project conditions with NFPA 70 and replace "##" in previous sentence with appropriate distance.
 - 3. Arc Flash Warning and Instructions: "WARNING – ARC FLASH AND SHOCK HAZARD. WEAR APPROPRIATE PPE. Determine appropriate protective clothing and personal protective equipment (PPE) for the task from NFPA 70E." Provide appropriate label for equipment listed under PART 3

Execution, including items supplied with equipment or provide under other Divisions. Include the following information of each label:

- a. Flash Hazard Boundary
- b. Short Circuit Current Available
- c. Shock Hazard when Cover is Removed
- d. Limited Approach Boundary
- e. Restricted Approach Boundary
- f. Prohibited Approach Boundary
- g. PPE Requirements, including the following:
 - 1) Hazard Risk Category
 - 2) Required Minimum Arc Rating of PPE in cal/cm²
 - 3) Clothing Description

2.5 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
 1. Engraved legend with black letters on white face.
 2. Punched or drilled for mechanical fasteners.
 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 ONE-LINE DIAGRAM NAMEPLATE

- A. Preprinted engraved, laminated acrylic or melamine plastics sign. Nominal size, 12 by 12 inches (305 by 305 mm) by 1/8 inch (3.2 mm) thick. Engraved legend with black letters on white face. Image on sign depicting equipment components in single-line diagram format, using symbols and letter designations consistent with final one-line bus diagram. Produce a concise visual presentation of principal equipment components and connections.

2.7 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Adhesive, Punched, or drilled for screw mounting. Minimum letter height shall be 3/8 inch (10 mm). Lettering and Background colors as indicated below:
 1. Power Circuits:
 - a. Normal: White lettering on Black background.
 - b. Emergency Legally Required Standby or Essential Electrical System prior to ATS: Black lettering on Orange background.
 - c. Emergency Optional Standby: White lettering on Blue background.
 - d. Life Safety Branch: Black Lettering on Red background.
 - e. Critical Branch: Black lettering on Yellow background.
 - f. Equipment Emergency System: Yellow lettering on Blue background.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

IDENTIFICATION FOR ELECTRICAL
SYSTEMS

- g. Non-Essential Emergency System: White lettering on Purple background.
 - h. UPS: White lettering on Green background.
2. Fire Alarm System: White lettering on Red background.
 3. Fire-Suppression Supervisory and Control System: Yellow lettering on Red background.
 4. Mechanical and Electrical Supervisory System: Green lettering on Blue background.
 5. Control Wiring: Green lettering on Red background.
 6. Clock: White lettering on Black background.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
 1. Minimum Width: 3/16 inch (5 mm).
 2. Tensile Strength: 50 lb (22.6 kg), minimum.
 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 4. Color: Black, except where used for color-coding.
- B. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.
 1. Exterior Ferrous Metal:
 - a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.
 - 1) Primer: Exterior ferrous-metal primer.
 - 2) Finish Coats: Exterior semigloss alkyd enamel.
 2. Exterior Zinc-Coated Metal (except Raceways):
 - a. Semigloss Alkyd-Enamel Finish: One finish coat(s) over a primer.
 - 1) Primer: Exterior zinc-coated metal primer.
 - 2) Finish Coats: Exterior semigloss alkyd enamel.
 3. Interior Ferrous Metal:
 - a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.
 - 1) Primer: Interior ferrous-metal primer.
 - 2) Finish Coats: Interior semigloss acrylic enamel.

- 4. Interior Zinc-Coated Metal (except Raceways):
 - a. Semigloss Acrylic-Enamel Finish: One finish coat(s) over a primer.
 - 1) Primer: Interior zinc-coated metal primer.
 - 2) Finish Coats: Interior semigloss acrylic enamel.
 - C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Accessible Raceways More Than 600 V: Identify with "DANGER-HIGH VOLTAGE" in black letters at least 2 inches (50 mm) high, with self-adhesive vinyl labels. Repeat legend at 10-foot (3-m) maximum intervals.
- B. Accessible Raceways 600 V or Less, for Service, Feeder, and Branch Circuits: Identify with orange self-adhesive vinyl label.
- C. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:
 - 1. Fire Alarm System: Red.
 - 2. Fire-Suppression Supervisory and Control System: Red and yellow.
 - 3. Combined Fire Alarm and Security System: Red and blue.
 - 4. Security System: Blue and yellow.
 - 5. Mechanical and Electrical Supervisory System: Green and blue.
 - 6. Telecommunication System: Green and yellow.
 - 7. Control Wiring: Green and red.
- D. Conductor Identification: Identify source and circuit number of each ungrounded conductor or set of conductors. For single conductor cables, identify phase in addition to the above.
 - 1. For conductors in pull and junction boxes, device boxes, and within 6-inches (153 mm) of termination use pre-printed marker tape.
 - 2. For conductors in vaults, manholes, hand holes and pull and junction boxes located in damp or wet locations use brass or stainless steel wraparound marker labels.
- E. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source and circuit number.

- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

- H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply baked-enamel warning signs. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
 - 1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Main-Tie-Main Switchboards
 - c. Generator Paralleling Switchgear.
 - d. Controls with external control power connections.
 - 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
 - 3. Arc Flash Warning Labels: Apply label to door or cover at all access point of equipment including, but not limited to, the following:
 - a. Disconnect switches.
 - b. Electrical substations.
 - c. Electrical switchgear and switchboards.
 - d. Emergency system boxes and enclosures.
 - e. Enclosed circuit breakers.
 - f. Meter Sockets and assemblies.
 - g. Motor starters.
 - h. Motor-control centers.
 - i. Panelboards.
 - j. Power transfer equipment.(ATS)
 - k. Transformers.
 - l. Uninterruptible power supply equipment.

- I. Junction Boxes and Pull Boxes: Identify voltage, source, and circuit number(s) on cover of pull and junction boxes with hand-written legible block lettering using black permanent marking pen.

J. Color Coding of Junction Boxes and Pull Boxes: Identify system on cover of pull and junction boxes using colored enamel spray paint. Where two colors are indicated identify each half of box with colors indicated.

1. Power Circuits:
 - a. Normal: Black.
 - b. Emergency Legally Required Standby or Essential Electrical System prior to ATS: Black and Orange.
 - c. Emergency Optional Standby: Blue.
 - d. Life Safety Branch: Black and Red.
 - e. Critical Branch: Black and Yellow.
 - f. Equipment Emergency System: Yellow and Blue.
 - g. Non-Essential Emergency System: Purple.
 - h. UPS: Green.
2. Fire Alarm System: Red.
3. Fire-Suppression Supervisory and Control System: Red and yellow.
4. Combined Fire Alarm and Security System: Red and blue.
5. Security System: Blue and yellow.
6. Mechanical and Electrical Supervisory System: Green and blue.
7. Telecommunication System: Green and yellow.
8. Control Wiring: Green and red.
9. Nurse Call: Verify with specialty consultant.
10. Public Address / Intercom: Verify with specialty consultant.
11. CATV / MATV: Verify with specialty consultant.
12. Clock: Verify with specialty consultant.

K. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
2. Emergency Operating Instructions: Install instruction signs with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer , load shedding and Kirk Key Controlled Breakers.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual.

1. Labeling Instructions:

- a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where 2 lines of text are required, use labels 2 inches (50 mm) high.
- b. Outdoor Equipment: Engraved, laminated acrylic or melamine label drilled and attached with corrosion-resistant screws.
- c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor per ANSI A13.1.

2. Equipment to be labeled

a. Provide for each of the following and any other similar equipment furnished under this Division identification as to its given name, voltage, origination of service, and branch. Table 1 below lists typical examples of label format, coordinate project specific requirements with Drawings:

- 1) Electrical switchgear and switchboards.
- 2) Panelboards, electrical cabinets, and enclosures.
- 3) Enclosed Bus Assemblies.
- 4) Transformers.
- 5) Electrical substations.
- 6) Motor-control centers.
- 7) Disconnect switches.
- 8) Emergency system boxes and enclosures.
- 9) Enclosed circuit breakers.
- 10) Motor starters.
- 11) Push-button stations.
- 12) Power transfer equipment.(ATS) – Label both sources
- 13) Auxiliary Equipment (TVSS, Capacitor Banks, etc.)
- 14) Contactors
- 15) Fire-alarm control panel and annunciators
- 16) Uninterruptible power supply equipment.

Table 1 (Examples Only)

NORMAL 'MSA' 480Y/277V SERVICE ENTRANCE	EMERGENCY SYSTEM 'EMSA' 480Y/277V FED FROM 'GEN-1'	<i>NORMAL</i> <i>'1DPHA'</i> <i>480Y/277V</i> <i>FED FROM 'MSA'</i>
LIFE SAFETY BRANCH '1LSHA' 480Y/277V FED FROM 'DPLSHA'	EQUIPMENT SYSTEM '1EQLA' 208Y/120V FED FROM 'T1EQLA'	<i>CRITICAL BRANCH</i> <i>'1CRHA'</i> <i>480Y/277V</i> <i>FED FROM 'ATS-CR'</i>
NORMAL 'CHP-1' 480Y/277V	NORMAL 'AHU-1' 480Y/277V	<i>EQUIPMENT SYSTEM</i> <i>'HWP-1'</i> <i>480Y/277V</i>

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

IDENTIFICATION FOR ELECTRICAL
SYSTEMS

FED FROM 'MCC-1'	FED FROM '1DPHA'	FED FROM 'CPEQHA'
CRITICAL BRANCH 'T2CLA' 75 KVA, 480V to 208Y/120V FED FROM '2CHA' FEEDS '2CRLA'	EQUIPMENT SYSTEM 'ATS EQ' 480Y/277V FED FROM 'MSA' NORMAL FED FROM 'EMSA' EMERGENCY FEEDS '1EQHA'	OPTIONAL STANDBY SYSTEM 'ATS SS' 480Y/277V FED FROM 'MSA' NORMAL FED FROM 'EMSA' EMERGENCY FEEDS '1SSHA'

- b. Provide for each of the following and any other similar equipment furnished under this Division identification as to its given name.
- 1) Access doors and panels for concealed electrical items.
 - 2) Remote-controlled switches, dimmer modules, and control devices.
 - 3) Battery inverter units.
 - 4) Battery racks.
 - 5) Power-generating units.
 - 6) Voice and data cable terminal equipment.
 - 7) Master clock and program equipment.
 - 8) Intercommunication and call system master and staff stations.
 - 9) Television/audio components, racks, and controls..
 - 10) Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
 - 11) Monitoring and control equipment.
 - 12) Terminals, racks, and patch panels for voice and data communication and for signal and control functions.
3. Provide for each feeder overcurrent protective device in each switchgear, switchboard, distribution panelboard, motor control center, and any other similar equipment furnished under this Division, identification as to the specific load that it serves.
4. Provide for each 3 phase motor: brass phase rotation tags securely attached to the equipment.

3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- G. Color-Coding for Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - 1. Color shall be factory applied or for sizes larger than No. 1 AWG, if authorities having jurisdiction permit, field applied.
 - 2. Colors for Grounding Conductors:
 - a. Equipment Grounding Conductor: Green.
 - b. Isolated Equipment Grounding Conductor: Green with Yellow Stripe.
 - 3. Colors for 208/120-V Wye Systems:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Grounded Conductor (Neutral): White
 - 4. Colors for 208/120-V and 240/120-V Delta Systems:
 - a. Phase A: Black.
 - b. Phase B (High Leg): Orange.
 - c. Phase C: Blue.
 - d. Grounded Conductor (Neutral): White
 - 5. Colors for 480/277-V Wye Systems:
 - a. Phase A: Brown.
 - b. Phase B: Purple.
 - c. Phase C: Yellow.
 - d. Grounded Conductor (Neutral): Gray
 - 6. Colors for 480/277-V Delta Systems:
 - a. Phase A: Brown.
 - b. Phase B (High Leg): Orange.
 - c. Phase C: Yellow.
 - d. Grounded Conductor (Neutral): Gray
 - 7. Colors for Ungrounded Systems: Comply with applicable paragraphs of the current editions of NFPA 70 and NFPA 99.

- a. Conductor 1: Orange with a distinctive colored stripe other than white, green, or gray
 - b. Conductor 2: Brown with a distinctive colored stripe other than white, green, or gray
 - c. Conductor 3 (for three phase systems): yellow with a distinctive colored stripe other.
8. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
- J. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

END OF SECTION

SECTION 16120 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
 - 3. Sleeves and sleeve seals for cables.

1.2 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.3 SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 16 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.
- B. Product Data: For each type of product indicated. Provide data for conductors and cables including, but not be limited to, the following:
 - 1. Complete physical properties of the conductors and cables.
 - 2. Ampacity for use intended.
 - 3. Allowable stresses and requirements for installations, including bend radii, linear stress, and other pertinent data.
- C. Coordination Drawings: Submit Coordination Drawings in accordance with Division 16 Section "Common Work Results for Electrical". Include the following:
 - 1. Feeder cable routing plans, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - a. Structural members in the paths of conduit groups with common supports.
 - b. HVAC, plumbing items, and architectural features in the paths of conduit groups. Denote where systems share common supports.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

LOW-VOLTAGE ELECTRICAL POWER
CONDUCTORS AND CABLES

- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For conductors and cables, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation And Maintenance Data," include the following:
 - 1. Manufacturer's routine maintenance requirements for cables, terminations and all installed components.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For independent agency as defined in Division 16 Section "Common Work Results for Electrical".
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.5 COORDINATION

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. American Insulated Wire Corp.; a Leviton Company.
 - 2. General Cable Corporation.
 - 3. Okonite Company, The.
 - 4. Senator Wire & Cable Company.
 - 5. Southwire Company.
- B. Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN, XHHW and SO, as indicated.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

LOW-VOLTAGE ELECTRICAL POWER
CONDUCTORS AND CABLES

D. Multiconductor Cables: Comply with NEMA WC 70; Exterior sheath color coded to differentiate cable voltages and quantity of phase conductors.

1. Health Care Facilities armored cable, Type AC-HCF; Comply with UL 4 and UL 1479; with green grounding conductor(s) in addition to Armor/Bond Wire ground combination; with exterior sheath colored green.
2. Mineral-insulated, metal-sheathed cable, Type MI; with green grounding conductor(s). Listed for use in Environmental Air space according to NPFA 70 Article 300.
3. Nonmetallic-sheathed cable, Type NM; with green grounding conductor(s).
4. Type SO; with green grounding conductor(s).

2.2 CONNECTORS AND SPLICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 MISCELLANEOUS PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength: 50 lb (22.6 kg), minimum.
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding. Refer to Division 16 Section "Identification for Electrical Systems" for color-coding requirements.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

LOW-VOLTAGE ELECTRICAL POWER
CONDUCTORS AND CABLES

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for all feeders, aluminum for feeders where indicated on Drawings. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. Provide conductors with minimum temperature ratings of 75 degrees C. For high temperature applications, provide conductors with temperature ratings in accordance with the NFPA 70 for the ambient condition.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance:
 - 1. Copper: Type XHHW - 2, single conductors in raceway.
- B. Exposed Feeders:
 - 1. Copper: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed ABOVE Ceilings, in Walls, and in Partitions:
 - 1. Copper: Type THHN-THWN, single conductors in raceway.
- D. Feeders below Slabs-on-Grade, and Underground:
 - 1. Copper: Type XHHW - 2, single conductors in raceway.
- F. Exposed Branch Circuits: Type THHN-THWN, single conductors in raceway.
- G. Branch Circuits Concealed above Ceilings, in Walls, and Partitions: Type THHN-THWN, single conductors in raceway and type AC-HCF in limited locations where indicated.
 - 1. Type AC-HCF is acceptable for the following applications.
 - a. Install cables for lighting fixture whips and for branch circuits concealed in walls and partitions only. Locate junction box and convert to single conductors in rigid raceway within 24-inches from the point the cable exits the wall. Do not install the cable in the web of metal studs.
 - b. Use only single-circuit cable (i.e. two wire plus ground). For devices in the same wall connected to different circuits, install separate single circuit cable for each circuit.
 - 2. Type AC-HCF is not acceptable for the following applications; instead provide single conductors in rigid raceway.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

LOW-VOLTAGE ELECTRICAL POWER
CONDUCTORS AND CABLES

- a. Homeruns to Panelboard.
 - b. Branch circuits serving Essential Electrical System (Emergency & Standby) loads; including Life Safety branch, Critical branch and equipment emergency system.
 - c. Branch circuits serving HVAC, elevator/escalator, medical and kitchen equipment loads.
 - d. Within mechanical, electrical or telecommunication equipment rooms.
 - e. Exposed Branch Circuits within areas that do not have a ceiling (i.e. open to structure).
- H. Branch Circuits below Slabs-on-Grade, and Underground in limited locations where indicated: Type THHN-THWN, single conductors in raceway.
 - I. Branch Circuits served from Isolation Panelboards: Copper stranded Low leakage Type XHHW conductor with a dielectric constant of 3.5 or less in raceway.
 - J. Fixture Whips: Armored cable, Type AC-HCF.
 - K. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
 - L. Class 1 Control Circuits: Type THHN-THWN, in raceway.
 - M. Class 2 and 3 Control Circuits; Concealed in Ceilings, Walls or Partitions: Power-limited cable or Type THHN-THWN, in raceway.
 - N. Class 2 and 3 Control Circuits; Exposed: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Run feeders in continuous lengths, without joints or splices. Where continuous runs are impractical; obtain Engineer's approval for splice locations and application.
- B. Make joints in branch circuits only where circuits divide.
- C. Do not use gutters of panelboards as raceways, junction boxes, or pull boxes for conductors not terminating in said panelboards.
- D. Run conduits for emergency power conductors separate from all other wiring.
- E. Make splices and terminations in cables with kits and instructions provided by the kit manufacturer. Each splice shall equal the integrity of the cable electrically and environmentally.
- F. Bundling Conductors: Bundle conductors in switchboards, panelboards, cabinets, and the like, using nylon ties made for the purpose. Bundle conductors larger than No. 10 in individual circuits. Smaller conductors may be bundled in larger groups.
- G. Install all conductors in raceways, unless specifically noted otherwise.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

LOW-VOLTAGE ELECTRICAL POWER
CONDUCTORS AND CABLES

- H. Sizes:
 - 1. Provide conductors no smaller than No. 12 AWG, except for signal or control circuits.
 - 2. Provide No. 10 AWG conductors for home runs on 120-volt, 20-ampere branch circuits, where the conductor length exceeds 100 lineal feet from panelboard to the first outlet.
 - 3. Provide No. 10 AWG conductors for home runs on 277-volt, 20-ampere branch circuits, where the conductor length exceeds 200 lineal feet from panelboard to the first outlet.
 - 4. Provide neutral conductors of the same size as the phase conductor(s) for individual branch circuit homeruns.
 - 5. Provide neutral conductor one size larger than the phase conductors for multiple branch circuit homeruns.
 - 6. Install a maximum of six (6) current carrying conductors in a conduit. Consider neutral conductors as a current carrying conductor in branch circuits which serve receptacles or electronic ballasted luminaries.
- I. Terminations of multiple branch circuit conductors on a single circuit breaker is not acceptable.
- J. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours.
- K. Support cables according to Division 16 Section "Hangers and Supports for Electrical Systems."
- L. Identify and color-code conductors and cables according to Division 16 Section "Identification for Electrical Systems."
- M. Feeders and Branch circuits concealed in concrete are prohibited.

3.4 WIRE PULLING

- A. Pull no conductors into conduits until all Work of a nature which may cause injury to conductors is completed.
- B. Follow manufacturers' recommendations for regulating temperature conditions of conductors prior to installation.
- C. Exercise care in handling and installing cables to avoid damage. Carefully form cables in equipment pull boxes. Form bends in cables larger than the minimum radii shown in the cable manufacturer's published data for minimum bends such that bends will not reduce the cable life.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

LOW-VOLTAGE ELECTRICAL POWER
CONDUCTORS AND CABLES

- D. Provide suitable installation equipment to prevent abrasion and cutting of conductors by raceways during the pulling of conductors. Use ropes of polyethylene, nylon or other suitable non-metallic material to pull in feeders. Metallic ropes are prohibited.
- E. Attach pulling lines to conductors by means of insulated woven basket grips or by pulling eyes attached directly to conductors. Do not use rope hitches, or bare steel basket grips. All conductors to be installed in a single conduit shall be pulled in simultaneously.
- F. Before any wire is pulled into any conduit, thoroughly swab the conduit to remove all foreign material and to permit the wire itself to be pulled into a clean, dry conduit.
- G. Use manufacturer-approved pulling compound or lubricant where necessary, of non-conducting type. Compounds used must not deteriorate the conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- H. Do not use cable pulling lubricants on conductors of ungrounded circuits which are electrically monitored by ground detector system, since such lubricant may increase the capacities to ground of these conductors. Including, but not limited to, conductors on the secondary side of Isolation Panels.

3.5 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice and tap conductor.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.
- D. Connectors: Make splices and connections in conductors using approved connectors.
 - 1. Provide lugs and connectors of proper size to match conductor size.
 - 2. Stranded Conductors: Solder-less, bolted pressure or compression connectors.
 - 3. Solid Conductors: Bolted pressure or spring connectors.
 - 4. Motor Lead Pigtails: Crimp lugs with through-bolt fasteners between lugs. Furnish proper sized dies and tools to apply connectors.
 - 5. Lighting Fixture Taps: Electrical spring connectors as specified for solid conductors.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

LOW-VOLTAGE ELECTRICAL POWER
CONDUCTORS AND CABLES

6. Ground Connections: Provide ground clamps or connectors of a type suitable for grounding applications.

E. Provide temperature ratings of connectors and splices to match wire rating.

3.6 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Apply Sleeve and Sleeve Seal where raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies. Sleeve and Sleeve Seal materials and installation requirements are specified in Division 16 Section "Common Work Results for Electrical."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each feeder, and branch circuit.
2. Test continuity of each circuit.

B. Testing Agency: Engage a qualified independent testing and inspecting agency as defined in Division 16 Section "Common Work Results for Electrical" to perform the following field tests and inspections and prepare certified test reports:

C. Perform the following field tests and inspections and prepare test reports:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance conductors, and conductors of No. 2 AWG and larger for compliance with requirements.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

D. Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Applied potential shall be 1000 volts dc for one minute.

E. Perform continuity test to insure correct cable connection.

F. Test Values

- a. Bolt-torque levels shall be in accordance with Table 1.1 thru Table 1.4, unless otherwise specified by the manufacturer.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

LOW-VOLTAGE ELECTRICAL POWER
CONDUCTORS AND CABLES

Table 1.1 - Bolt Torque for Bus Connection using Cadmium or Zinc Plated Heat-Treated Steel

Grade	SAE 1 & 2	SAE 5	SAE 7	SAE 8
Minimum Tensile (P.S.I.)	64K	105K	133K	150K
Bolt Diameter (Inches)	Torque (Foot Pounds)			
1/4	4.0	5.6	8.0	8.4
5/16	7.2	11.2	15.2	17.6
3/8	12.0	20.0	27.2	29.6
7/16	19.2	32.0	44.0	48.0
1/2	29.6	48.0	68.0	73.6
9/16	42.4	70.4	96.0	105.6
5/8	59.2	96.0	133.6	144.0
3/4	96.0	160.0	224.0	236.8
7/8	152.0	241.6	352.0	378.4
1	225.6	372.8	528.0	571.2

Table 1.2 - Bolt Torque for Bus Connection using Silicon Bronze Fasteners ¹

	Non-Lubricated	Lubricated
Bolt Diameter (Inches)	Torque (Foot Pounds)	
5/16	15.0	10.0
3/8	20.0	14.0
1/2	40.0	25.0
5/8	55.0	40.0
3/4	70.0	60.0

¹ Bronze alloy bolts with minimum tensile strength of 70,000 pounds per square inch.

Table 1.3 - Bolt Torque for Bus Connection using Aluminum Alloy Fasteners ²

	Lubricated
Bolt Diameter (Inches)	Torque (Foot Pounds)
5/16	8.0
3/8	11.2
1/2	20.0
5/8	32.0
3/4	48.0

² Aluminum alloy bolts with minimum tensile strength of 55,000 pounds per square inch.

Table 1.4 - Bolt Torque for Bus Connection using Stainless Steel Fasteners ³

	Uncoated
Bolt Diameter (Inches)	Torque (Foot Pounds)
5/16	14.0
3/8	25.0
1/2	45.0
5/8	60.0
3/4	90.0

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

LOW-VOLTAGE ELECTRICAL POWER
CONDUCTORS AND CABLES

³ Bolts, cap screws, nuts, flat washers, locknuts: 18-8 alloy. Belleville washers: 302 alloy.

- b. Minimum insulation-resistance values shall be not less than 50 megohms.
 - c. Investigate deviations between adjacent phases.
2. Infrared Scanning: Perform Thermographic Survey in accordance with NETA ATS, Section 9.0.
- a. Initial Infrared Scanning: Within 60 Days after Substantial Completion, perform an infrared scan of each termination of or splice in cables and conductors No. 3 AWG and larger. Open or remove doors and covers so connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each termination and splice 11 months after date of Substantial Completion.
 - c. Instruments, Equipment:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- B. Correct Deficiencies, Retest and Report:
- 1. Correct unsatisfactory conditions, and retest to demonstrate compliance; replace conductors, units, and devices as required to bring system into compliance.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Prepare a report, certified by testing agency, that identifies conductor, units, and devices checked and describes results. Include notation of deficiencies detected, remedial action taken, and observations and test results after remedial action.

END OF SECTION

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

LOW-VOLTAGE ELECTRICAL POWER
CONDUCTORS AND CABLES

SECTION 16130 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Provide raceways and boxes for all the other systems, as specified in other Sections of Division 16.
- C. Related Sections include the following:
 - 1. Division 16 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.2 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. EPC: Electrical Plastic Conduit
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. FMC: Flexible metal conduit.
- E. IMC: Intermediate metal conduit.
- F. LFMC: Liquidtight flexible metal conduit.
- G. LFNC: Liquidtight flexible nonmetallic conduit.
- H. NBR: Acrylonitrile-butadiene rubber.
- I. RAC: Rigid aluminum conduit.
- J. RMC: Rigid metal conduit.
- K. RSC: Rigid Steel conduit.

1.3 SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 16 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

RACEWAY AND BOXES FOR
ELECTRICAL SYSTEMS

- B. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- C. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Custom enclosures and cabinets.
- D. Coordination Drawings: Submit Coordination Drawings in accordance with Division 16 Section "Common Work Results for Electrical". Include the following:
 - 1. Raceway routing plans, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - a. Proposed cable pull points.
 - b. Structural members in the paths of conduit groups with common supports.
 - c. HVAC, plumbing items, and architectural features in the paths of conduit groups. Denote where systems share common supports.
 - d. Proposed splice locations.
- E. Manufacturer Seismic Qualification Certification: certification that enclosures, cabinets, accessories, and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 16 Section "Vibration and Seismic Controls for Electrical Systems" including items as defined in Division 16 Section "Common Work Results for Electrical".

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Alflec Inc.
 - 3. Allied Tube & Conduit; a Tyco International Ltd. Co.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

RACEWAY AND BOXES FOR
ELECTRICAL SYSTEMS

4. Electri-Flex Co.
 5. O-Z Gedney; a unit of General Signal.
 6. Manhattan/CDT/Cole-Flex.
 7. Wheatland Tube Company.
- B. RSC: Comply with ANSI C80.1 and UL 6; Galvanized rigid steel, each length with a coupling on one end and thread protector on opposite end.
- C. RAC: Comply with ANSI C80.5 and UL 6A; Rigid aluminum, each length with a coupling on one end and thread protector on opposite end.
- D. IMC: Comply with ANSI C80.6. and UL 1242.
- E. Fittings for RSC, RAC and IMC: Provide factory made threaded couplings of same material as the conduit.
1. Molded thermoplastic insulating bushing at all boxes and cabinets, with locknuts inside and outside box or cabinet. In wet locations, provide water-tight hubs for conduit entry into enclosures.
 2. Thermoplastic insulated grounding bushing on all conduits where grounding bushings are required, with locknuts inside and outside the enclosure. In wet locations provide watertight hubs for conduit entry into enclosures.
 3. Expansion joints: O-Z/Gedney or acceptable submission, with internal ground and external bonding jumper.
 - a. Expansion fitting: Type AX.
 - b. End type expansion fitting: Type EXE.
 - c. Deflection fitting: Type DX.
 - d. Pull box fitting: Type EXPB.
 - e. Combination expansion/deflection fitting: Type AXDX.
- F. Conduit fittings for Hazardous (Classified) Locations: Comply with UL 886.
- G. PVC-Coated Steel Conduit: Comply with NEMA RN 1; PVC-coated RSC IMC with 0.040 inch (1 mm), minimum coating thickness.
- H. Coating for fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch(1 mm), with overlapping sleeves protecting threaded joints.
- I. EMT: ANSI C80.3 and UL 797.
- J. Fittings for EMT:
1. Steel, compression couplings.

2. Steel, compression insulated throat box connectors with molded thermoplastic insulating bushing at all boxes and cabinets, with locknuts inside box or cabinet.
 3. Steel, compression insulated throat box connectors with thermoplastic insulated grounding bushing on all tubing where grounding bushings are required.
 4. Expansion joints: O-Z/Gedney, type TX or acceptable submission, with internal ground and external bonding jumper.
 5. Insulated throat material for fittings to be of a color that is easily distinguishable; clear thermoplastic throats are not acceptable.
- K. FMC: Comply with UL 1; Zinc-coated steel.
- L. LFMC: Comply with UL 360; Flexible steel conduit with neoprene jacket and copper grounding strand.
- M. Fittings for FMC and LFMC:
- a. Adapters at connections between flexible and rigid conduit.
 - b. Thermoplastic insulated throat, steel connectors at box or cabinet terminations.
 - c. Insulated throat material for fittings to be of a color that is easily distinguishable; clear thermoplastic throats are not acceptable.
- N. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
- O. Wire Support Bushings: Provide for vertical runs as required by the NFPA 70. Select for the conductor size involved.
1. For conductors NO. 8 AWG and smaller provide galvanized, non-insulating type.
 2. For conductors No. 6 AWG and larger provide O-Z/Gedney, Type SR, insulating type.
- P. Joint Compound for RSC or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 METAL WIREWAYS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

RACEWAY AND BOXES FOR
ELECTRICAL SYSTEMS

1. Cooper B-Line, Inc.
 2. Hoffman.
 3. Square D; Schneider Electric.
- B. Description: Comply with UL 870.
- C. Sheet metal sized and shaped as required, NEMA 250, Type as required.
- D. Fittings and Accessories:
1. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
 2. Construct wireways with/without knockouts, as required.
 3. Provide spring nuts or guards on all screws installed toward the inside to prevent wire insulation damage.
- E. Wireway Covers:
1. Hinged type unless access restrictions require screw-cover type.
 2. Flanged-and-gasketed as required for NEMA type.
 3. Construct cover to close without the use of parts other than the standard lengths, fittings, and connectors.
 4. Provide provisions for the cover to be sealed in the closed position with a sealing wire.
- F. Finish: Manufacturer's standard enamel finish.

2.3 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Thomas & Betts Corporation.
 - b. Wiremold Company (The).
- B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hubbell Incorporated; Wiring Device-Kellems Division.
 - b. Lamson & Sessions; Carlon Electrical Products.
 - c. Panduit Corp.
 - d. Wiremold Company (The).

- C. Surface raceways used together with couplings, clips, bushings, straps, connectors, connection covers, elbows, boxes, extension boxes, fixture boxes, extension adapters, blank covers and all other required fittings; size to accommodate the conductors to be installed therein in each case.

2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 2. EGS/Appleton Electric.
 3. Hoffman.
 4. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
 5. O-Z/Gedney; a unit of General Signal.
 6. RACO; a Hubbell Company.
 7. Robroy Industries, Inc.; Enclosure Division.
 8. Thomas & Betts Corporation.
 9. Wiremold Company (The).

- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1.

- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

- D. Metal Floor Boxes: Cast or sheet metal, fully adjustable or semi-adjustable, rectangular or as indicated.

- E. Nonmetallic Floor Boxes: Nonadjustable, round.

- F. Sheet Metal Pull and Junction Boxes: Comply with NEMA OS 1.

1. Construct boxes from code gauge sheet steel no lighter than 14 gauge with overlapped riveted or welded corners and with edges turned to receive trim.
 2. Construct covers from same gauge as box with screw fasteners. Sectionalize boxes over 864 square inches.
- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1, galvanized, cast iron with gasketed cover.
- H. Hinged-Cover Enclosures: Comply with NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- I. Cabinets:
1. Comply with NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 2. Hinged door in front cover with flush latch and concealed hinge.
 3. Key latch to match panelboards.
 4. Metal barriers to separate wiring of different systems and voltage.
 5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
1. Above Ground: RAC, RSC, or IMC.
 2. Emergency Feeders: RSC
 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R, unless otherwise indicated.
- B. Comply with the following indoor applications, unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed and Subject to Physical Damage: RAC, RSC, or IMC. Includes, but is not limited to, raceways in the following locations:

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

RACEWAY AND BOXES FOR
ELECTRICAL SYSTEMS

- a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Central Plant Mechanical Rooms
 - d. Parking Garages, where exposed to vehicular traffic.
3. Conductors over 600 volts: RSC, or IMC.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Concealed within Masonry Walls: RSC, or IMC.
 6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 7. Damp or Wet Locations: RSC, or IMC.
 8. Elevator Pits: RSC, IMC, or LFMC.
 9. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
 10. Emergency feeders and branch circuits: EMT
- C. Minimum Raceway Size:
1. Individual Branch Circuits: 3/4-inch(21-mm)
 2. For feeder circuits and multiple branch circuits: 3/4-inch(21-mm)
- D. Provide minimum 1/2"-inch(16-mm) conduit for controls circuiting.
- E. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. RAC, RSC and IMC: Use threaded fittings, unless otherwise indicated.
- F. Magnetic Resonance Imaging (MRI) Environments: Provide aluminum raceways, boxes and fittings within RF shielding.
- G. Use the shortest path possible to the intended load or receptacle for raceways of ungrounded circuits which are electrically monitored by ground detector system; this is intended to minimize leakage current to ground. In ceiling space, utilize paths that deviate from that perpendicular to structure where these paths will not interfere with other overhead systems.
- H. Junction and Pull Boxes: Sheet steel boxes, unless noted or required otherwise.
1. Provide boxes no smaller than 4 inches square and 1-1/2 inches deep.

2. Size all junction and pull boxes in accordance with the NFPA 70, unless project conditions dictate use of larger boxes.
 3. Boxes in Hazardous Areas: Cast metal boxes with appropriate sealing fittings.
- I. Outlet and Device Boxes: Sheet steel boxes, unless noted or required otherwise.
 1. For Lighting Fixture Outlets: 4 inch square with raised fixture ring.
 2. For Wall Switches, Receptacles, and Communication Use: 4 inch square, one-piece. Use boxes with plaster rings in all plastered walls where wall thickness permits. Use boxes less than 1-1/2 inch deep only in locations where deep boxes cannot be accommodated by construction.
 3. Boxes in Hazardous Areas: Cast metal boxes with appropriate sealing fittings.
 - J. Boxes Used Outdoors or in Damp/Wet Locations: Cast metal boxes with gasketed covers and threaded hubs.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Store conduit in dry locations during construction. Swab conduits out prior to pulling conductors.
- C. Set metal floor boxes level and flush with finished floor surface.
- D. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- E. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- F. Recessed Boxes in Fire-Rated Partitions: For boxes located on opposite sides of same partition do not install boxes back-to-back; separate boxes with a minimum of 24 inch separation, unless otherwise indicated in the installation requirements specified in Division 07 Section "Penetration Firestopping."
- G. Recessed Boxes in partitions around Acoustically-Sensitive Spaces: For boxes located on opposite sides of same partition do not install boxes back-to-back; separate boxes with a minimum of 24 inch separation. Acoustically-Sensitive Spaces include, but are not limited to, the following:
 1. Conference Rooms, Meeting rooms and similar spaces.
 2. Classrooms, Training Rooms and similar spaces.

3. Interview Rooms, Consultation Rooms and similar spaces.
 4. Auditoriums, Lecture Rooms, and similar spaces.
 5. Ballrooms, Private Dining, and similar spaces.
 6. Other spaces specifically listed in the Project Acoustic Consultants' recommendation reports or specifications.
- H. On concealed conduit systems where boxes are not otherwise accessible, set boxes flush with finished surfaces for access, and provide overlapping covers.
- I. Provide boxes where shown and where necessary for the installation and pulling of cables and wires.
- J. Install covers on junction boxes and conduit bodies after wiring and connections are completed.
- K. Install raceways perpendicular or parallel to building surfaces with boxes set plumb and square. In areas where there are no suspended ceilings, run all conduits parallel and perpendicular to building surface planes.
- L. Install conduits to prevent excessive strain or damage to conductors.
- M. Run conductors over 48 Volts in raceway, unless otherwise indicated.
- N. Install raceways a minimum of 6-inches (150 mm) away from parallel runs of flues, steam pipes, hot-water pipes, and other objects operating at high temperatures.
- O. Install horizontal raceway runs above water and steam piping. Install raceways a minimum of 1-inch (25.4-mm) from pipe insulation.
- P. Complete raceway installation before starting conductor installation.
- Q. Support raceways and boxes as specified in Division 16 Section "Hangers and Supports for Electrical Systems."
- R. Conceal conduit within finished walls, ceilings, and raised floors, unless otherwise indicated.
- S. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
1. Change from ENT to RSC or IMC before rising above the floor.
- T. No feeders or branch circuits are to be installed in any slab, unless otherwise indicated.
- U. No branch circuits are to be installed below slab-on-grade, unless otherwise indicated. Exception: On-grade floor boxes, route raceway minimum of 6 inches below slab-on-grade.

- V. Do not install aluminum conduits in contact with concrete.
- W. Install no more than the equivalent of three 90-degree bends and a maximum of 150 feet between pull points in any conduit run except for communications conduits, for which fewer bends are allowed.
- X. Join RSC and IMC with threaded couplings. Ream conduits after threading and keep each end closed.
- Y. Join EMT with the specified type of couplings. At EMT terminations, provide insulated throat, box connectors and locknuts.
- Z. Provide insulating bushing at conduit box terminations. Provide bonding clamps where grounding bushings are required.
- AA. Secure rigid conduits at cabinets and boxes with galvanized locknuts, both inside and outside.
- BB. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- CC. Install raceways to avoid moisture traps. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. In damp or wet locations.
 - 3. Where otherwise required by NFPA 70.
- DD. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- EE. Provide an expansion joint in each raceway run which is buried in, or rigidly secured to, the building construction on opposite sides of a building expansion joint, and in each long straight run of raceway which may be subject to excessive expansion.
- FF. Flexible Conduit Connections:
 - 1. Use minimum of 12 inches (305 mm) at final connections to equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 2. Use LFMC in damp or wet locations subject to severe physical damage including mechanical equipment rooms, at motor or equipment locations at or near pumps, and when installed outdoors.

- 3. Use LFMC in damp or wet locations not subject to severe physical damage.
 - GG. Where raceways do not terminate in a box or cabinet, install thermoplastic insulating bushings on end of raceway to protect future cabling from physical damage.
 - HH. Install pull wires free of splices in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Coil and identify each end of each line with plastic tag bearing complete information as to the purpose of the raceway and the location of its other end.
- 3.3 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS
- A. Apply Sleeve and Sleeve Seal where raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies. Sleeve and Sleeve Seal materials and installation requirements are specified in Division 16 Section "Common Work Results for Electrical."
- 3.4 FIRESTOPPING
- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."
- 3.5 PROTECTION
- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.
- 3.6 CONNECTIONS
- A. Ground raceways and boxes according to Division 16 Section "Grounding and Bonding for Electrical Systems."
- 3.7 IDENTIFICATION
- A. Identify raceways and boxes as specified in Division 16 Section "Identification for Electrical Systems".
- 3.8 SEGREGATION OF WIRING SYSTEMS
- A. Segregation of wiring systems shall not be compromised by the use of common pullboxes, wireways, cabinets or any other type of enclosure.

- B. The raceway system for each feeder shall be a separate system completely fault isolated from all other raceway systems.
- C. The raceway system for the branch circuits of each panelboard shall be a separate system completely fault isolated from all other raceway systems.
- D. In systems operating at more than 300 volts between phase conductors, and where different phase conductors are to be run to a common device or outlet box, provide code gauge barrier equal to box gauge between conductors so that two different phase wires will not be in the same compartment.

3.9 CLEANING

- A. On completion of raceway installation but before any cable is installed, perform the following:
 - 1. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. On completion of box, enclosure, and cabinet installation but before any cable or wiring devices are installed, inspect interior of boxes and perform the following:
 - 1. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION

SECTION 16133 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks, and in single duct runs.
 - 2. Handholes and boxes.
 - 3. Manholes.
- B. Related Sections include the following:
 - 1. Division 16 Section "Raceways and Boxes for Electrical Systems" for raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 DEFINITION

- A. Duct: an underground raceway. This term may be used interchangeably with the term raceway.
- B. Duct Bank: two or more raceways grouped together, irrespective of duct material or encasement material.
- C. EPC: Electrical Plastic Conduit
- D. RMC: Rigid metal conduit.
- E. RNC: Rigid nonmetallic conduit.
- F. RSC: Rigid Steel conduit.

1.3 SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 16 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.
- B. Product Data: For the following:
 - 1. Duct-bank materials, including separators and miscellaneous components.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

UNDERGROUND DUCTS AND RACEWAYS
FOR ELECTRICAL SYSTEMS

2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
 3. Accessories for manholes, handholes, boxes, and other utility structures.
 4. Warning tape.
 5. Warning planks.
- C. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans and elevations with dimensions and weights. Include sections, details, attachments to other work, and accessories, including the following:
1. Duct entry provisions, including locations and duct sizes.
 2. Reinforcement details.
 3. Frame and cover design and manhole frame support rings.
 4. Ladder details.
 5. Grounding details.
 6. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
 7. Joint details.
- D. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:
1. Duct entry provisions, including locations and duct sizes.
 2. Cover design.
 3. Grounding details.
 4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
- E. Coordination Drawings: Submit Coordination Drawings in accordance with Division 16 Section "Common Work Results for Electrical". Include the following:
1. Duct-Bank, Manhole, and Handhole plans, sections and elevation profiles; on which the following items are shown and coordinated with each other, passed on input from installers of the items involved:
 - a. Duct banks included in the Work. Denote duct routing including bends and locations of expansion fittings. Include system profiles and elevations.

- b. Other utilities, underground structures, architectural features, and topographic elements in the paths of duct banks. Denote system profiles and elevations.
 - c. Precast or Factory-Fabricated Underground Utility Structures.
 - d. Factory-Fabricated Handholes and Boxes.
- F. Product Certificates: For concrete and steel used in precast concrete manholes and handholes, as required by ASTM C 858.
- G. Source quality-control test reports.
- H. Field quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For independent agency as defined in Division 16 Section "Common Work Results for Electrical" and according to ASTM E 329.
- B. Comply with ANSI C2.
- C. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver ducts to Project site with ends capped. Protect conduit from corrosion and entrance of debris by storing above grade with an appropriate covering. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.
- B. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
- C. Lift and support precast concrete units only at designated lifting or supporting points.

1.6 COORDINATION

- A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Verify field measurements, routing and termination locations of duct bank prior to excavation for rough-in. Coordinate duct bank installation with underground Work and site Work and other site improvement Work specified in other Divisions.
- B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Duct bank routing as indicated on the Drawings is the approximate location. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Engineer.

- C. Accurately record actual routing of duct bank on Project record documents, and submit in accordance with Division 01.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND DUCTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Alflec Inc.
 - 3. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 4. Electri-Flex Co.
 - 5. O-Z Gedney; a unit of General Signal.
 - 6. Manhattan/CDT/Cole-Flex.
 - 7. Wheatland Tube Company.
- B. RSC: Comply with ANSI C80.1 and UL 6; Galvanized rigid steel, each length with a coupling on one end and thread protector on opposite end.
- C. Fittings for RSC: Provide factory made threaded couplings of same material as the conduit.
 - 1. Molded thermoplastic insulating bushing at all boxes and cabinets, with locknuts inside and outside box or cabinet. In wet locations, provide watertight hubs for conduit entry into enclosures.
 - 2. Thermoplastic insulated grounding bushing on all conduits where grounding bushings are required, with locknuts inside and outside the enclosure. In wet locations provide watertight hubs for conduit entry into enclosures.

2.2 NONMETALLIC CONDUIT AND DUCTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. ARNCO Corp.
 - 2. Cantex, Inc.
 - 3. Condux International, Inc.

4. Electri-Flex Company.
 5. Lamson & Sessions; Carlon Electrical Products.
 6. Manhattan/CDT; a division of Cable Design Technologies.
 7. Spiraduct/AFC Cable Systems, Inc.
- B. ENT: Comply with NEMA TC 13.
- C. Paragraph below specifies Schedule 40 and Schedule 80 weights, respectively, of same RNC specified in Division 16/26 Section "Raceway and Boxes for Electrical Systems." Coordinate with Part 3 "Underground Duct Application" Article. See Evaluations.
- D. RNC: Comply with NEMA TC 2 and UL 651, type EPC-40-PVC or type EPC-80-PVC as indicated.
- E. Fittings for ENT and RNC: Comply with NEMA TC 3 and UL 514B.; match to conduit or tubing type and material.

2.3 DUCT ACCESSORIES

- A. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
- B. Corrosion Resistance Tape for RSC: 20 mil polyvinyl chloride (PVC) tape with a high-tack adhesive and pipe primer to provide a corrosion- and impact-resistant seal.
- C. Warning Tape: Underground-line warning tape specified in Division 16 Section "Identification for Electrical Systems."
- D. Warning Caps: Cast-in-Place Cap or multiple manufactured Planks.
1. Cast-In-Place Cap: 6000-psi (41-MPa) minimum 3-inches (76 mm) thick concrete meeting the requirements of Division 03 "Cast-In-Place Concrete".
 - a. Color: Dye added to concrete during batching or powder dye applied to top prior to curing.
 - 1) ELECTRIC: Red for duct systems with power wires and cables.
 - 2) SIGNAL: Orange for communications, data, and telephone duct systems
 2. Planks: Nominal 12 by 24 by 3 inches (300 by 600 by 76 mm) in size, manufactured from 6000-psi (41-MPa) concrete.
 - a. Color: Dye added to concrete during batching.

- 1) ELECTRIC: Red for duct systems with power wires and cables.
- 2) SIGNAL: Orange for communications, data, and telephone duct systems.

2.4 PRECAST CONCRETE HANDHOLES AND BOXES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Christy Concrete Products.
 2. Oldcastle Precast Group.
 3. Riverton Concrete Products; a division of Cretex Companies, Inc.
 4. Utility Concrete Products, LLC.
- B. Comply with ASTM C 858 for design and manufacturing processes.
- C. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
1. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
 2. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 3. Cover Legend: Molded lettering, selected to suit system or as otherwise required.
 - a. Legend: "ELECTRIC-LV" for duct systems with power wires and cables operating at 600 V and less.
 - b. Legend: "ELECTRIC-HV" for duct systems with power wires and cables operating over 600 V.
 - c. Legend: "SIGNAL" for communications, data, and telephone duct systems.
 4. Configuration: Units shall be designed for flush burial and have integral closed bottom, unless otherwise indicated.
 5. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
 - a. Extension shall provide increased depth as required.
 - b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.

6. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
 - a. Type and size shall match fittings to duct or conduit to be terminated.
 - b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.
7. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.5 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Description: Comply with SCTE 77.

1. Color: Gray for paved areas and Green for landscaped areas, unless otherwise indicated.
2. Configuration: Units shall be designed for flush burial and have integral closed bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, selected to suit system or as otherwise required.
 - a. Legend: "ELECTRIC-LV" for duct systems with power wires and cables operating at 600 V and less.
 - b. Legend: "ELECTRIC-HV" for duct systems with power wires and cables operating over 600 V.
 - c. Legend: "SIGNAL" for communications, data, and telephone duct systems.
6. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have factory-installed inserts for cable racks and pulling-in irons.

B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. CDR Systems Corporation.
 - d. NewBasis.

- C. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. Christy Concrete Products.
 - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.

- D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of polymer concrete.
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carson Industries LLC.
 - b. Christy Concrete Products.
 - c. Nordic Fiberglass, Inc.

2.6 PRECAST MANHOLES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Christy Concrete Products.
 2. Oldcastle Precast Group.
 3. Riverton Concrete Products; a division of Cretex Companies, Inc.
 4. Utility Concrete Products, LLC.
 5. Dalworth Concrete Products, Inc.

- B. ANSI/ACI 301 - Specifications for Structural Concrete for Buildings.

- C. ANSI/ASTM A615 - Specifications for Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- D. AASHTO HS-20 - Standard Specification for Highway Bridges.
- E. Comply with ASTM C 858, with structural design loading as specified in Part 3 "Underground Enclosure Application" Article and with interlocking mating sections, complete with accessories, hardware, and features.
 - 1. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
 - a. Type and size shall match fittings to duct or conduit to be terminated.
 - b. Fittings shall align with elevations of approaching ducts and be located near interior corners of manholes to facilitate racking of cable.
- F. Concrete Knockout Panels: 1-1/2 to 2 inches (38 to 50 mm) thick, for future conduit entrance and sleeve for ground rod.

2.7 CAST-IN-PLACE MANHOLES

- A. Description: Underground utility structures, constructed in place, complete with accessories, hardware, and features. Include concrete knockout panels for conduit entrance and sleeve for ground rod.
- B. Materials: Comply with ASTM C 858 and with Division 03 Section "Cast-in-Place Concrete."
- C. Structural Design Loading: As specified in Part 3 "Underground Enclosure Application" Article.

2.8 UTILITY STRUCTURE ACCESSORIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Bilco Company (The).
 - 2. Campbell Foundry Company.
 - 3. Christy Concrete Products.
 - 4. East Jordan Iron Works, Inc.
 - 5. Neenah Foundry Company.
 - 6. NewBasis.
 - 7. Oldcastle Precast Group.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

UNDERGROUND DUCTS AND RACEWAYS
FOR ELECTRICAL SYSTEMS

8. Osburn Associates, Inc.
 9. Pennsylvania Insert Corporation.
 10. Riverton Concrete Products; a division of Cretex Companies, Inc..
 11. Strongwell Corporation; Lenoir City Division.
 12. Underground Devices, Inc.
 13. Utility Concrete Products, LLC.
- B. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.
1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A 48/A 48M, Class 30B or cast aluminum with milled cover-to-frame bearing surfaces; diameter, 29 inches (737 mm).
 - a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.
 2. Cover Legend: Cast in. Selected to suit system.
 - a. Legend: "ELECTRIC-LV" for duct systems with power wires and cables for systems operating at 600 V and less.
 - b. Legend: "ELECTRIC-HV" for duct systems with medium-voltage cables.
 - c. Legend: "SIGNAL" for communications, data, and telephone duct systems.
 3. Manhole Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.
 - a. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. (60 L) where packaged mix complying with ASTM C 387, Type M, may be used.
- C. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch- (50-mm-) diameter eye, and 1-by-4-inch (25-by-100-mm) bolt.
1. Working Load Embedded in 6-Inch (150-mm), 4000-psi (27.6-MPa) Concrete: 13,000-lbf (58-kN) minimum tension.
- D. Pulling Eyes in Nonconcrete Walls: Eyebolt with reinforced fastening, 1-1/4-inch- (32-mm-) diameter eye, rated 2500-lbf (11-kN) minimum tension.

- E. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch- (22-mm-) diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.
 - 1. Ultimate Yield Strength: 40,000-lbf (180-kN) shear and 60,000-lbf (270-kN) tension.
- F. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch (13-mm) ID by 2-3/4 inches (69 mm) deep, flared to 1-1/4 inches (32 mm) minimum at base.
 - 1. Tested Ultimate Pullout Strength: 12,000 lbf (53 kN) minimum.
- G. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch (13-mm) bolt, 5300-lbf (24-kN) rated pullout strength, and minimum 6800-lbf (30-kN) rated shear strength.
- H. Cable Rack Assembly: Steel, hot-dip galvanized, except insulators.
 - 1. Stanchions: T-section or channel; 2-1/4-inch (57-mm) nominal size; punched with 14 holes on 1-1/2-inch (38-mm) centers for cable-arm attachment.
 - 2. Arms: 1-1/2 inches (38 mm) wide, lengths ranging from 3 inches (75 mm) with 450-lb (204-kg) minimum capacity to 18 inches (460 mm) with 250-lb (114-kg) minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.
 - 3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.
- I. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F (2 deg C). Capable of withstanding temperature of 300 deg F (150 deg C) without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals. Capable of withstanding maximum hydrostatic pressures at the installation location with the ground-water level at grade.
- J. Fixed Manhole Ladders: Arranged for attachment to roof or wall and floor of manhole. Ladder and mounting brackets and braces shall be fabricated from nonconductive, structural-grade, fiberglass-reinforced resin.
- K. Cover Hooks: Heavy duty, designed for lifts 60 lbf (270 N) and greater. Two required.

2.9 SOURCE QUALITY CONTROL

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

UNDERGROUND DUCTS AND RACEWAYS
FOR ELECTRICAL SYSTEMS

- A. Test and inspect precast concrete utility structures according to ASTM C 1037.
- B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Strength tests of complete boxes and covers shall be by either an independent testing agency or the manufacturer.
 - 2. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 UNDERGROUND DUCT APPLICATION

- A. Ducts for Electrical Cables Over 600 V: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank with warning tape, unless otherwise indicated.
- B. Ducts for Electrical Services and Feeders 600 V and Less: Provide the following, unless otherwise indicated:
 - 1. Outside building footprint: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank with warning tape.
 - 2. Under building slab: RNC, NEMA Type EPC-40-PVC, installed in direct-buried duct bank with warning tape.
- C. Ducts for Electrical Branch Circuits 600 V and Less: Provide the following, unless otherwise indicated:
 - 1. Outside building footprint: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank with warning tape.
 - 2. Under building slab, where permitted: RNC, NEMA Type EPC-40-PVC, installed in direct-buried duct bank with warning tape.
 - a. No branch circuits are to be installed below slab-on-grade, unless otherwise indicated. Exception: On-grade floor boxes, route raceway minimum of 6 inches below slab-on-grade.
- D. Ducts for Emergency or Essential Electrical System Feeders 600 V and Less: Provide the following, unless otherwise indicated:
 - 1. Outside building footprint: RSC, wrapped with corrosion resistance tape, in concrete-encased duct bank with warning tape.
 - 2. Under building slab: RSC, wrapped with corrosion resistance tape in direct-buried duct bank with warning tape.

- E. Ducts for Emergency or Essential Electrical System Branch Circuits 600 V and Less: Provide the following, unless otherwise indicated:
 - 1. Outside building footprint: RSC, wrapped with corrosion resistance tape in direct-buried duct bank with warning tape.
 - 2. Under building slab, where permitted: RSC, wrapped with corrosion resistance tape in direct-buried duct bank with warning tape.
 - a. No branch circuits are to be installed below slab-on-grade, unless otherwise indicated. Exception: On-grade floor boxes, route raceway minimum of 6 inches below slab-on-grade.
- F. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC, installed in direct-buried duct bank with warning caps and warning tape, unless otherwise indicated.
- G. Underground Ducts for Telephone, Communications, or Data Circuits: RNC, NEMA Type EPC-40-PVC, installed in direct-buried duct bank with warning tape, unless otherwise indicated.
- H. Underground Ducts Crossing Paved Paths, Walks and Roadways: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank with warning tape.

3.2 UNDERGROUND ENCLOSURE APPLICATION

- A. Handholes and Boxes for 600 V and Less, Including Telephone, Communications, and Data Wiring:
 - 1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
 - 2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 structural load rating.
 - 3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer concrete units, SCTE 77, Tier 8 structural load rating.
 - 4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.
- B. Manholes: Precast or cast-in-place concrete.
 - 1. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.
 - 2. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating according to AASHTO HB 17.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

UNDERGROUND DUCTS AND RACEWAYS
FOR ELECTRICAL SYSTEMS

3.3 EARTHWORK

- A. Excavation and Backfill: Comply with Division 2 Section "Earthwork" but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 2.
- D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 01 Section "Cutting and Patching."
- E. Prepare excavation, base material installation, and compaction necessary for the specific ductbank arrangement.
- F. Verify that excavation, base material installation, and compaction is completed.
- G. Backfill trenches as specified in Division 2.

3.4 DUCT INSTALLATION

- A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.
- B. Curves and Bends:
 - 1. Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches (1220 mm), both horizontally and vertically, at other locations, unless otherwise indicated.
 - 2. Where RNC is provided, use RSC elbows with corrosion resistance tape and primer for all bends.
- C. Install conduits to locate top of ductbank at depths as indicated or as required to coordinate with other portions of the Work.
- D. Apply corrosion resistance tape and primer to direct-buried or concrete-encased RSC.
- E. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

- F. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches (250 mm) o.c. for 5-inch (125-mm) ducts, and vary proportionately for other duct sizes.
1. Begin change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell without reducing duct line slope and without forming a trap in the line.
 2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.
 3. Grout end bells into structure walls from both sides to provide watertight entrances.
- G. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet (3 m) outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Division 16 Section "Common Work Results for Electrical/Common Work Results for Communications/Common Work Results for Electronic Safety and Security."
- H. Stub-Ups: Use manufactured rigid steel conduit elbows and rigid steel conduit extensions for stub-ups at poles, equipment, and at building entrances through the floor. Install insulated bushings on terminations.
1. Where RNC is permitted, convert to RSC prior to turning up into equipment.
 2. Extend conduit extensions installed in floors a minimum of 4 inches (102 mm) above finished floor level.
 3. Extend conduit extensions installed in equipment bases a minimum of 4 inches (102 mm) above finished base level.
 4. Stub-Ups to Outdoor Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit below base horizontally a minimum of 60 inches (1500 mm) from edge of base. Install insulated grounding bushings on terminations at equipment.
- I. Sealing: Provide temporary caps to protect installed conduit against entrance of dirt and moisture prior to cable installation. Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.
- J. Pulling Cord: Install 100-lbf- (445-N-) test nylon cord in ducts, including spares.
- K. Concrete-Encased Duct(s) and Duct Banks:
1. Support duct(s) on duct separators.

2. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches (150 mm) between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
3. Minimum Space between Ducts: 3 inches (75 mm) between ducts and exterior envelope wall, 2 inches (50 mm) between ducts for like services, and 4 inches (100 mm) between power and signal ducts.
4. Depth: Install top of duct bank at least 24 inches (600 mm) below finished grade in areas not subject to deliberate traffic, and at least 30 inches (750 mm) below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.
5. Stub Ups: Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
6. Concrete Color: Dye added to concrete during batching or powder dye applied to top prior to curing.
 - a. ELECTRIC: Red for duct systems with power wires and cables.
 - b. SIGNAL: Orange for communications, data, and telephone duct systems.
7. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
 - a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
 - b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch (19-mm) reinforcing rod dowels extending 18 inches (450 mm) into concrete on both sides of joint near corners of envelope.
 - c. For Cast-In-Place manholes: Connect to manhole wall using dowels.
8. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

9. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
 10. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
 11. Label top of encased duct bank with stenciled lettering 2-inch- (50-mm-) high letters at not less than 10-foot intervals, after curing. Label selected to suit system or as otherwise required.
 - a. Legend: "ELECTRIC-LV" for duct systems with power wires and cables operating at 600 V and less.
 - b. Legend: "ELECTRIC-HV" for duct systems with power wires and cables operating over 600 V.
 - c. Legend: "SIGNAL" for communications, data, and telephone duct systems.
- L. Direct-Buried Duct(s) and Duct Banks:
1. Support duct(s) on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
 2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches (150 mm) between tiers.
 3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 02 Section "Earthwork" for pipes less than 6 inches (150 mm) in nominal diameter.
 4. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches (100 mm) over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Division 02 Section "Earthwork".
 5. Install ducts with a minimum of 3 inches (75 mm) between ducts for like services and 6 inches (150 mm) between power and signal ducts.
 6. Depth: Install top of duct bank at least 36 inches (900 mm) below finished grade, unless otherwise indicated.
 7. Set elevation of bottom of duct bank below the frost line.

8. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
 - b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

- M. Warning Caps: Install Cast-In-Place Caps or Manufactured Planks approximately 12 inches (300 mm) above direct-buried ducts and duct banks, where indicated.
 1. Cast-In-Place Caps: Place to cover entire width of duct bank.
 2. Warning Planks: Place planks 24 inches (600 mm) o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional planks 12 inches (300 mm) apart, horizontally.
 3. Label Cap and Planks with stenciled lettering 2-inch- (50-mm-) high letters at not less than 10-foot intervals, after curing. Label selected to suit system or as otherwise required.
 - a. Legend: "ELECTRIC-LV" for duct systems with power wires and cables operating at 600 V and less.
 - b. Legend: "ELECTRIC-HV" for duct systems with power wires and cables operating over 600 V.
 - c. Legend: "SIGNAL" for communications, data, and telephone duct systems.

- N. Warning Tape: Bury Warning Tape Caps approximately 12 inches (300 mm) above ducts and duct banks, where indicated.
 1. Align tape parallel to and within 3 inches (75 mm) of the centerline of duct bank.
 2. Provide an additional warning tape for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.

3.5 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

- A. Cast-in-Place Manhole Installation:
 1. Finish interior surfaces with a smooth-troweled finish.
 2. Windows for Future Duct Connections: Form and pour concrete knockout panels 1-1/2 to 2 inches (38 to 50 mm) thick. Repair all unused conduit knockouts and other openings in sides of manhole.

3. Cast-in-place concrete, formwork, and reinforcement are specified in Division 03 Section "Cast-in-Place Concrete."
- B. Precast Concrete Handhole and Manhole Installation:
1. Comply with ASTM C 891, unless otherwise indicated.
 2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
 3. Unless otherwise indicated, support units on a minimum 6-inch (150-mm) level bed of crushed stone or gravel, graded from 1-inch (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevations:
1. Manhole Roof: Install with rooftop at least 15 inches (380 mm) below finished grade or as required to prevent floating of manhole.
 2. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch (25 mm) above finished grade.
 3. Install handholes with bottom below the frost line.
 4. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
 5. Where indicated, cast handhole cover frame integrally with handhole structure.
- D. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions by others.
- E. Manhole Access: Circular opening in manhole roof; sized to match cover size.
1. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
 2. Install chimney, constructed of precast concrete collars and rings to support frame and cover and to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.
- F. Waterproofing: Apply waterproofing to exterior surfaces of manholes after concrete has cured at least three days. Waterproofing materials and installation are specified in Division 07 Section "Elastomeric Sheet Waterproofing" or "Thermoplastic Sheet Waterproofing." After ducts have been connected and grouted, and before backfill-

ling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

- G. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.
- H. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.
- I. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches (98 mm) for manholes and 2 inches (50 mm) for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.
- J. Warning Sign: Install "Confined Space Hazard" warning sign on the inside surface of each manhole cover.

3.6 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.
- B. Unless otherwise indicated, support units on a minimum 4-inch (100-mm) level bed of crushed stone or gravel, graded from 1/2-inch (12.7-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
- D. Install handholes and boxes with bottom below the frost line.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
- F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
- G. For enclosures installed in asphalt paving and other non-concrete surfaces and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
 - 1. Concrete: 3000 psi (20 kPa), 28-day strength, complying with Division 03 Section "Cast-in-Place Concrete," with a troweled finish.

2. Dimensions: 10 inches wide by 12 inches deep (250 mm wide by 300 mm deep).

3.7 GROUNDING

- A. Ground underground ducts and utility structures according to Division 16 Section "Grounding and Bonding for Electrical Systems."

3.8 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Apply Sleeve and Sleeve Seal where raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, exterior walls, sub-grade walls or fire-rated floor and wall assemblies. Sleeve and Sleeve Seal materials and installation requirements are specified in Division 16 Section "Common Work Results for Electrical."

3.9 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
 2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
 3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 16 Section "Grounding and Bonding for Electrical Systems."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.10 CLEANING

- A. On completion of installation but before any equipment or cable is installed, inspect interior and exterior surfaces and perform the following:
 1. Clean ducts prior to cleaning manhole or pull box.
 2. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
 3. Remove all dirt and debris and pump out the manhole or pull box so that it is free of standing water. Manholes and pull boxes shall be dry prior to equipment or cable is installed.
 4. Clean internal surfaces of manholes, including sump and remove foreign material.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

UNDERGROUND DUCTS AND RACEWAYS
FOR ELECTRICAL SYSTEMS

5. Repaired of damages resulting from construction after initial installation.

END OF SECTION

SECTION 16140 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Snap switches and wall-box dimmers.
- B. Related Sections include the following:
 - 1. Division 16 Section "Communications Horizontal Cabling" for workstation outlets.

1.2 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.3 SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 16 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.
- B. Product Data: For each type of product indicated under PART 2 – PRODUCTS.
- C. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- D. Samples: One for each type of device and wall plate specified, in each color specified.
- E. Field quality-control test reports.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

- F. Operation and Maintenance Data: For wiring devices, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation And Maintenance Data," include the following:
 - 1. Manufacturer's routine maintenance requirements for wiring devices and all installed components.
 - 2. Manufacturers' packing label warnings and instruction manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 99
- D. Comply with NFPA 70

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles. Part numbers listed under products paragraphs in Part 2 articles of this section are included to list the manufacturers' product series and they do not designate the color of the device. Subject to compliance with requirements, provide products by one of the following:
 - 1. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 2. Leviton Mfg. Company Inc. (Leviton).
 - 3. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

- A. Industrial-Grade, Convenience Receptacles, Standard Style, 125 V, 20 A:
 - 1. Requirements:
 - a. Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, UL 498, and Federal Specification (FS) W-C-596.
 - b. Description: Industrial Specification Grade receptacles constructed of a high-impact resistant thermoplastic. Wide-body design; back and side-wired; Triple wipe, T-slot, one-piece copper alloy contact design; One-piece brass grounding strap; green ground screw and automatic grounding system attached to the strap.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; HBL5361 (simplex), HBL5362 (duplex).
 - b. Leviton; 5361 (simplex), 5362 (duplex).
 - c. Pass & Seymour; 5361 (simplex), 5362A (duplex).

2.3 GFCI RECEPTACLES

A. Commercial-Grade, GFCI Convenience Receptacles, 125 V, 20 A:

1. Requirements:
 - a. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A.
 - b. Feed-through type, nominal sensitivity to earth leakage of 4-6 milliamperes; Meeting <2006> CSA/UL requirements for End of Life Provision and Reverse Line-Load Miswire.
 - 1) Device shall either render itself incapable of delivering power or indicate by visual or audible means that the device can no longer provide ground fault protection.
 - 2) Device shall not allow current to pass through device when miswired.
 - c. Description: Commercial Specification Grade receptacle constructed of a high-impact resistant thermoplastic. Wide-body design; back and side-wired; Triple wipe, T-slot, one-piece copper alloy contact design; One-piece steel grounding strap; green ground screw and automatic grounding system attached to the strap.
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; GFR5352
 - b. Leviton; 8899
 - c. Pass & Seymour; 2095

2.4 SWITCHES

- A. General Description: All products listed shall meet the following requirements:
 1. Comply with NEMA WD 1, UL 20; Rated UL-94, V2 or better. Manufacturer shall test all switches for proper operation prior to shipment, sample testing is not acceptable.
 2. Description: Constructed of high-impact arc-resistant thermoplastic; back and side-wired; heavy-gauge copper alloy one-piece arm and silver-cadmium oxide contacts with quiet-action mechanism; heavy-gauge zinc-plated steel-mounting strap with automatic grounding feature. Compatible with fluorescent, tungsten and resistive loads; with a motor load capacity of at least 80% of switch's current rating. Terminal screws shall be brass double-combination: Philips-head, slotted. Mounting screws shall be triple combination: Philips-head, slotted, Robertson.
- B. Toggle Switches, 120/277 V, 20 A:
 1. Requirements: Comply with Federal Specification (FS) W-S-896; Industrial Specification Grade toggle switch.
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; HBL1221 (single pole), HBL1222 (two pole), HBL1223 (three way), HBL1224 (four way).

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

WIRING DEVICES
SYSTEMS
16140 - 3

- b. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
 - c. Pass & Seymour; PS20AC1 (single pole), PS20AC2 (two pole), PS20AC3 (three way), PS20AC4 (four way).
- C. Illuminated Light Switches, 120/277V, 20 A:
- 1. Requirements: Industrial Specification Grade toggle switch; Single pole, with neon-lighted handle, illuminated when switch is "OFF."
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; HBL1221IL (single pole); HBL1223IL (3-way) for 120/277V.
 - b. Leviton; 1221-LH (single pole) 1223-LH (3-way) for 120 V; 1221-7L (single pole) 1223-7L (3-way) for 277 V.
 - c. Pass & Seymour; PS20AC1-CSL (single pole); PS20AC3-CSL (3-way) for 120/277V.
- D. Key-Operated / Security Switches, 120/277 V, 20 A:
- 1. Requirements: Single pole, with factory-supplied key in lieu of switch handle. Corbin-style or Barrel lock and key, single-hump key not acceptable.
 - 2. Description: Single pole, with factory-supplied key in lieu of switch handle.
 - 3. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; HBL1221RKL.
 - b. Leviton; 1221-2KL.
 - c. Pass & Seymour; PS20AC1-KL.

2.5 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
- 1. Requirements:
 - a. Plate-Securing Screws: Metal with head color to match plate finish.
 - b. Material for Finished Areas: Smooth, high-impact thermoplastic (nylon).
 - c. Material for Utility Areas: Galvanized steel Smooth, high-impact thermoplastic (nylon).
 - d. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."
 - 2. Products: Subject to compliance with requirements, provide plate from same manufacturer as device.
- B. Wet-Location, Weatherproof Cover Plates:
- 1. Requirements: NEMA 250, complying with type 3R weather-resistant while-in-use metal with lockable cover; non-removable gasket between the mounting plate/base and cover; stainless steel hinges and mounting hardware
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Leviton; 5977DCL.
 - b. Taymac;

2.6 FINISHES

- A. Color: Wiring device catalog numbers in Section Text above do not designate device color. The wiring devices and associated wall plates shall conform to the colors listed in Table 1 below or as otherwise required by NFPA 70. Final color selections for all devices and wall plates shall be submitted to and approved by the Architect.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

WIRING DEVICES
SYSTEMS
16140 - 4

1. * Indicates: Provide Orange Triangle on device to Indicate Isolated Ground Receptacle
2. ** Indicates: Engrave (Metal) or Hot Stamp (Thermoplastic) as indicated in "Identification" paragraphs of PART 3 - Execution section.

Table 1

<u>Connected to Normal Power in Finish Areas</u>	<u>Device</u>	<u>Wall Plate</u>	<u>Lettering**</u>
Standard NEMA 5-20R Receptacles	White	White	Black
GFCI NEMA 5-20R Receptacles	White	White	Black
Switches	White	White	Black
<u>Connected to Normal Power in Utility Areas</u>	<u>Device</u>	<u>Wall Plate</u>	<u>Lettering**</u>
Standard NEMA 5-20R Receptacles	Black	Metal	Black
GFCI NEMA 5-20R Receptacles	White	Metal	Black
Switches	Black	Metal	Black
<u>Connected to Emerg. Pwr. in Finish Areas</u>	<u>Device</u>	<u>Wall Plate</u>	<u>Lettering**</u>
Standard NEMA 5-20R Receptacles	Red	Red	White
GFCI NEMA 5-20R Receptacles	Red	Red	White
Switches	Red	Red	White
<u>Connected to Emerg. Pwr. in Utility Areas</u>	<u>Device</u>	<u>Wall Plate</u>	<u>Lettering**</u>
Standard NEMA 5-20R Receptacles	Red	Metal	Red
GFCI NEMA 5-20R Receptacles	Red	Metal	Red
Switches	Red	Metal	Red

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with the following for all indoor applications, unless otherwise indicated:
 1. Receptacle Grade: Industrial Grade
 2. Receptacle Style: Standard
 3. Switch Style: Toggle
- B. GFCI Receptacles: Install in locations as indicated but in no case less than those listed below:
 1. Where device is located on the exterior of the building, provide with Wet-Location Weatherproof Cover Plate.
 2. Where device is located within a garage.
 3. Where device is located in an elevator pit.
 4. Where device is located within 6 feet (2-m) of a lavatory or sink.
- C. Tamper-Resistant Receptacles: Install in locations as indicated but in no case less than those listed below:
 1. Public Lobbies.

3.2 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Mounting Heights: Comply with applicable codes and requirements of Authorities Having Jurisdiction. Mount devices at 18" AFF or as otherwise indicated on Drawings, including but not limited to Architectural elevations. Coordinate all above counter receptacles with backsplash to avoid interferences. All dimensions are given to centerline of box above finished floor (AFF), unless otherwise indicated.
- C. Comply with mounting and support requirements specified in Division 16 Section "Hangers and Supports for Electrical Systems."
- D. Coordination with Other Trades:
 - 1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
 - 5. Install wiring devices with appropriate backbox and raceway according to room finish (i.e. flush mounted devices in recessed backboxes with concealed conduit in finished spaces; surface mounted boxes with exposed conduit in unfinished spaces. Refer to Architectural Documents for room finish types.
- E. Conductors:
 - 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
- F. Device Installation:
 - 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until substantial completion.
 - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.

5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 8. Tighten unused terminal screws on the device.
 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
 10. Mount Switches, Wall Box Dimmers or Wall-Switch Sensors within 6 inches (152 mm) of door frame, unless otherwise indicated.
 11. Install Isolated-Ground devices so as not to bond the ground pole or isolated ground conductor (green/yellow) to the conduit system or equipment ground conductor (green).
 12. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical.
- G. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up and on horizontally mounted receptacles to the left (i.e. neutral blade at the top).
- H. Device Plates and Covers:
1. Do not use oversized or extra-deep plates.
 2. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
 3. Install weather-proof-while-in-use covers over receptacles in wet, damp and exterior locations.
 4. Group adjacent devices under single, multigang wall plates.

3.3 IDENTIFICATION

- A. Comply with Division 16 Section "Identification for Electrical Systems."
1. Receptacles: Identify panelboard and circuit number from which served on all receptacles. Use hot, stamped or engraved machine filled lettering on face of plate.
 2. Switches: Identify panelboard and circuit number from which served on All Switches. Use hot, stamped or engraved machine filled lettering on face of plate.

3.4 CONNECTIONS

- A. Ground equipment according to Division 16 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 16 Section "Low-Voltage Electrical Power Conductors and Cables."

3.5 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

1. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems.
- B. Correct Deficiencies and Report:
1. Correct unsatisfactory conditions, and retest to demonstrate compliance; replace devices as required to bring system into compliance.
 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 3. Prepare a report that identifies enclosure, units, conductors and devices checked and describes results. Include notation of deficiencies detected, remedial action taken, and observations and test results after remedial action.

3.6 CLEANING

- A. Clean components according to manufacturer's written instructions.
- B. On completion of device box installation but before any wiring devices are installed, inspect interior of boxes and perform the following:
1. Vacuum dirt and debris; do not use compressed air to assist in cleaning.
- C. On completion of wall plate installation, inspect exterior surfaces and perform the following:
1. Remove paint splatters and other spots.
 2. Remove all temporary markings and labels.
 3. Replace cracked or damaged wall plates.
 4. Wipe down all wall plates with approved cleaning agent to remove fingerprints and dust.

END OF SECTION

SECTION 16211 - ELECTRICITY METERING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes equipment for utility company's electricity metering.

1.2 SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 16 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.
- B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Describe electrical characteristics, features, and operating sequences, both automatic and manual. Include the following:
1. Electricity-metering equipment.
- C. Shop Drawings for Electricity-Metering Equipment:
1. Dimensioned plans and sections or elevation layouts.
 2. Wiring Diagrams: Power, signal, and control wiring specific to this Project. Identify terminals and wiring designations and color codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features.
 3. Seismic Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting seismic restraints.
- D. Manufacturer Seismic Qualification Certification for Electricity-Metering Equipment: Submit certification that equipment components will withstand seismic forces defined in Division 16 Section "Vibration and Seismic Controls for Electrical Systems" including items as defined in Division 16 Section "Common Work Results for Electrical".
- E. Field quality-control test reports including the following:
1. Test results that comply with requirements.
 2. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- F. Operation and Maintenance Data: For electrical equipment, accessories and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

1. Routine maintenance requirements for Electricity-Metering Equipment and all installed components.
2. Manufacturer's sample system checklists and log sheets.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Prepare equipment for shipment.
 1. Provide suitable crating, blocking, and supports so equipment will withstand expected domestic shipping and handling shocks and vibration.
 2. Weatherproof equipment for shipment. Close connection openings to prevent entrance of foreign material during shipment and storage.
- B. Installation Pathway: Coordinate delivery of equipment to allow movement into designated space.
 1. Deliver in shipping splits in sizes that can be moved past obstructions in delivery path.
 2. Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving equipment into place.
- C. Store equipment indoors in clean dry space with uniform temperature in accordance with manufacturer's requirements to prevent condensation. Protect equipment from exposure to dirt, fumes, water, corrosive substances, and physical damage.
- D. Handle equipment components according to manufacturer's written instructions. Use factory-installed lifting provisions.
- E. Receive, store, and handle modular meter center as specified in NECA 400.

1.5 PROJECT CONDITIONS

- A. Interruption of Existing Electric Service: Comply with requirements defined in Division 16 Section "Common Work Results for Electrical".
- B. Field Measurements: Indicate field measurements on Shop Drawings where equipment is proposed for installation in existing spaces.

1.6 COORDINATION

- A. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

ELECTRICITY METERING
SYSTEMS
16211 2

1. Comply with requirements of utilities providing electrical power and communication services.
2. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

PART 2 - PRODUCTS

2.1 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

- A. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.
- B. Meter Sockets: Comply with requirements of electrical power utility company.
- C. Provide unistrut support and electrical conduit for electrical power utility company metering equipment company with utility company requirements for transformed pad, grounding metering, primary conduits and secondary conduits.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with equipment installation requirements in NECA 1.
- B. Install equipment for utility company metering. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

3.2 CLEANING

- A. Clean components according to manufacturer's written instructions.
- B. Prior to installation of front trim and cover plates inspect interior surfaces and perform the following:
 1. Remove paint splatters and other spots.
 2. Vacuum dirt and debris; do not use compressed air to assist in cleaning.
- C. On completion of front trim and cover installation, inspect exterior surfaces and perform the following:
 1. Remove paint splatters and other spots.
 2. Remove all temporary markings and labels.
 3. Vacuum dirt and debris; do not use compressed air to assist in cleaning.
 4. Repair exposed surfaces to match original finish.

END OF SECTION

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

SECTION 16410 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

1 PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Bolted-pressure contact switches.
 - 4. High-pressure, butt-type contact switches.
 - 5. Molded-case circuit breakers.
 - 6. Molded-case switches.
 - 7. Enclosures.

1.2 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. GFEP: Ground-fault equipment protection.
- C. HD: Heavy duty.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.

1.3 PERFORMANCE REQUIREMENTS

- A. Overcurrent Protective Device Coordination: All overcurrent protective devices proposed for inclusion in the Work shall be selected to be selectively coordinated with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the branch circuit panelboard to open. This coordination shall be carried through each level of distribution for all branches of normal and emergency power. Refer to Division 16 Section "Overcurrent Protective Device Coordination Study" for additional requirements.

1.4 SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 16 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.
- B. Simultaneous Action Submittals: Enclosed Switches and Circuit Breaker Product Data submittal shall be made in conjunction with action submittals required under Division 16 Section "Overcurrent Protective Device Coordination Study."
- C. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
 - 1. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Time-current curves for each type of overcurrent protection device. Include hardcopy of characteristic curve and TCC Number for use with Power Tools by SKM Systems Analysis, Inc. Indicate available setting points and selectable ranges for each type of adjustable circuit breaker.
- D. Shop Drawings: For each enclosed circuit breaker, switch and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of device and overcurrent protective devices.
 - 2. Wiring Diagrams: Power, signal, and control wiring.
- E. Coordination Drawings: Submit Coordination Drawings in accordance with Division 16 Section "Common Work Results for Electrical" for each location where enclosed switches and circuit breakers are included in the Work.
- F. Manufacturer Seismic Qualification Certification: certification that enclosed switches and circuit breakers, accessories, and components will withstand seismic forces defined in Division 16 Section "Vibration and Seismic Controls for Electrical Systems" including items as defined in Division 16 Section "Common Work Results for Electrical".
- G. Field quality-control test reports including the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- H. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Manufacturer's routine maintenance requirements for enclosed switches and circuit breakers and all installed components.
 2. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 3. Time-current curves, including selectable ranges for each type of circuit breaker. Include directory listing each adjustable breaker included in the Work and their final set points.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For independent agency as defined in Division 16 Section "Common Work Results for Electrical".
- B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories through one source from a single manufacturer, unless otherwise indicated.
1. Breaker Manufacturer: Manufacturer for breakers shall be the same as the manufacturer of other breakers proposed for other portions of the Work.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NFPA 70.
- E. Product Options: Drawings indicate spatial allocation for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum spatial allocation. Refer to Division 01 Section "Product Requirements."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare equipment for shipment.
1. Provide suitable crating, blocking, and supports so equipment will withstand expected domestic shipping and handling shocks and vibration.
 2. Weatherproof equipment for shipment. Close connection openings to prevent entrance of foreign material during shipment and storage.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

ENCLOSED SWITCHES AND
CIRCUIT BREAKERS

- B. Installation Pathway: Coordinate delivery of equipment to allow movement into designated space.
 - 1. Deliver in shipping splits in sizes that can be moved past obstructions in delivery path.
 - 2. Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving equipment into place.
- C. Store equipment indoors in clean dry space with uniform temperature in accordance with manufacturer's requirements to prevent condensation. Protect equipment from exposure to dirt, fumes, water, corrosive substances, and physical damage.
- D. Handle equipment components according to manufacturer's written instructions. Use factory-installed lifting provisions.

1.7 PROJECT CONDITIONS

Retain paragraph below if interruption of existing electrical service is required.

- A. Environmental Limitations: Rate equipment for continuous operation at indicated ampere ratings for the following conditions:
 - 1. Ambient Temperature for Circuit Breakers: Not less than 23 deg F (minus 5 deg C) and not exceeding 104 deg F (40 deg C).
 - 2. Ambient Temperature for Fused Switches: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 122 deg F (50 deg C).
 - 3. Altitude: Not exceeding 6600 feet (2000 m).

1.8 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate ratings with utilization equipment nameplate limitations of maximum overcurrent protection device size. Provide enclosed switch or circuit breakers to match utilization equipment requirements.

1.9 EXTRA MATERIALS

- A. Extra materials may not be allowed for publicly funded projects.
- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

ENCLOSED SWITCHES AND
CIRCUIT BREAKERS

1. Keys: Six spares for each type of cabinet lock.
2. Touchup Paint: Three 0.5 pint (250 mL) containers of paint matching enclosure finish.
3. Indicating Lights: one for every ten of each type and rating installed. Furnish at least one of each type.
4. Spare Fuses for the following:
 - a. Potential Transformer Fuses: One for every ten of each type and rating installed. Furnish at least one of each type.
 - b. Control-Power Fuses: One for every ten of each type and rating installed. Furnish at least one of each type.
 - c. Fuses for Fusible Power-Circuit Devices: One for every ten of each type and rating installed. Furnish at least three of each type.
 - d. Fuses and Fusible Devices for Fused Circuit Breakers: One for every ten of each type and rating installed. Furnish at least three of each type.
 - e. Fuses for Fusible Switches: One for every ten of each type and rating installed. Furnish at least three of each type.

2 PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Manufacturers:
 1. Eaton Corporation; Cutler-Hammer Products.
 2. General Electric Co.; Consumer and Industrial Division.
 3. Siemens Energy & Automation, Inc.
 4. Square D/Group Schneider.
- B. Fusible Switch, 1200 A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Nonfusible Switch, 1200 A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

ENCLOSED SWITCHES AND
CIRCUIT BREAKERS

- D. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
 3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.
- E. Fuses are specified in Division 16 Section "Fuses."

2.3 FUSED POWER CIRCUIT DEVICES

- A. Bolted-Pressure or High-Pressure, Butt-Type Contact Switch: UL 977; operating mechanism shall use either a rotary-mechanical-bolting action to produce and maintain high-clamping pressure on the switch blade after it engages the stationary contacts or butt-type contacts and a spring-charged mechanism to produce and maintain high-contact pressure when switch is closed.
1. Manufacturers:
 - a. Eaton Corporation; Cutler-Hammer Products.
 - b. General Electric Co.; Consumer and Industrial Division.
 - c. Pringle Electrical Mfg. Co.
 - d. Siemens Energy & Automation, Inc.
 - e. Square D/Group Schneider.
 2. Main Contact Interrupting Capability: Twelve times the switch current rating, minimum.
 3. Operating Mechanism: Manual handle operation to close switch stores energy in mechanism for closing and opening.
 - a. Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
 - b. Mechanical Trip: Operation of mechanical lever or push button or another device causes switch to open.
 4. Auxiliary Switches: Factory installed, SPDT, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.
 5. Service-Rated Switches: Labeled for use as service equipment.
 6. Ground-Fault Relay: Comply with UL 1053. Self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.

- a. Configuration: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground fault indicator.
 - b. Internal Memory: Integrates the cumulative value of intermittent arcing ground-fault currents and uses the effect to initiate tripping.
 - c. No-Trip Relay Test: Operation of "no-trip" test control permits ground-fault simulation test without tripping switch.
 - d. Test Control: Simulates ground fault to test relay and switch (or relay only if "no-trip" mode is selected).
7. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.

B. Fuses are specified in Division 16 Section "Fuses."

2.4 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

A. Manufacturers:

- 1. Eaton Corporation; Cutler-Hammer Products.
- 2. General Electric Co.; Electrical Distribution & Control Division.
- 3. Siemens Energy & Automation, Inc.
- 4. Square D/Group Schneider.

B. Molded-Case Circuit Breaker Requirements: UL 489, NEMA AB 3, with interrupting capacity rating to meet available fault current.

- 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- 3. Electronic trip-unit circuit breakers: RMS sensing, field-replaceable rating plug, and the following field-adjustable settings:
 - a. Long- and short-time pickup levels.
 - b. Long- and short-time time adjustments.
 - c. Instantaneous trip.
 - d. Ground-fault pickup level, time delay, and I^2t response, where indicated.
 - e. Ground-fault indication alarm, where indicated.
 - f. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection and short-time trip function.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
 6. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity. Provide as indicated and as required by NFPA 70 for personnel protection.
 7. GFEP Circuit Breakers: Single- and two-pole configurations with 30-mA trip sensitivity. Provide as indicated and as required by NFPA 70 for equipment protection.
- C. Molded-Case Circuit-Breaker Features: Standard frame sizes, trip ratings, and number of poles. Provide the following features for all included in the Work:
1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material; UL 486 B listed, dual rated and marked for use with copper- or aluminum load-side conductors.
 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 3. Lock-Out Tag Provisions: For installing at least three Lock-Out tags on each circuit breaker to secure the breaker and prevent movement mechanism.
- D. Circuit-Breaker Accessories: Standard frame sizes, trip ratings, and number of poles. Provide the following accessories where indicated:
1. Ground-Fault Protection: Provide integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 2. Shunt Trip: Set to trip at 55 percent of rated voltage, where indicated.
 3. Communication Capability: Communication module with functions and features compatible with power monitoring and control system specified in Division 16 Section "Electrical Power Monitoring and Control."
 4. Key Interlock Kit: where indicated, provide to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 5. Auxiliary Switch: where indicated, provide two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 6. Remote trip indication and control.

- E. Molded-Case Switch Requirements: Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- F. Molded-Case Switch Features and Accessories:
 - 1. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.
 - 2. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.
 - 3. Auxiliary Switch: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 - 4. Key Interlock Kit: Externally mounted to prohibit operation; key shall be removable only when switch is in off position.

2.5 ELEVATOR SHUNT-TRIP DISCONNECT SWITCHES

- A. Manufacturers:
 - 1. Eaton Corporation; Cutler-Hammer Products – ES Elevator Switch
 - 2. Cooper Bussmann, Inc. Model - Power Module Switch - PS
 - 3. Littelfuse, Inc. Model - LPS Series Elevator POWR-Switch
- B. Fusible Switch with Shunt-Trip: Manufactured unit that combines fused disconnect switch with all necessary relay(s), control transformer and other options, required to provide disconnecting means and fire protection shunt-trip interface for elevator controller.
 - 1. Ampere Rating: As required by elevator manufacturer for elevator proposed for inclusion in the Work.
 - 2. Short-Circuit Current Rating: 200,000A.
 - 3. Interlocks to prevent the opening of the cover when the switch is in the ON position. Interlock shall be defeatable for testing purposes.
 - 4. Handle: lockable in the OPEN/OFF position.
 - 5. Control Power Transformer: Integral 100VA rated with primary and secondary fuses. Primary voltage rating of 480 VAC with a 120 VAC secondary.
 - 6. Isolation relay (3PDT, 10amp, 120V): Provide isolation relay with 120V AC or 24V DC coil as required to coordinate fire alarm system.

- a. Coordinate a normally open dry contact to energize the isolation relay and activate the shunt trip solenoid (140VA inrush at 120V); relay provided under Division 16 Section "Fire Alarm System". If 24V DC coil is selected, a separate 24V DC source and contact shall be provided by the Fire Alarm Safety System.
7. Provide options as follows:
- a. Key to Test Switch
 - b. Pilot Light indicating systems is in the CLOSED/ON position.
 - c. Isolated Full Capacity Neutral Lug
 - d. For hydraulic elevators with automatic recall: Provide one pole normally closed Mechanical Interlock.
 - e. Fire Alarm Voltage Monitoring Relay; Comply with NFPA 72.

2.6 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location as follows, unless otherwise indicated:
 - 1. Indoor Locations: NEMA 250, Type 1.
 - 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 - 3. Outdoor Locations: NEMA 250, Type 3R.
 - 4. Within 50 feet of cooling towers: NEMA 250, Type 4X, stainless steel.
 - 5. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - 6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.
- B. Enclosure Finish for Outdoor Units: Factory-applied finish in manufacturer's standard ANSI Gray enamel over corrosion-resistant treatment or rust-inhibiting primer coat, undersurfaces treated with corrosion-resistant undercoating.
- C. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard ANSI Gray enamel over corrosion-resistant treatment or rust-inhibiting primer coat.

3 PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces where equipment will be installed for compliance with installation tolerances, required clearances, and other conditions affecting performance.
- B. Examine roughing-in of conduits to verify the following:
 - 1. Wiring entries comply with layout requirements.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

ENCLOSED SWITCHES AND
CIRCUIT BREAKERS

2. Entries are within conduit-entry tolerances specified by manufacturer and no feeders will have to cross section barriers to reach load or line lugs.
- C. Verify that ground connections are in place and that requirements in Division 16 Section "Grounding and Bonding for Electrical Systems" have been met.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION

- A. Fused Power Circuit Device Operating Mechanism: Mechanical Trip, except Electrical Trip for switches with ground-fault protection or remotely tripped switches.
- B. Molded-Case Circuit Breakers OCPD Type: Electronic Trip-Unit Circuit Breakers, unless otherwise indicated.

3.3 INSTALLATION

3.4 CONCRETE BASES

- A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
- B. Concrete base is specified in Division 16 Section "Hangers and Supports for Electrical Systems," and concrete materials and installation requirements are specified in Division 03.
- C. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Comply with mounting and support requirements specified in Division 16 Section "Hangers and Supports for Electrical Systems."
- F. Comply with mounting and anchoring requirements specified in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."
- G. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated.
- H. Anchor floor-mounting switches to concrete base.
- I. Mount top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.
- J. Mount plumb and rigid without distortion of box. Mount recessed equipment with fronts uniformly flush with wall finish.
- K. Install overcurrent protective devices, controllers, and instrumentation.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

ENCLOSED SWITCHES AND
CIRCUIT BREAKERS

- L. Install filler plates in unused spaces.
- M. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- N. Close unused conduit opening or other unused holes in sides of box with proper mating blank-off plates.
- O. Do not use gutters of equipment as raceways for routing feeder conductors from bottom entrance to top-feed lugs or vice versa; an external gutter or conduit shall be used for this purpose.

3.5 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Identification for Electrical Systems."
- B. Enclosure Nameplates: Label each enclosure with engraved Equipment Identification Label as specified in Division 16 Section "Identification for Electrical Systems."

3.6 CONNECTIONS

- A. Ground equipment according to Division 16 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 16 Section "Low-Voltage Electrical Power Conductors and Cables."

3.7 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each equipment bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
 - 3. Verify switch and relay type and labeling verification.
 - 4. Verify rating of installed fuses.
 - 5. Assist in field testing of equipment including pre-testing and adjusting of equipment and components.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Test mounting and anchorage devices according to requirements in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."
 - 2. Inspect equipment installation, including wiring, components, connections, and equipment. Test and adjust components and equipment.

3. Verify that electrical control wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing. Verify that wiring installation complies with requirements in Division 16 Sections.
- C. Testing Agency: Engage a qualified independent testing and inspecting agency as defined in Division 16 Section "Common Work Results for Electrical" to perform the following field tests and inspections and prepare certified test reports:
1. After installing enclosed switches and circuit breakers but before equipment is energized, verify that grounding system at equipment tests to specified value or better.
 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for each of the following NETA categories:
 - a. Section 7.3 for Cables
 - b. Section 7.5 for Switches
 - c. Section 7.6 for Circuit Breakers
 - d. Section 7.11 for Metering and Instrumentation Devices
 - e. Section 7.13 for Grounding Systems
 - f. Section 7.14 for Ground-Fault Protection Systems; where applicable.
 3. Infrared Scanning: Perform Thermographic Survey in accordance with NETA ATS, Section 9.0.
 - a. Initial Infrared Scanning: Within 60 Days after Substantial Completion, perform an infrared scan of each enclosed switch and circuit breaker. Open or remove doors and covers so connections are accessible to portable scanner.
 - b. Instruments, Equipment:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 4. Complete installation and startup checks according to manufacturer's written instructions.
- D. Correct Deficiencies, Retest and Report:
1. Correct unsatisfactory conditions, and retest to demonstrate compliance; replace conductors, units, and devices as required to bring system into compliance.
 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 3. Prepare a report, certified by testing agency, that identifies switchboards, units, conductors and devices checked and describes results. Include nota-

tion of deficiencies detected, remedial action taken, and observations and test results after remedial action.

- E. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.8 ADJUSTING

- A. Set field-adjustable overcurrent protection device trip characteristics according to settings provided by Engineer-of-Record.
 - 1. Settings will be provided by Engineer-of-Record after the submittal process and review of report required by Division 16 Section "Overcurrent Protective Device Coordination Study." are completed.

3.9 CLEANING

- A. Clean components according to manufacturer's written instructions.
- B. Prior to installation of front trim and cover plates inspect interior surfaces and perform the following:
 - 1. Remove paint splatters and other spots.
 - 2. Vacuum dirt and debris; do not use compressed air to assist in cleaning.
- C. On completion of front trim and cover installation, inspect exterior surfaces and perform the following:
 - 1. Remove paint splatters and other spots.
 - 2. Remove all temporary markings and labels.
 - 3. Vacuum dirt and debris; do not use compressed air to assist in cleaning.
 - 4. Repair exposed surfaces to match original finish.

3.10 PROTECTION

- A. Temporary Heating: Maintain a clean dry space with uniform temperature in accordance with manufacturer's requirements to prevent condensation. Apply temporary heating as required.
- B. Protect equipment from exposure to dirt, fumes, water, corrosive substances, and physical damage.

3.11 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain enclosed switches and circuit breakers, overcurrent pro-

protective devices, instrumentation, and accessories. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

PSP #407480

CONSTRUCTION DOCUMENTS – 2 MAY 2008

ENCLOSED SWITCHES AND
CIRCUIT BREAKERS

16410 - 15

SECTION 16442 – PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes service and distribution panelboards rated 600 V and less, including the following:
 - 1. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.
- B. Related Sections include the following:
 - 1. Division 16 Section "Overcurrent Protective Device Coordination Study" for short-circuit rating of devices and for setting of overcurrent protective devices.
- C. Equipment specified in this Section includes distribution equipment for stand-alone mounting. Equipment specified in this Section shall not be installed as part of an Integrated Power System Switchboard.

1.2 DEFINITIONS

- A. AFCI: Arc-fault circuit interrupter.
- B. DPM: Multifunction Digital-Metering Monitor
- C. EMI: Electromagnetic interference.
- D. GFCI: Ground-fault circuit interrupter.
- E. GFEP: Ground-fault equipment protection.
- F. RFI: Radio-frequency interference.
- G. RMS: Root mean square.
- H. SPDT: Single pole, double throw.

1.3 PERFORMANCE REQUIREMENTS

- A. Overcurrent Protective Device Coordination: All overcurrent protective devices proposed for inclusion in the Work shall be selected to be selectively coordinated with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the

branch circuit panelboard to open. This coordination shall be carried through each level of distribution for all branches of normal and emergency power. Refer to Division 16 Section "Overcurrent Protective Device Coordination Study" for additional requirements.

1.4 SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 16 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.
- B. Simultaneous Action Submittals: Panelboard Product Data submittal shall be made in conjunction with action submittals required under Division 16 Section "Overcurrent Protective Device Coordination Study."
- C. Product Data: For each type of panelboard, overcurrent protection device, accessory, and related component, include the following:
 - 1. Manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
 - 2. Rated capacities, features, operating characteristics, furnished specialties, factory settings, accessories and time-current characteristic curves for individual relays and overcurrent protective devices.
 - a. Time-current curves for each type of overcurrent protection device. Include hardcopy of characteristic curve and TCC Number for use with Power Tools by SKM Systems Analysis, Inc. Indicate available setting points and selectable ranges for each type of adjustable overcurrent protection device.
- D. Shop Drawings: For each panelboard and related equipment, include the following:
 - 1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show method of field assembly and location and size of each field connection. Include the following:
 - a. Tabulation of installed devices with features and ratings.
 - b. Enclosure types and details.
 - c. Outline and general arrangement drawing showing dimensions, shipping sections, and weights of each assembled section.
 - d. Bus configuration with size and number of conductors in each bus run, including phase, neutral, and ground conductors of main and branch buses.
 - e. One-line diagram.
 - f. Bus current and voltage ratings.
 - g. Short-time and short-circuit current rating of equipment assembly.
 - h. Feeder entry locations and lug configuration.
 - i. Elevation drawing showing locations for anchor bolts.
 - j. Nameplate legends.

2. Seismic Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting seismic restraints.
3. Wiring Diagrams: For each type of panelboard and related equipment, include the following:
 - a. Power, signal, and control wiring.
- E. Coordination Drawings: Submit Coordination Drawings in accordance with Division 16 Section "Common Work Results for Electrical" for each location where panelboards are included in the Work.
- F. Manufacturer Seismic Qualification Certification: certification that electrical equipment assemblies, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 16 Section "Vibration and Seismic Controls for Electrical Systems" including items as defined in Division 16 Section "Common Work Results for Electrical".
- G. Panelboard Directories: For installation in panelboards.
- H. Field quality-control Test Method and Procedure: List of procedures to be used during functional and operations sequence testing. Method of Procedure should include but not be limited to the following:
 1. Tabulation of Testing Equipment and PPE required for tests.
 2. Schedule of Shutdowns required.
 3. Manufacturer's Recommended Pre-Start Checklists for the following:
 - a. Overcurrent Protection Devices
 4. Step-by-Step Testing Operations and Criteria for tests listed in Part 3 Paragraph "Field quality-control".
- I. Field quality-control test reports including the following:
 1. Test results that comply with requirements.
 2. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- J. Operation and Maintenance Data: For electrical equipment, accessories and components to be included in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 1. Manufacturer's routine maintenance requirements for panelboard and all installed components.
 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

3. Time-current curves, including selectable ranges for each type of relay and overcurrent protective device. Include directory listing each adjustable breaker included in the Work and their final set points.
4. Manufacturer's sample system checklists and log sheets.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For independent agency as defined in Division 16 Section "Common Work Results for Electrical".
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer, unless otherwise indicated.
 1. Breaker Manufacturer: Manufacturer for breakers shall be the same as the manufacturer of other breakers proposed for other portions of the Work.
- C. Product Options: Drawings indicate spatial allocation for panelboards, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum spatial allocation. Refer to Division 01 Section "Product Requirements."
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with IEEE C2.
- F. Comply with NFPA 70.
- G. Comply with NEMA PB 1 "Panelboards".

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare equipment for shipment.
 1. Provide suitable crating, blocking, and supports so equipment will withstand expected domestic shipping and handling shocks and vibration.
 2. Weatherproof equipment for shipment. Close connection openings to prevent entrance of foreign material during shipment and storage.
- B. Installation Pathway: Coordinate delivery of equipment to allow movement into designated space.
 1. Deliver in shipping splits in sizes that can be moved past obstructions in delivery path.
 2. Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving equipment into place.

- C. Store equipment indoors in clean dry space with uniform temperature in accordance with manufacturer's requirements to prevent condensation. Protect equipment from exposure to dirt, fumes, water, corrosive substances, and physical damage.
- D. Handle equipment components according to manufacturer's written instructions. Use factory-installed lifting provisions.
- E. Handle panelboards according to NEMA PB 1.1 and NECA 407.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation at indicated ampere ratings for the following conditions:
 - 1. Ambient Temperature for Circuit Breakers: Not less than 23 deg F (minus 5 deg C) and not exceeding 104 deg F (40 deg C) for panelboards and 122 deg F (50 deg C) for breakers.
 - 2. Ambient Temperature for Fused Switches: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 122 deg F (50 deg C).
 - 3. Altitude: Not exceeding 6600 feet (2000 m).

1.8 COORDINATION

- A. Coordinate layout and installation of panelboard and components with other construction that penetrates floors, ceilings or walls or are supported by them, including but not limited to conduit, piping, other electrical equipment, light fixtures, HVAC equipment, fire-suppression-system components and adjacent surfaces. Maintain required clearances for workspace and equipment access doors and panels.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Keys: Six spares for each type of panelboard cabinet lock.
 - 2. Touchup Paint: Three 0.5 pint (250 mL) containers of paint matching enclosure finish.
 - 3. Indicating Lights: one for every ten of each type and rating installed. Furnish at least one of each type.
 - 4. Spare Fuses for the following:
 - a. Potential Transformer Fuses: One for every ten of each type and rating installed. Furnish at least one of each type.
 - b. Control-Power Fuses: One for every ten of each type and rating installed. Furnish at least one of each type.

- c. Fuses for Fusible Power-Circuit Devices: One for every ten of each type and rating installed. Furnish at least three of each type.
 - d. Fuses and Fusible Devices for Fused Circuit Breakers: One for every ten of each type and rating installed. Furnish at least three of each type.
 - e. Fuses for Fusible Switches: One for every ten of each type and rating installed. Furnish at least three of each type.
5. Molded-Case Circuit Breakers rated 100 amperes and less: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. Cutler-Hammer, Inc.; Eaton Corporation.
 - 2. General Electric Co.; Consumer and Industrial Div.
 - 3. Square D; Schneider Electric.

2.2 RATINGS

- A. Suitable for application in 3-phase, 60-Hz, solidly grounded-neutral system, unless otherwise indicated.
- B. Nominal System Voltage: As indicated on the Drawings.
- C. Main-Bus: Amperage as indicated on the Drawings. Provide continuous rating across entire length of main-bus.
- D. Short-Time and Short-Circuit Current: Match rating of highest-rated overcurrent protective device in panelboard assembly.
- 1. Available Short-Circuit Current: As indicated on the Drawings. Refer to Division 16 Section "Overcurrent Protective Device Coordination Study" for additional requirements.

2.3 MANUFACTURED UNIT FABRICATION

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."
- B. Enclosures: Flush- and surface-mounted cabinets, as indicated. NEMA PB 1.
- 1. Rated for environmental conditions at installed location.
 - a. Indoor Locations: NEMA 250, Type 1.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

- b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - e. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.
2. Front Cover: Provide the following, unless otherwise indicated:
- a. Hinged Front Cover: Door-in-Door construction with entire front trim hinged to box and with standard door within hinged trim cover to access device handles.
3. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor, as indicated on Drawings.
4. Enclosure Finish for Outdoor Units: Factory-applied finish in manufacturer's standard ANSI Gray enamel over corrosion-resistant treatment or rust-inhibiting primer coat, undersurfaces treated with corrosion-resistant undercoating.
5. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard ANSI Gray enamel over corrosion-resistant treatment or rust-inhibiting primer coat.
- C. Buses and Connections: Three phase, four wire, unless otherwise indicated.
- 1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated, with copper feeder circuit-breaker line connections.
 - a. Lugs: compression lug kits for main-lug-only panel main feeders, one or two hole style to suit conditions, suitable for quantity and size of conductor. UL 486 B listed, dual rated and marked for use with copper- or aluminum conductors to suit project conditions.
 - 2. Ground Bus: Hard-drawn copper of 98 percent conductivity, Adequate for feeder and branch-circuit equipment ground conductors; bonded to box. Equipped with compression connectors for feeder and branch-circuit ground conductors.
 - 3. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with compression connectors for outgoing circuit neutral cables.
 - 4. Bus Size: Comply with UL 489, including allowance for spare circuit breakers and spaces for future circuit breakers. Include bus to extend the full length of vertical sections.
 - 5. Support and Brace Buses for indicated short-circuit currents.
 - 6. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of panelboard section.

7. Conductor Connectors: Suitable for use with conductor material; dual rated for use with copper- or aluminum conductors; marked AL7CU for 75 degrees C rated circuits.
 8. Feed-Through Lugs where indicated on Drawings: Compression type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 9. Isolated Equipment Ground Bus, where indicated on Drawings: Adequate for branch-circuit equipment ground conductors; insulated from box.
 10. Extra-Capacity Neutral Bus, where indicated on Drawings: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
 11. Extra-Capacity Neutral Lugs: Where Extra-Capacity Neutral Bus is indicated on Drawings, provided lugs rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- D. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- E. Future Device Provision: Equip compartments with unused space with mounting brackets, bus connections, and necessary appurtenances required for future installation of devices. Provide bussing for full length of enclosure section.
- F. DISTRIBUTION PANELBOARDS
1. Door Hardware: Secured with vault-type latch with tumbler lock; keyed alike. Omit for fused-switch panelboards.
 2. Main Overcurrent Protection Device Type: Provide overcurrent device as follows, unless otherwise indicated: Circuit breaker
 - a. Retain and edit the following paragraphs if retaining Circuit Breaker above.
 - b. Main OCPD rated less than 125 Amps: Adjustable Instantaneous-Trip Circuit Breakers.
 - c. Main OCPD rated 125 Amps and greater Electronic Trip-Unit Circuit Breakers.
 3. Feeder Overcurrent Protection Device Type: Provide overcurrent device as follows, unless otherwise indicated: Circuit breaker.
 - a. Feeder OCPD rated less than 125 Amps: Adjustable Instantaneous-Trip Bolt-on circuit breakers.
 - b. Feeder OCPD rated 125 Amps and greater: Electronic Trip-Unit; Bolt-on circuit breakers.
 4. Branch Overcurrent Protection Device Type: Provide overcurrent device as follows, unless otherwise indicated: Circuit breaker.

- a. Branch OCPD: Current-Limiting; Bolt-on circuit breakers replaceable without disturbing adjacent units.

G. LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

1. Door Hardware: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
2. Main Overcurrent Protection Device Type: Provide overcurrent device as follows, unless otherwise indicated: Circuit breaker.
 - a. Main OCPD rated less than 125 Amps: Adjustable Instantaneous-Trip Circuit Breakers.
 - b. Main OCPD rated 125 Amps and greater: Electronic Trip-Unit Circuit Breakers.
3. Branch Overcurrent Protection Device Type: Provide overcurrent device as follows, unless otherwise indicated: Circuit breaker.
 - a. Branch OCPD: Thermal-Magnetic; Bolt-on circuit breakers replaceable without disturbing adjacent units.

2.4 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker Requirements: UL 489, NEMA AB 3, with interrupting capacity rating to meet available fault current.
 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 125 A and larger.
 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Electronic trip-unit circuit breakers: RMS sensing, field-replaceable rating plug, and the following field-adjustable settings:
 - a. Long- and short-time pickup levels.
 - b. Long- and short-time time adjustments.
 - c. Instantaneous trip.
 - d. Ground-fault pickup level, time delay, and I^2t response, where indicated.
 - e. Ground-fault indication alarm, where indicated.
 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.

6. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity. Provide as indicated and as required by NFPA 70 for personnel protection.
 7. GFEP Circuit Breakers: Single- and two-pole configurations with 30-mA trip sensitivity. Provide as indicated and as required by NFPA 70 for equipment protection.
 8. AFCI Circuit Breakers: Single- and two-pole configurations. Provide as indicated and as required by NFPA 70 for personnel protection.
- B. Molded-Case Circuit-Breaker Features: Standard frame sizes, trip ratings, and number of poles. Provide the following features for all included in the Work:
1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material; UL 486 B listed, dual rated and marked for use with copper- or aluminum load-side conductors.
 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 3. Lock-Out Tag Provisions: For installing at least three Lock-Out tags on each circuit breaker to secure the breaker and prevent movement mechanism.
- C. Circuit-Breaker Accessories: Standard frame sizes, trip ratings, and number of poles. Provide the following accessories where indicated:
1. Ground-Fault Protection: Provide integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 2. Shunt Trip: Set to trip at 55 percent of rated voltage, where indicated.
 3. Communication Capability: Communication module with functions and features compatible with power monitoring and control system specified in Division 16 Section "Electrical Power Monitoring and Control."
 4. Key Interlock Kit: where indicated, provide to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 5. Retain for Under-voltage trip, this is not a common requirement. Under-voltage Trip is available with field-adjustable settings from 0.1- to 0.6-second.
 6. Auxiliary Switch: where indicated, provide two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 7. Remote trip indication and control.

- D. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle. Fuses are specified in Division 16 Section "Fuses."

2.5 ACCESSORY COMPONENTS AND FEATURES

- A. Storage for Manual: Include a rack or holder, near the operating instructions, for a copy of maintenance manual.

PART 3 - EXECUTION

1.1 EXAMINATION

- A. Examine elements and surfaces where equipment will be installed for compliance with installation tolerances, required clearances, and other conditions affecting performance.
- B. Examine roughing-in of conduits to verify the following:
 - 1. Wiring entries comply with layout requirements.
 - 2. Entries are within conduit-entry tolerances specified by manufacturer and no feeders will have to cross section barriers to reach load or line lugs.
- C. Verify that ground connections are in place and that requirements in Division 16 Section "Grounding and Bonding for Electrical Systems" have been met.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with NECA 407, "Recommended Practice for the Installing and Maintaining Panelboards" as published by the National Electrical Contractors Association.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards and components once unit is secured in place.
- D. Comply with mounting and support requirements specified in Division 16 Section "Hangers and Supports for Electrical Systems."
- E. Comply with mounting and anchoring requirements specified in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."
- F. Mount top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.
- G. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

- H. Install overcurrent protective devices, controllers, and instrumentation.
- I. Install filler plates in unused spaces.
- J. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- K. For Recessed Panels: Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.
- L. Close unused conduit opening or other unused holes in sides of box with proper mating blank-off plates.
- M. Do not use gutters of panelboards as raceways for routing feeder conductors from bottom entrance to top-feed lugs or vice versa; an external gutter or conduit shall be used for this purpose.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components and provide warning signs as specified in Division 16 Section "Identification for Electrical Systems."
- B. Equipment Identification Nameplates: Label each panelboard with engraved Equipment Identification Label as specified in Division 16 Section "Identification for Electrical Systems."
- C. Distribution Panelboard Feeder OCPD Labels: Label each OCPD with nameplate that indicates the device it feeds using engraved Equipment Identification Label as specified in Division 16 Section "Identification for Electrical Systems."
- D. Panelboard Directory: Create a directory to indicate name/descriptions of installed circuit loads, including final room numbers. Obtain approval before installing within clear plastic pocket inside panelboard cover. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- E. Diagram and Instructions:
 - 1. Frame and mount the following items in clear acrylic plastic holder on the front of panelboard.
 - a. Operating Instructions: Printed basic instructions for panelboard, including control and key-interlock sequences and emergency procedures where applicable.
 - 2. Storage for Maintenance Manual: Include a rack or holder, near the operating instructions, for a copy of maintenance manual.

3.4 CONNECTIONS

- A. Tighten bus joints, electrical connectors, and terminals according to manufacturer's published torque-tightening values.

- B. Ground equipment according to Division 16 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 16 Section "Low-Voltage Electrical Power Conductors and Cables."

3.5 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
 - 3. Assist in field testing of equipment including pre-testing and adjusting of equipment and components.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Test mounting and anchorage devices according to requirements in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."
 - 2. Inspect panelboard installation, including wiring, components, connections, and equipment. Test and adjust components and equipment.
- C. Testing Agency: Engage a qualified independent testing and inspecting agency as defined in Division 16 Section "Common Work Results for Electrical" to perform the following field tests and inspections and prepare certified test reports:
 - 1. After installing panelboard but before equipment is energized, verify that grounding system at panelboard tests to specified value or better.
 - 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for each of the following NETA categories:
 - a. Section 7.1 for Switchgear & Switchboard Assemblies
 - b. Section 7.3 for Cables
 - c. Section 7.5 for Switches
 - d. Section 7.6 for Circuit Breakers
 - e. Section 7.11 for Metering and Instrumentation Devices
 - f. Section 7.13 for Grounding Systems
 - g. Section 7.14 for Ground-Fault Protection Systems; where applicable.
 - 3. Infrared Scanning: Perform Thermographic Survey in accordance with NETA ATS, Section 9.0.

- a. Initial Infrared Scanning: Within 60 Days after Substantial Completion, perform an infrared scan of each panelboard. Open or remove doors and covers so connections are accessible to portable scanner.
- 4. Complete installation and startup checks according to manufacturer's written instructions.
- D. Correct Deficiencies, Retest and Report:
 - 1. Correct unsatisfactory conditions, and retest to demonstrate compliance; replace conductors, units, and devices as required to bring system into compliance.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Prepare a report, certified by testing agency, that identifies switchboards, units, conductors and devices checked and describes results. Include notation of deficiencies detected, remedial action taken, and observations and test results after remedial action.
- E. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.6 ADJUSTING

- A. Set field-adjustable overcurrent protection device trip characteristics according to settings provided by Engineer-of-Record.
 - 1. Settings will be provided by Engineer-of-Record after the submittal process and review of report required by Division 16 Section "Overcurrent Protective Device Coordination Study." are completed.

3.7 CLEANING

- A. Clean components according to manufacturer's written instructions.
- B. Prior to installation of front trim and cover plates inspect interior surfaces and perform the following:
 - 1. Remove paint splatters and other spots.
 - 2. Vacuum dirt and debris; do not use compressed air to assist in cleaning.
- C. On completion of front trim and cover installation, inspect exterior surfaces and perform the following:
 - 1. Remove paint splatters and other spots.
 - 2. Remove all temporary markings and labels.

3. Vacuum dirt and debris; do not use compressed air to assist in cleaning.
4. Repair exposed surfaces to match original finish.

3.8 PROTECTION

- A. Temporary Heating: Maintain a clean dry space with uniform temperature in accordance with manufacturer's requirements to prevent condensation. Apply temporary heating as required.
- B. Protect equipment from exposure to dirt, fumes, water, corrosive substances, and physical damage.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain panelboards, overcurrent protective devices, instrumentation, and accessories. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION

SECTION 16461 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

1. Distribution transformers.

1.2 SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 16 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.

- B. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

1. Include typical manufacturer's test data reports for each type and size transformer. Reports shall include but not be limited to the following data:

- a. Maximum Efficiency in accordance with NEMA TP 1.
- b. Efficiency at 50-percent and 100-percent load.
- c. Percent voltage regulation at 80-percent and 100-percent power factor.
- d. Losses in kVA at no load and full load conditions.
- e. Percent X and Percent R values,
- f. Maximum sound level of transformer in enclosure (in dBA).
- g. Maximum 30-Deg hot spot and average temperature rise over a 40 degree C ambient.

- C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

- D. Coordination Drawings: Submit Coordination Drawings in accordance with Division 16 Section "Common Work Results for Electrical" for each location where transformers are included in the Work. Include the following:

1. Ground rod and grounding cable locations.

- E. Manufacturer Seismic Qualification Certification: certification that transformers, supporting devices, accessories, and components will withstand seismic forces defined

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

in Division 16 Section "Vibration and Seismic Controls for Electrical Systems" including items as defined in Division 16 Section "Common Work Results for Electrical".

- F. Source quality-control test reports.
- G. Field quality-control test reports.
- H. Operation and Maintenance Data: For transformers, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation And Maintenance Data," include the following:
 - 1. Manufacturer's routine maintenance requirements for transformers and all installed components.

1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For independent agency as defined in Division 16 Section "Common Work Results for Electrical".
- B. Source Limitations: Obtain each transformer type through one source from a single manufacturer, unless otherwise indicated.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Prepare equipment for shipment.
 - 1. Provide suitable crating, blocking, and supports so equipment will withstand expected domestic shipping and handling shocks and vibration.
 - 2. Weatherproof equipment for shipment. Close connection openings to prevent entrance of foreign material during shipment and storage.
- B. Installation Pathway: Coordinate delivery of equipment to allow movement into designated space.
 - 1. Deliver in shipping splits in sizes that can be moved past obstructions in delivery path.
 - 2. Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving equipment into place.

- C. Store equipment indoors in clean dry space with uniform temperature in accordance with manufacturer's requirements to prevent condensation. Protect equipment from exposure to dirt, fumes, water, corrosive substances, and physical damage.
- D. Handle equipment components according to manufacturer's written instructions. Use factory-installed lifting provisions.

1.5 COORDINATION

- A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Products.
 - 2. General Electric Company.
 - 3. Square D; Schneider Electric.

2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: High grade, grain-oriented, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses.
- C. Coils: Continuous windings without splices except for taps.
 - 1. Internal Coil Connections: Brazed or pressure type.
 - 2. Coil Material: Aluminum

2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Energy Efficiency for Transformers Rated 15 kVA and Larger:
 - 1. Complying with NEMA TP 1, Class 1 efficiency levels.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

2. Tested according to NEMA TP 2.
- C. Provide transformers that are constructed to withstand seismic forces specified in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Cores: One leg per phase.
- E. Enclosure for Interior Transformers: Ventilated, NEMA 250, Type 2, unless otherwise indicated.
 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- F. Enclosure for Exterior Transformers: Ventilated, NEMA 250, Type 3R, unless otherwise indicated.
 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- G. Transformer Enclosure Finish: Comply with NEMA 250. The entire enclosure shall be finished utilizing a continuous process consisting of degreasing, cleaning and phosphatizing, followed by electrostatic deposition of a polymer polyester powder coating and baking cycle to provide uniform coating of all edges and surfaces.
 1. Finish Color: ANSI Gray.
- H. Taps for Transformers Smaller Than 3 kVA: One 5 percent tap above normal full capacity.
- I. Taps for Transformers 7.5 to 14 kVA: Two 5 percent taps below normal full capacity.
- J. Taps for Transformers 15 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.
- K. Insulation Class: Materials in accordance with NEMA ST20 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.
- L. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for non-sinusoidal load current-handling capability to the degree defined by designated K-factor.
 1. Construct K-rated transformers in accordance with requirements of Distribution Transformers listed above, unless otherwise indicated.
 2. Indicate value of K-factor on transformer nameplate.
 3. Taps for Transformers 15 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

4. Neutral Terminal: Rated for 200-percent of secondary phase current.
 5. Electrostatic Shielding: Provide electrostatic shield as specified below.
- M. Electrostatic Shielding: Transformers indicated to be K-Factor rated shall have electrostatic shielding and each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
 2. Include special terminal for grounding the shield.
 3. Shield Effectiveness:
 - a. Capacitance between Primary and Secondary Windings: Not to exceed 33 picofarads over a frequency range of 20 Hz to 1 MHz.
 - b. Common-Mode Noise Attenuation: Minimum of minus 120 dBA at 0.5 to 1.5 kHz; minimum of minus 65 dBA at 1.5 to 100 kHz.
 - c. Normal-Mode (Transverse) Noise Attenuation: Minimum of minus 52 dBA at 1.5 to 10 kHz; 30 dbA at 10kHz to 1mHz.
- N. Wall Brackets: Manufacturer's standard brackets.
- O. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91, unless otherwise indicated.
1. 9 kVA and below: 37 dBA
 2. 10 kVA to 50 kVA: 42 dBA
 3. 51 kVA to 150 kVA: 47 dBA
 4. 151 kVA to 300 kVA: 52 dBA
 5. 301 kVA to 500 kVA: 57 dBA
 6. 501 kVA to 700 kVA: 59 dBA
 7. 701 kVA to 1000 kVA: 61 dBA

2.4 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.91.

PART 3 – EXECUTION

3.1 EXAMINATION

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Division 16 Section "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION

- A. Transformer Mounting
 - 1. 15 kVA or less: wall mounted or suspended, as indicated.
 - 2. 30 kVA and 45kVA: floor mounted or suspended, as indicated.
 - 3. 75 kVA: Floor mounted or rack mounted, as indicated.
 - 4. Greater than 75 kVA: Floor mounted, unless otherwise indicated.

3.3 INSTALLATION

- A. Comply with NECA 409, "Recommended Practice for Installing and Maintaining Dry-Type Transformers" as published by the National Electrical Contractors Association.
- B. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
 - 1. Brace wall-mounting transformers as specified in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."
 - 2. Wall mounted and suspended units shall utilize appropriate hardware based on the weight of the unit and installation location.
- C. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions and requirements of Division 16 Section "Hangers and Supports for Electrical Systems." Comply with seismic codes applicable to Project, and requirements in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Construct steel channel support system for rack-mounted or suspended transformers according to manufacturer's written instruction and requirements of Division 16 Section "Hangers and Supports for Electrical Systems." Comply with seismic codes

applicable to Project, and requirements in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."

3.4 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Identification for Electrical Systems."
- B. Transformer Nameplates: Label each transformer with Engraved, laminated-plastic or metal nameplate for each transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 16 Section "Identification for Electrical Systems."

3.5 CONNECTIONS

- A. Ground equipment according to Division 16 Section "Grounding and Bonding for Electrical Systems."
 - 1. Ground transformer before it is energized.
- B. Connect wiring according to Division 16 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Provide flexible metal conduit with a minimum 12" to a maximum 24" length for wiring connections to transformer enclosure.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency as defined in Division 16 Section "Common Work Results for Electrical" to perform the following field tests and inspections and prepare certified test reports:
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Test mounting and anchorage devices according to requirements in Division 16 Section "Vibration and Seismic Controls for Electrical Systems."
 - 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.2 for dry-type transformers. Certify compliance with test parameters.
 - 3. Infrared Scanning: Perform Thermographic Survey in accordance with NETA ATS, Section 9.0.
 - a. Initial Infrared Scanning: Within 60 Days after Substantial Completion, perform an infrared scan of each transformer's connections. Remove covers so connections are accessible to portable scanner.
- C. Correct Deficiencies and Report:

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

1. Correct unsatisfactory conditions, and retest to demonstrate compliance; replace transformers, conductors, units, and devices as required to bring system into compliance.
 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 3. Prepare a report certified by testing agency that identifies transformer, connection, conductors and devices checked and describes results. Include notation of deficiencies detected, remedial action taken, and observations and test results after remedial action.
- D. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.7 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare a written report listing output voltages and tap settings.

3.8 CLEANING

- A. Clean components according to manufacturer's written instructions.
- B. On completion of installation, inspect interior and exterior surfaces and perform the following:
 1. Remove paint splatters and other spots.
 2. Vacuum dirt and debris; do not use compressed air to assist in cleaning.
 3. Repair exposed surfaces to match original finish.

3.9 PROTECTION

- A. Temporary Heating: Maintain a clean dry space with uniform temperature in accordance with manufacturer's requirements to prevent condensation. Apply temporary heating as required.
- B. Protect equipment from exposure to dirt, fumes, water, corrosive substances, and physical damage.

3.10 DEMONSTRATION

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

- A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain transformers. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION

SECTION 16491 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Cartridge fuses rated 600 V and less for use in switches switchboards controllers and motor-control centers.
 2. Spare-fuse cabinets.

1.2 PERFORMANCE REQUIREMENTS

- A. Overcurrent Protective Device Coordination: All overcurrent protective devices proposed for inclusion in the Work shall be selected to be selectively coordinated with the overcurrent protective devices installed on their supply side such that an overcurrent event (overload, short-circuit, or ground-fault) occurring at the lowest level in the system (branch circuit) cannot cause the feeder protective device supplying the branch circuit panelboard to open. This coordination shall be carried through each level of distribution for all branches of normal and emergency power. Refer to Division 16 Section "Overcurrent Protective Device Coordination Study" for additional requirements.

1.3 SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 16 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.
- B. Simultaneous Action Submittals: Fuse Product Data submittal shall be made in conjunction with action submittals required under Division 16 Section Overcurrent Protective Device Coordination Study.
- C. Product Data: Include the following for each fuse type indicated:
1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 2. Let-through current curves for fuses with current-limiting characteristics.
 3. Time-current curves, coordination charts and tables, and related data. Include hardcopy of characteristic curve and TCC Number for use with Power Tools by SKM Systems Analysis, Inc.
 4. Tabulated schedule which indicates type, characteristics, and ratings of individual fuses and lists the devices and equipment in which they will be applied.
 5. Fuse size for elevator feeders and elevator disconnect switches.
- D. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
- E. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Let-through current curves for fuses with current-limiting characteristics.
 2. Time-current curves, coordination charts and tables, and related data.
 3. Ambient temperature adjustment information.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEMA FU 1.
- D. Comply with NFPA 70.

1.5 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size. Provide fuses to match utilization equipment requirements.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Fuses: Quantity equal to one for every ten of each type and rating installed. Furnish at least three of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Cooper Bussman, Inc.
 2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.
 3. Ferraz Shawmut, Inc.
 4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

2.3 SPARE-FUSE CABINET

- A. Cabinet: Wall-mounted, 0.05-inch- (1.27-mm-) thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
 - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
 - 2. Finish: ANSI Gray, baked enamel.
 - 3. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.
 - 4. Fuse Pullers: For each size of fuse.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Service Entrance: Class L, time delay.
- B. Feeders rated 600 Amperes or less: Class RK1, time delay.
- C. Feeders rated 601 Amperes and above: Class L, time delay.
- D. Motor Branch Circuits: Class RK1, time delay.
- E. Other Branch Circuits: Class RK1, time delay.

3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

- A. Install labels indicating fuse replacement information on inside door of each fused switch.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

- B. Install labels indicating Type and Rating of fuse installed on outside of door of each fused switch.

END OF SECTION

SECTION 16511 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior luminaires, lamps, and ballasts.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Luminaire supports.
 - 5. Retrofit kits for fluorescent luminaires.
 - 6. Lowering system for luminaires.
- B. Related Sections include the following:
 - 1. Division 16 Section "Wiring Devices" for, snap switches.

1.2 DEFINITIONS

- A. BF: Ballast factor.
- B. CRI: Color-rendering index.
- C. CU: Coefficient of utilization.
- D. FMG: FM Global (formally Factory Mutual)
- E. HID: High-intensity discharge.
- F. LER: Luminaire efficacy rating.
- G. Luminaire: Complete Lighting unit including, housing, lamps, reflector, socket, wiring, diffuser, and ballast and ballast housing where applicable.
- H. RCR: Room cavity ratio.

1.3 SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 16 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.
- B. Product Data: For each type of luminaire, arranged in order of fixture designation. Include data on features, accessories, finishes and the following:
 - 1. Physical description of luminaire including dimensions.
 - 2. Emergency lighting units including battery and charger.
 - 3. Performance data for Ballast.
 - 4. Energy-efficiency data.
 - 5. Life, output, and energy-efficiency data for lamps.

6. Photometric data, in IESNA format, based on laboratory tests of each luminaire type, outfitted with lamps, ballasts, and accessories identical to those indicated for the luminaire as applied in this Project.
 - a. Photometric data shall be certified by a qualified independent testing agency or by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.
- C. Shop Drawings: Show details of nonstandard or custom luminaires. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
 1. Wiring Diagrams: Power and control wiring.
- D. Coordination Drawings: Submit Reflected Ceiling Coordination Drawings in accordance with Division 16 Section "Common Work Results for Electrical."
- E. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.
- F. Qualification Data: For agencies providing photometric data for luminaires.
- G. Field quality-control test reports.
- H. Operation and Maintenance Data: For luminaires and accessories to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation And Maintenance Data," include the following:
 1. Manufacturer's routine maintenance requirements for lighting and all installed components.
 2. Special Lamp and Ballast disposal requirements; including manufacturer's safety data sheet with EPA requirements.
 3. Lamp and Ballast Summary: Prepare a tabulation of lamps and ballast used on project; include part numbers and ordering information.
- I. Warranties: Special warranties specified in this Section. Include registration information for Lamp and Ballast Specialty Warranty Programs (i.e. Sylvania Quick60+®, Advance PLUS 90 Protection®, etc).

1.4 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

- C. Source Limitations: All luminaires with the same type designation shall be obtained from a single manufacturer. Obtain similar luminaire types through one source from a single manufacturer, unless otherwise indicated.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with NFPA 70.
- F. FMG Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare products for shipment.
 - 1. Provide suitable packaging materials, crating, blocking, and supports so equipment will withstand expected domestic shipping and handling shocks and vibration.
 - 2. Weatherproof packaging for shipment. Close connection openings to prevent entrance of foreign material during shipment and storage.
- B. Store luminaires indoors in clean dry space with uniform temperature in accordance with manufacturer's requirements to prevent condensation. Protect products from exposure to dirt, fumes, water, corrosive substances, and physical damage.
- C. Handle product components according to manufacturer's written instructions.

1.6 COORDINATION

- A. Coordinate layout and installation of luminaires and suspension system with other construction that penetrates ceilings or is supported by them, including but not limited to HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

- A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
 - 2. Warranty Period for Emergency Fluorescent Ballast Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.
- B. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to replace ballasts replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 - 1. Warranty Period for Electronic Ballasts: 36 months from date of Substantial Completion.

2. Warranty Period for Fluorescent Electromagnetic Ballasts: 36 months from date of Substantial Completion.
 3. Warranty Period for HID Electromagnetic Ballasts: 24 months from date of Substantial Completion.
- C. Special Warranty for Fluorescent and HID Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
1. Warranty Period: 24 months from date of Substantial Completion.
- D. Special Warranty for Ballast: In addition to Warranties listed above, provide Manufacturer's standard form, made out to Owner and signed by Ballast manufacturer agreeing to replace ballasts that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site and labor costs to replace failed ballasts, within specified warranty period indicated below.
1. Ballast Warranty Period from date of Substantial Completion:
 - a. Metal Halide Electronic, Standard Case Temperature (Up to and including 70°C): Minimum of 60 months.
 - b. Metal Halide Electronic, High Case Temperature (71°C to 85°C): Minimum of 36 months.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
 2. Specialty Incandescent lamps: Exact distribution of lamps will not be known until Final Aiming and Adjustment; therefore, furnish 25 for every 100 each type and rating required as "spot" distribution and 25 for every 100. "flood" distribution.
 3. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
 4. Battery and Charger Data: One for each emergency lighting unit.
 5. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
 6. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide luminaires in accordance with the designations and descriptions in the "Luminaire Schedule" located on the Drawings. In Luminaire Schedule, products are listed below column or row headings that introduce lists, the following requirements apply to product selection:
1. Available Manufacturers: Where the Luminaire Schedule indicates only one product by manufacturer and associated catalog number and does not list other manufacturers by name; the design for each luminaire is based on the product named by manufacturer and associated catalog number scheduled. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 2. Manufacturers: Where the Luminaire Schedule indicates more than one manufacturer and associated catalog number; Subject to compliance with requirements, provide one of the products named by the manufacturers specified.
 3. Basis-of-Design Product: Where the Luminaire Schedule indicates only one product by manufacturer and associated catalog number and lists other manufacturers by name only; the design for each luminaire is based on the product named by manufacturer and associated catalog number scheduled. Subject to compliance with requirements; provide either the named product or a comparable product by one of the other manufacturers specified.
 4. Specific Product: Where the Luminaire Schedule indicates only one product by manufacturer and associated catalog number and does not list other manufacturers by name and includes the phrase "NO SUBSTITUTIONS ALLOWED"; the design for each luminaire is based on the product named by manufacturer and associated catalog number scheduled. Subject to compliance with requirements, provide the product named by the manufacturers specified. Provide a list of Unit Prices for these items in accordance with requirements of Division 01 Section "Unit Prices".

2.2 LUMINAIRES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.
- C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.
- E. Metal Parts: Free of burrs and sharp corners and edges.
- F. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

- G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
 - 4. Laminated Silver Metallized Film: 90 percent.
- I. Plastic Diffusers, Covers, and Globes:
 - 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass, unless otherwise indicated.
- J. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic-interference as required by MIL-STD-461E. Fabricate luminaires with one filter on each ballast indicated to require a filter.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Transformer Company; a Division of Phillips Electronics.
 - b. OSRAM Sylvania.
 - c. Universal Lighting Technologies.
- B. Electronic Ballasts: Comply with ANSI C82.11; programmed-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.
 - 1. Compatibility: Certified by manufacturer for use with specific lamp type indicated.
 - 2. Thermal Protection: Comply with UL Class P, Type 1 Outdoor.
 - 3. Sound Rating: Class A.
 - 4. Total Harmonic Distortion Rating: Less than 10 percent.
 - 5. Transient Voltage Protection: ANSI/IEEE C62.41, Category A or better.
 - 6. Operating Frequency: 42 kHz or higher.
 - 7. Voltage Range: 108-305 Volts
 - 8. Lamp Current Crest Factor: 1.7 or less.
 - 9. BF: 0.85 or higher.
 - 10. Power Factor: 0.98 or higher.
 - 11. Starting Temperature: 0 Deg C minimum, unless otherwise indicated..

12. Ballast Case Temperature: 70 Deg C maximum, unless otherwise indicated.
 13. Remote Mounting Distance: Up to 20-feet, where indicated.
 14. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
 15. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C 82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.
- C. Electronic Programmed-Start Ballasts for T5 and T5HO Lamps: Comply with ANSI C82.11 and the following:
1. Compatibility: Certified by manufacturer for use with specific lamp type indicated.
 2. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
 3. Automatic lamp starting after lamp replacement.
 4. Thermal Protection: Comply with UL Class P, Type 1 Outdoor.
 5. Sound Rating: Class A.
 6. Total Harmonic Distortion Rating: Less than 10 percent.
 7. Transient Voltage Protection: ANSI/IEEE C62.41, Category A or better.
 8. Operating Frequency: 40 kHz or higher.
 9. Voltage Range: 108-305 Volts
 10. Lamp Current Crest Factor: 1.7 or less.
 11. BF: 0.95 or higher, unless otherwise indicated.
 12. Power Factor: 0.98 or higher.
 13. Starting Temperature: 0 Deg C minimum, unless otherwise indicated.
 14. Ballast Case Temperature: 70 Deg C maximum, unless otherwise indicated.
 15. Remote Mounting Distance: Up to 18-feet, where indicated.
 16. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
- D. Single Ballasts for Multiple Luminaires: Where indicated, provide Factory-wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.
- E. Ballasts for Low-Temperature Environments:
1. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.
- F. Ballasts for Low Electromagnetic-Interference Environments: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for consumer equipment.

2.4 EMERGENCY FLUORESCENT POWER UNIT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. Bodine Company, The.
 - b. IOTA Engineering, L.L.C.

- B. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with ballast. Comply with UL 924.
 - 1. Compatibility: Certified by manufacturer for use with specific lamp type indicated.
 - 2. Emergency Connection: Operate 1 fluorescent lamp(s) continuously at an output of 1100 lumens each, unless otherwise indicated. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 - 3. Night-Light Connection: Operate one fluorescent lamp continuously, unless otherwise indicated.
 - 4. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 5. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - 6. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

- C. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more fluorescent lamps, remote mounted from luminaire. Comply with UL 924.
 - 1. Compatibility: Certified by manufacturer for use with specific lamp type indicated.
 - 2. Emergency Connection: Operate one fluorescent lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 - 3. Night-Light Connection: Operate one fluorescent lamp in a remote fixture continuously, unless otherwise indicated.
 - 4. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - 5. Charger: Fully automatic, solid-state, constant-current type.
 - 6. Housing: NEMA 250, Type 1 enclosure.
 - 7. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - 8. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.5 BALLASTS FOR HID LAMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Transformer Company; a Division of Phillips Electronics.
 - b. OSRAM Sylvania.
 - c. Universal Lighting Technologies.

- B. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features, unless otherwise indicated:
 - 1. Compatibility: Certified by manufacturer for use with specific lamp type indicated.
 - 2. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.

3. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single-lamp ballasts.
 4. Normal Ambient Operating Temperature: 104 deg F (40 deg C).
 5. Open-circuit operation that will not reduce average life.
 6. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.
- C. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:
1. Compatibility: Certified by manufacturer for use with specific lamp type indicated.
 2. Lamp end-of-life detection and shutdown circuit.
 3. Thermal Protection: Class P thermal cutout.
 4. Sound Rating: Class A.
 5. Total Harmonic Distortion Rating: Less than 15 percent.
 6. Transient Voltage Protection: ANSI/IEEE C62.41, Category A or better.
 7. Lamp Current Crest Factor: 1.5 or less.
 8. Power Factor: .90 or higher.
 9. Ballast Case Temperature: 75 Deg C maximum, unless otherwise indicated.
 10. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
- D. Auxiliary Instant-On Quartz System (Quartz Re-Strike): Factory-installed feature automatically switches quartz lamp on under hot and cold starting conditions, when fixture is initially energized or when power outages occur.
1. Separate 120-volt circuit for quartz lamp not required; wiring for the quartz lamp is internal to the ballast assembly; the ballast supplies voltage required to operate the quartz lamp. The luminaire must be energized for quartz lamp to operate.
 2. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent light output by use of time delay circuit or other approved method.

2.6 EMERGENCY HID POWER UNIT

- A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with ballast. Comply with UL 924.
1. Emergency Connection: Operate and maintain arc on HID lamp(s) continuously during AC power sags, interruptions or failure for a minimum of 2 minutes, unless otherwise indicated. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 2. Battery: Sealed, maintenance-free, nickel-cadmium type.
 3. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

2.7 EXIT SIGNS

- A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Chevrons: Fixture Schedule does not indicate chevron quantity or direction. Coordinate chevron arrows required with plans. Chevrons shall be external to the lettering on sign face.

- C. Internally Lighted Signs:
 - 1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.

2.8 LAMPS – GENERAL

- A. General: Configurations and ratings as noted in Luminaire Schedule on drawings.
 - 1. Requirements: Comply with subparagraphs below for specific lamp types.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. General Electric;
 - b. OSRAM Sylvania;
 - c. Phillips;

2.9 Incandescent and Halogen Lamps

- A. General: Configurations, beam pattern and ratings as noted in Luminaire Schedule on Drawings.

2.10 FLUORESCENT LAMPS

- A. Low-Mercury Lamps: Comply with EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.
- B. T8 Linear, rapid-start, low-mercury lamps: 2-pin, CRI 82 (minimum), color temperature 4100K or otherwise as Specified in Luminaire Schedule, and average rated life 24,000 hours, unless otherwise indicated.
 - 1. 32W:Nominal length of 48 inches (1220 mm), rated 3000 initial lumens (minimum).
 - 2. 25W:Nominal length of 36 inches (915 mm), rated 2250 initial lumens (minimum).
 - 3. 17W:Nominal length of 24 inches (610 mm), rated 1400 initial lumens (minimum).

2.11 HID LAMPS

- A. Metal-Halide Lamps: ANSI C78.43, with a minimum CRI 65, and color temperature 4000K. Comply with NFPA 72 and ANSI criteria for containment rated operation in open fixtures. Provide 'o' rated lamps for open fixtures.
- B. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000K. Comply with NFPA 72 and ANSI criteria for containment rated operation in open fixtures. Provide 'o' rated lamps for open fixtures.
- C. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K. Comply with NFPA 72 and ANSI criteria for containment rated operation in open fixtures. Provide 'o' rated lamps for open fixtures.
- D.

2.12 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with Division 16 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture, unless otherwise indicated.
- C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture, unless otherwise indicated.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).
- F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- H. Suspension Bar for Light Fixtures: Factory-fabricated metal hanger for supporting luminaires at locations between ceiling system t-grid components. Attached to ceiling tee bar with screws or integral clamp for stability. Includes tab for independent support wire attachment.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper B-Line, Inc.; a division of Cooper Industries.
 - b. ERICO International Corporation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA/IESNA 500 "Standard for Installing Indoor Commercial Lighting" as published by the National Electrical Contractors Association.
- B. Comply with applicable portions of NECA/IESNA 502 "Standard for Installing Industrial Lighting Systems" as published by the National Electrical Contractors Association.
- C. Refer to Architectural Reflected Ceiling Plans for locations of luminaires. Do not scale locations from Electrical Drawings.
- D. Luminaires: Set level, plumb, and square with ceilings and walls. Install so as not to interfere with the installation or removal of adjacent ceiling panels.
- E. Lamps: Install lamps in each fixture.

- F. Ceiling Types: Verify the exact ceiling type and arrangement within which the luminaires will be installed with the Architectural reflected ceiling plans prior to procurement. Provide appropriate flanges and accessories with each luminaire to accommodate the defined ceiling.
- G. Suspended Luminaire Support:
 - 1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swaying or other horizontal movement.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with stem hangers, unless otherwise indicated.

3.2 CONNECTIONS

- A. Ground equipment according to Division 16 Section "Grounding and Bonding for Electrical Systems."
- B. Conductors and Cables."

3.3 CLEANING AND RELAMPING

- A. Clean components according to manufacturer's written instructions.
- B. After completing equipment installation and before substantial completion, inspect all luminaires and components.
 - 1. Remove paint splatters and other spots, dirt, fingerprints and debris.
 - 2. Repair damaged finish to match original finish.
- 3. Dust or Vacuum interiors of suspended indirect and pendant luminaires to remove all dust, dirt, and debris.
- 4. Clean all lenses with cleaning agent approved by Luminaire Manufacturer.
- 5. Verify all warning labels in fixtures do not obstruct any reflective surface. Relocate warning labels as necessary so that they are not in plain view, yet they are still accessible to qualified personnel during re-lamping.
- 6. Perform Lamp Burn-in procedure for all lamps as recommended by the lamp and ballast manufacturer prior to Final Acceptance.

3.4 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Verify transfer from normal power to battery and retransfer to normal by both of the following methods.
 - 1. Interrupt power supply to demonstrate proper operation.
 - 2. Depress Push-To-Test button to demonstrate proper operation.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.5 FOLLOW-UP SERVICE

- A. Final Aiming and Adjusting: Perform adjustments to all aimable and track mounted luminaires as directed by the Architect to provide required light intensities and distributions.
 - 1. Scheduling: After Substantial Completion, but not more than three months after Final Acceptance; after delivery and placement of amenities including

but not limited to furniture, artwork, plantings, and signage/graphics; during a period mutually agreeable to the Architect and Owner.

2. Required Equipment: Provide scaffolding, ladders, motorized man-lifts or hoists as required to reach luminaires.
3. Re-Lamp: Utilizing the extra materials furnished under Part 1 above, re-lamp fixtures with new lamps having differing beam-spreads as directed by the Architect. Return all unused or minimally-used lamps to the facilities stock at the completion of the aiming and adjustment as directed by the Owner.

END OF SECTION

SECTION 16521 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Exterior luminaires.
 - 2. Luminaire-mounted photoelectric relays.
 - 3. Poles and accessories.
- B. Related Sections include the following:
 - 1. Division 16 Section "Interior Lighting" for exterior luminaires normally mounted on interior surfaces of buildings.
 - 2. Division 16 Section "Vibration and Seismic Controls for Electrical Systems" for seismic design criteria for Poles, bases and accessories.

1.2 DEFINITIONS

- A. CRI: Color-rendering index.
- B. HID: High-intensity discharge.
- C. Luminaire: Complete Lighting unit including, housing, lamps, reflector, socket, wiring, diffuser, and ballast and ballast housing where applicable.
- D. Pole: Luminaire support structure, including tower used for large area illumination.
- E. Standard: Same definition as "Pole" above.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design support bases and select poles and other support components for the standard mounted luminaires proposed for inclusion in the Work. Include comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.4 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

- A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4.
- B. Ice Load: Load of 3 lbf/sq. ft. (143.6 Pa), applied as stated in AASHTO LTS-4.
- C. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4.

1.5 SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 16 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

- B. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
 - 2. Details of attaching luminaires and accessories.
 - 3. Details of installation and construction.
 - 4. Luminaire materials.
 - 5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
 - a. Photometric data shall be certified by a qualified independent testing agency or by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.
 - 6. Photoelectric relays.
 - 7. Performance data for Ballasts, including energy-efficiency data.
 - 8. Lamps, including life, output, and energy-efficiency data.
 - 9. Materials, dimensions, and finishes of poles.
 - 10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
 - 11. Anchor bolts for poles.

- C. Shop Drawings:
 - 1. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
 - 2. Wiring Diagrams: Power and control wiring.
 - 3. Photometric Calculation Drawings: overall site plan prepared using computerized point-by-point analysis software based on luminaires proposed for inclusion in the Work. Plans shall indicate the following:
 - a. Illuminance levels at grade on a maximum of a 24-inch by 24-inch grid.
 - b. Schedule of Luminaires, include the following:
 - 1) Make and Model number of Luminaires.
 - 2) Description of Luminaire; including mounting and accessories.
 - 3) Lamps, including initial and maintained lumen output.
 - 4) Assumed light loss factors used in calculations.
 - c. Calculation Summary showing the following:
 - 1) Average Illuminance.
 - 2) Minimum to Maximum Ratio.
 - 3) Average to Minimum Ratio.
 - 4) Maximum illuminance at Property Line

- D. Finish Samples for Verification: Nominal 3-inch by 3-inch metal squares, factory finished for all standard finishes available; indicate specified finish with unique tag or marker.

- E. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4 and that load imposed by luminaire has been included in design.

- F. Qualification Data: For agencies providing photometric data for Luminaires.

- G. Field quality-control test reports.

- H. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation And Maintenance Data," include the following:
 - 1. Manufacturer's routine maintenance requirements for lighting and all installed components.
 - 2. Special Lamp and Ballast disposal requirements; including manufacturer's safety data sheet with EPA requirements.
 - 3. Lamp and Ballast Summary: Prepare a tabulation of lamps and ballast used on project; include part numbers and ordering information.
- I. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.
- C. Source Limitations: All luminaries with the same type designation shall be obtained from a single manufacturer. Obtain similar luminaire types through one source from a single manufacturer, unless otherwise indicated.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with IEEE C2, "National Electrical Safety Code."
- F. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Prepare products for shipment.
 - 1. Provide suitable packaging materials, crating, blocking, and supports so equipment will withstand expected domestic shipping and handling shocks and vibration.
 - 2. Weatherproof packaging for shipment. Close connection openings to prevent entrance of foreign material during shipment and storage.
- B. Store luminaires in clean dry area in accordance with manufacturer's requirements. Protect products from exposure to dirt, fumes, water, corrosive substances, and physical damage.
- C. Handle product components according to manufacturer's written instructions.
- D. Package aluminum poles for shipping according to ASTM B 660.
- E. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

- F. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.8 WARRANTY

- A. Special Warranty for Luminaire and Luminaire Accessories: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, or unauthorized repairs or alterations from special warranty coverage. Manufacturer may exclude vandalism or abuse for luminaires that are not designated as high-abuse products where vandal resistance is a product requirement.
 - 1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
 - 2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
 - 3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
 - 4. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.
- B. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to replace ballasts replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 - 1. Warranty Period for Electronic Ballasts: 36 months from date of Substantial Completion.
 - 2. Warranty Period for Fluorescent Electromagnetic Ballasts: 36 months from date of Substantial Completion.
 - 3. Warranty Period for HID Electromagnetic Ballasts: 24 months from date of Substantial Completion.
- C. Special Warranty for Fluorescent and HID Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 - 1. Warranty Period: 24 months from date of Substantial Completion.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Glass and Plastic Lenses, Covers, and Other Optical Parts: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 3. Ballasts: 10 for every 100 of each type and rating installed. Furnish at least one of each type.

4. Globes and Guards: 10 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide luminaires in accordance with the designations and descriptions in the "Luminaire Schedule" located on the Drawings. In Luminaire Schedule, products are listed below column or row headings that introduce lists, the following requirements apply to product selection:
 1. Available Manufacturers: Where the Luminaire Schedule indicates only one product by manufacturer and associated catalog number and does not list other manufacturers by name; the design for each luminaire is based on the product named by manufacturer and associated catalog number scheduled. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 2. Manufacturers: Where the Luminaire Schedule indicates more than one manufacturer and associated catalog number; Subject to compliance with requirements, provide one of the products named by the manufacturers specified.
 3. Basis-of-Design Product: Where the Luminaire Schedule indicates only one product by manufacturer and associated catalog number and lists other manufacturers by name only; the design for each luminaire is based on the product named by manufacturer and associated catalog number scheduled. Subject to compliance with requirements; provide either the named product or a comparable product by one of the other manufacturers specified.
 4. Specific Product: Where the Luminaire Schedule indicates only one product by manufacturer and associated catalog number and does not list other manufacturers by name and includes the phrase "NO SUBSTITUTIONS ALLOWED"; the design for each luminaire is based on the product named by manufacturer and associated catalog number scheduled. Subject to compliance with requirements, provide the product named by the manufacturers specified. Provide a list of Unit Prices for these items in accordance with requirements of Division 01 Section "Unit Prices".

2.2 LUMINAIRES, GENERAL REQUIREMENTS

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
- B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field, where indicated in Luminaire Schedule.
- J. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
- K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- L. Luminaire Finish: Finish as indicated in Luminaire Schedule. Manufacturer's standard paint or clear coat finish and custom Colors where indicated; applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

- A. Comply with UL 773 or UL 773A.
- B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.
 - 1. Relay with locking-type receptacle shall comply with NEMA C136.10.
 - 2. Adjustable window slide for adjusting on-off set points.

2.4 BALLASTS FOR HID LAMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Transformer Company; a Division of Phillips Electronics.
 - b. OSRAM Sylvania.
 - c. Universal Lighting Technologies.
- B. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features, unless otherwise indicated:
 - 1. Compatibility: Certified by manufacturer for use with specific lamp type indicated.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

2. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 3. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single-lamp ballasts.
 4. Normal Ambient Operating Temperature: 104 deg F (40 deg C).
 5. Open-circuit operation that will not reduce average life.
 6. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.
- C. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:
1. Compatibility: Certified by manufacturer for use with specific lamp type indicated.
 2. Lamp end-of-life detection and shutdown circuit.
 3. Thermal Protection: Class P thermal cutout.
 4. Sound Rating: Class A.
 5. Total Harmonic Distortion Rating: Less than 15 percent.
 6. Transient Voltage Protection: ANSI/IEEE C62.41, Category A or better.
 7. Lamp Current Crest Factor: 1.5 or less.
 8. Power Factor: .90 or higher.
 9. Ballast Case Temperature: 75 Deg C maximum, unless otherwise indicated.
 10. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
- D. Auxiliary Instant-On Quartz System: Factory-installed feature automatically switches quartz lamp on when fixture is initially energized and when power outages occur. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent light output.

2.5 HID LAMPS

- A. Metal-Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature 4000K.
- B. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000K.
- C. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K.

2.6 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

- A. Structural Characteristics: Comply with AASHTO LTS-4.
 1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in Part 1 "Structural Analysis Criteria for Pole Selection" Article, with a gust factor of 1.3.
 2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
- B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts, unless otherwise indicated.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

- C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
 - 1. Materials: Shall not cause galvanic action at contact points.
 - 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication, unless stainless-steel items are indicated.
 - 3. Anchor-Bolt Template: Plywood or steel.
- D. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."

2.7 STEEL POLES

- A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); 1-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.
 - 1. Shape: As indicated in Luminaire Schedule on Drawings.
 - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- B. Steel Mast Arms: Single-arm type, continuously welded to pole attachment plate. Material and finish same as pole.
- C. Brackets for Luminaires: Detachable, cantilever, without underbrace.
 - 1. Adapter fitting welded to pole and bracket, then bolted together with stainless galvanized-steel bolts.
 - 2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
 - 3. Match pole material and finish.
- D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- E. Intermediate Handhole and Cable Support: Weathertight, 3-by-5-inch (76-by-127-mm) handhole located at midpoint of pole with cover for access to internal welded attachment lug for electric cable support grip.
- F. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 16 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- G. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.
- H. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel,

- complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
- 2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
- 3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: as selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

- A. Comply with NECA/IESNA 501 "Standard for Installing Exterior Lighting Systems" as published by the National Electrical Contractors Association.
- B. Fasten luminaire to indicated structural supports.
 - 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Install lamps in each luminaire.
- D. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.

3.2 POLE INSTALLATION

- A. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features, unless otherwise indicated on Drawings:
 - 1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
 - 2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m).
 - 3. Trees: 15 feet (5 m).
- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
 - 1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
- 2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
- 3. Install base covers, unless otherwise indicated.
- 4. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- E. Raise and set poles using web fabric slings (not chain or cable).

3.3 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Division 16 Section "Underground Ducts and Raceways for Electrical Systems." In concrete foundations, wrap conduit with 20 mil polyvinyl chloride (PVC) tape with a high-tack adhesive and pipe primer to provide a corrosion- and impact-resistant seal. Apply with a 50 percent overlap.

3.4 CONNECTIONS

- A. Connect wiring according to Division 16 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Secure all wiring routed inside poles using cable support grips. Remove slack in conductors to prevent lateral movement.

3.5 GROUNDING

- A. Ground metal poles and support structures according to Division 16 Section "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole.
 - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
- B. Ground nonmetallic poles and support structures according to Division 16 Section "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole.
 - 2. Install grounding conductor and conductor protector.
 - 3. Ground metallic components of pole accessories and foundations.

3.6 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
 - 1. Verify operation of photoelectric controls.
- C. Illumination Tests:
 - 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with requirements of authorities having jurisdiction and the following IESNA testing guide(s):
 - a. IESNA LM-50, "Photometric Measurements of Roadway Lighting Installations."
 - b. IESNA LM-64, "Photometric Measurements of Parking Areas."
 - c. IESNA LM-72, "Directional Positioning of Photometric Data."

- D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards and design requirements.

3.7 CLEANING AND RELAMPING

- A. Clean components according to manufacturer's written instructions.
- B. After completing equipment installation and before substantial completion, inspect all luminaires and components.
 - 1. Remove paint splatters and other spots, dirt, fingerprints and debris.
 - 2. Repair damaged finish to match original finish.
 - 3. Dust or Vacuum interiors of luminaires to remove all dust, dirt, and debris.
 - 4. Clean all lenses with cleaning agent approved by Luminaire Manufacturer.
 - 5. Verify all warning labels in fixtures do not obstruct any reflective surface. Relocate warning labels as necessary so that they are not in plain view, yet they are still accessible to qualified personnel during re-lamping.
 - 6. Perform Lamp Burn-in procedure for all lamps as recommended by the lamp and ballast manufacturer prior to Final Acceptance.

END OF SECTION

SECTION 16670 - LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes lightning protection for buildings.
- B. Related Sections include the following:
 - 1. Division 16 Section "Grounding and Bonding for Electrical Systems" for common grounding and bonding.

1.2 DEFINITIONS

- A. LPI: Lightning Protection Institute.
- B. NRTL: National recognized testing laboratory.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design lightning protection, including comprehensive engineering analysis by a UL certified company, using performance requirements and design criteria indicated.
- B. Design lightning protection components and systems to meet the requirements of UL 96A, NFPA 780 and LPI 175.

1.4 SUBMITTALS

- A. Submit product data and shop drawings in accordance with Division 01 and Division 16 Section "Common Work Results for Electrical" for products specified under PART 2 - PRODUCTS.
- B. Product Data: For air terminals, conductors, and mounting accessories.
- C. Delegated-Design Shop Drawings: Detail lightning protection system, including air-terminal locations, conductor routing, conductor connections, and bonding and grounding provisions. In addition also Include the following on shop drawings:
 - 1. Type, material, and size of conductors.
 - 2. Indications for where raceways will be used.
 - 3. Data on how concealment requirements will be met,
 - 4. Calculations required by NFPA 780 for bonding of grounded and isolated metal bodies.
 - 5. Installation details for thru roof penetrations.
 - 6. Installation details for conductor connections.
- D. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include data on listing or certification by an NRTL or LPI.

- E. Certification, signed by Contractor, that roof adhesive for air terminals is approved by manufacturers of both the terminal assembly and the single-ply membrane roofing material where air terminals are mounted on single-ply membrane roofing.
- F. Field inspection reports indicating compliance with specified requirements.
- G. Operation and Maintenance Data: For lightning protection system, to include in emergency, operation, and maintenance manuals. Provide items specified in Division 01 Section "Operation and Maintenance Data."
- H. Label and Certification: LPI System Certification, a written guarantee of UL compliance, and subsequent issuance of the UL Certificate of Inspection.

1.5 QUALITY ASSURANCE

- A. Designer and Installer Qualifications: Engage an experienced installer who is an NRTL or who is certified by LPI as a Master Installer/Designer.
- B. Listing and Labeling: As defined in NFPA 780, "Definitions" Article.

1.6 COORDINATION

- A. Coordinate installation of lightning protection with installation of other building systems and components, including electrical wiring, supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.
- B. Coordinate installation of air terminals attached to roof systems with roofing manufacturer and Installer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advanced Lightning Technology, Ltd.
 - 2. Automatic Lightning Protection.
 - 3. East Coast Lightning Equipment, Inc.
 - 4. ERICO International Corporation.
 - 5. Harger Lightning Protection, Inc.
 - 6. Heary Bros. Lightning Protection Co. Inc.
 - 7. Independent Protection Co.
 - 8. Robbins Lightning Inc.

2.2 LIGHTNING PROTECTION SYSTEM COMPONENTS

- A. Comply with UL 96.
- B. Classification of Lightning Protection Equipment: Provide components in accordance with reference standards.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

LIGHTNING PROTECTION FOR STRUCTURES
SYSTEMS

1. For Roof Levels 75 feet and below in height: Provide NFPA Class [I] [II] components.
 2. For Roof Levels greater than 75 feet in height: Provide NFPA Class II components.
- C. Roof-Mounting Air Terminals: Solid Aluminum or Copper, as required by standards and dictated by construction materials to which lightning protection systems components are attached.
- D. Conductors: Stranded Aluminum or Copper, as required by standards and dictated by construction materials to which lightning protection systems components are attached.
1. Provide copper down lead conductors even when aluminum is required at roof level. Extend Copper down lead conductors to roof. Provide approved bi-metallic connector at the thru-roof assembly to transition between aluminum and copper.
- E. Roof Attachment Components: Coordinate installation of roof-attachment components and roof penetrations with roofing installer. Refer to items specified in Division 07 Sections for roofing materials specified and other roof accessories.
1. Provide specialty membrane patches, pads, pavers or other specialty items as required by the roofing manufacturer.
 2. Single-Membrane, Roof-Mounting Air Terminals: Where single membrane roofs are specified, provide products designed for single-membrane roof materials.
- F. Mounting Hardware: Stainless steel.
- G. Stack-Mounting Air Terminals: Stainless steel.
- H. Below Grade Cable Connections: Use approved exothermic-welded connections for all conductor splices and connections between conductors and other components.
- I. Above Grade Cable Connections: Use approved bolted connections for all conductor splices and connections between conductors and other components. Pressure squeeze clamps are not acceptable.
- J. Ground Rods, Ground Loop Conductors, and Concrete-Encased Electrodes: Comply with Division 16 Section "Grounding and Bonding for Electrical Systems" and with standards referenced in this Section.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install lightning protection components and systems according to UL 96A and NFPA 780.
- B. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends and narrow loops.

ST. LUKE'S CLEAR LAKE HOSPITAL & PARKING GARAGE
PARKING GARAGE PACKAGE

LIGHTING PROTECTION FOR STRUCTURES
SYSTEMS

- C. Comply with mounting and support requirements specified in Division 16 Section "Hangers and Supports for Electrical Systems."
- D. Conceal the following conductors:
 - 1. System conductors.
 - 2. Down conductors.
 - 3. Interior conductors.
 - 4. Conductors within normal view from exterior locations at grade within 200 feet (60 m) of building.
 - 5. Notify Architect at least 48 hours in advance of inspection before concealing lightning protection components.
- E. Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer's written instructions.
- F. For building in excess of 60 feet (18 m) Tall: Bond lightning protection components with intermediate-level interconnection loop conductors to grounded metal bodies of building at 60-foot (18-m) intervals.

3.2 CORROSION PROTECTION

- A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.
- B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.3 FIELD QUALITY CONTROL

- A. UL Inspection: Provide inspections as required to obtain a UL Certificate of Inspection for system.
- B. Provide an inspection by an inspector certified by LPI to obtain an LPI certification.

END OF SECTION