

EVERGREEN BAPTIST CHURCH

10301 EAST 111TH STREET

BROKEN ARROW, OKLAHOMA

PHASE 5 SPECIFICATIONS

**REED ARCHITECTURE AND INTERIORS
18 EAST HOBSON AVENUE
SAPULPA, OKLAHOMA 74066**

SECTION 00 0107 - SEALS PAGE

PROJECT

Evergreen Baptist Church - Phase 5

OWNER

Evergreen Baptist Church
10301 East 111th St. S
Broken Arrow, OK 74011

ARCHITECT OF RECORD

David R. Reed, AIA, ALEP
Reed Architecture & Interiors, LLC
18 E. Hobson Ave
Sapulpa, OK 74066



03.03.2025

Architect of Record

SECTION 00 0107 - SEALS PAGE

PROJECT

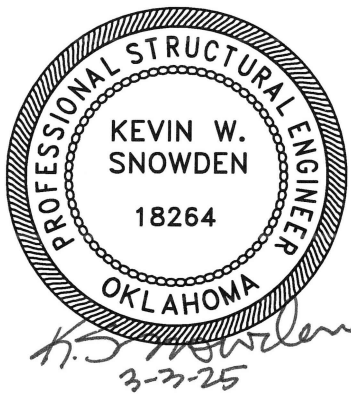
Evergreen Baptist Church - Phase 5

OWNER

Evergreen Baptist Church
10301 East 111th St. S
Broken Arrow, OK 74011

STRUCTURAL ENGINEER OF RECORD

Snowden Engineering
8128 E. 63rd Street
Tulsa, OK 74133



Structural Engineer of Record

SECTION 00 0107 - SEALS PAGE

PROJECT

Evergreen Baptist Church - Phase 5

OWNER

Evergreen Baptist Church
10301 East 111th St. S
Broken Arrow, OK 74011

MECHANICAL ELECTRICAL AND PLUMBING ENGINEER(S) OF RECORD

V2 Engineering, LLC
3134 E. 15th Street
Tulsa, OK 74104

CofA # 7856 Expires 6/2025



Mechanical Plumbing and Electrical Engineer(s) of Record

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**SECTION 00 7200
GENERAL CONDITIONS**

**FORM OF GENERAL CONDITIONS: AIA DOCUMENT A-201-2007 IS INCLUDED HEREIN BY
REFERENCE. COPIES ARE AVAILABLE UPON REQUEST.**

RELATED REQUIREMENTS

2.01 SECTION 00 7300 - SUPPLEMENTARY CONDITIONS.

SUPPLEMENTARY CONDITIONS

**3.01 REFER TO DOCUMENT 00 7300 - SUPPLEMENTARY CONDITIONS FOR AMENDMENTS TO
THESE GENERAL CONDITIONS.**

END OF SECTION

SECTION 00 7301
SUPPLEMENTARY GENERAL CONDITIONS

Evergreen Baptist Church
Phase 5
Broken Arrow, Oklahoma
March 3, 2025

Supplementary General Conditions
00 7301
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Construction Documents

Reed Architecture and Interiors
18 East Hobson Avenue
Sapulpa, Oklahoma

THIS SUPPLEMENT TO THE GENERAL CONDITIONS IS EXECUTED SIMULTANEOUSLY WITH AND CONSTITUTES A PART OF THE STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR, AIA A101-2007 AND GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION AIA DOCUMENT A201-2007 EDITION. FOR PURPOSES OF THIS PROJECT "CONTRACTOR" MEANS CONSTRUCTION MANAGER.

THIS SUPPLEMENT MODIFIES THE GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION AIA DOCUMENT A201-2007 AND TO THE EXTENT THAT THERE IS ANY CONFLICT BETWEEN THE PRINTED GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION AND THIS SUPPLEMENT, THE TERMS OF THIS SUPPLEMENT SHALL CONTROL. THE GENERAL CONDITIONS AS MODIFIED BY THIS SUPPLEMENT CONTAIN TERMS REGARDING THE DUTIES OF THE ARCHITECT TO THE OWNER AND THE RELATIONSHIP AMONG THE ARCHITECT, CONTRACTOR AND THE OWNER.

CONDITIONS OF THE CONTRACT FOR CONSTRUCTION AND THIS SUPPLEMENT, THE TERMS OF THIS SUPPLEMENT SHALL CONTROL. THE GENERAL CONDITIONS AS MODIFIED BY THIS SUPPLEMENT CONTAIN TERMS REGARDING THE DUTIES OF THE ARCHITECT TO THE OWNER AND THE RELATIONSHIP AMONG THE ARCHITECT, CONTRACTOR AND THE OWNER.

THE FOLLOWING SECTION NUMBERS CORRESPOND TO THE NUMBERING OF THE ARTICLES IN THE GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION. SECTIONS THAT ARE SUBSTITUTED OR MODIFIED ARE SET FORTH UNDER THE CORRESPONDING SECTION USED IN THE GENERAL CONDITIONS. IF NEW MATERIALS ARE ADDED, THE SECTION NUMBERS FOR THOSE PROVISIONS ARE NUMBERED TO BE CONSISTENT WITH THE GENERAL CONDITIONS FORMAT.

CONDITIONS OF THE CONTRACT FOR CONSTRUCTION. SECTIONS THAT ARE SUBSTITUTED OR MODIFIED ARE SET FORTH UNDER THE CORRESPONDING SECTION USED IN THE GENERAL CONDITIONS AND IF NEW MATERIALS ARE ADDED, THE SECTION NUMBERS FOR THOSE PROVISIONS ARE NUMBERED TO BE CONSISTENT WITH THE GENERAL CONDITIONS FORMAT.

ARTICLE 1- GENERAL PROVISIONS:

BASIC DEFINITIONS

REPLACE THE LAST SENTENCE IN SECTION 1.1.1 WITH THE FOLLOWING:

"THE CONTRACT DOCUMENTS INCLUDE THE INVITATION TO BID, INSTRUCTIONS TO BIDDERS, SAMPLE FORMS, OTHER INFORMATION FURNISHED BY THE OWNER IN ANTICIPATION OF RECEIVING BIDS OR PROPOSALS, THE CONTRACTORS BID OR PROPOSAL, AND PORTIONS OF ADDENDA RELATING TO BIDDING REQUIREMENTS."

EXECUTION, CORRELATION AND INTENT

ADD THE FOLLOWING CLAUSE 1.2.3.1 TO SECTION 1.2.3

"1.2.3.1 IN THE EVENT OF CONFLICTS OR DISCREPANCIES AMONG THE CONTRACT DOCUMENTS, INTERPRETATIONS WILL BE BASED ON THE FOLLOWING PRIORITIES:

1. ADDENDA, WITH THOSE OF LATER DATE HAVING PRECEDENCE OVER THOSE OF EARLIER DATE
2. THE SUPPLEMENTARY CONDITIONS
3. THE GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION
4. DIVISION 1 OF THE SPECIFICATIONS
5. DRAWINGS AND DIVISION 2-49 OF THE SPECIFICATIONS. IN THE CASE OF CONFLICTS OR

Evergreen Baptist Church
Phase 5
Broken Arrow, Oklahoma
March 3, 2025

Supplementary General Conditions
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Construction Documents

Reed Architecture and Interiors
18 East Hobson Avenue
Sapulpa, Oklahoma

19.01 DISCREPANCIES BETWEEN DRAWINGS AND DIVISIONS 2-49 OF THE SPECIFICATIONS, OR WITHIN EITHER DOCUMENT NOT CLARIFIED BY ADDENDUM, THE ARCHITECT WILL DETERMINE WHICH TAKES PRECEDENCE IN ACCORDANCE WITH SECTION 4.2.12

6. ALTERNATES IN THE CONTRACT DOCUMENTS.”

PERIODIC MEETINGS:

ADD THE FOLLOWING SECTION 1.7, AND SUBSEQUENT SECTION 1.7.1:

“REPRESENTATIVES OF THE OWNER, CONTRACTOR AND ARCHITECT SHALL MEET PERIODICALLY AT MUTUALLY AGREED UPON INTERVALS FOR THE PURPOSE OF ESTABLISHING PROCEDURES TO FACILITATE COOPERATION, COMMUNICATION AND TIMELY RESPONSES AMONG THE PARTICIPANTS. BY PARTICIPATING IN THIS ARRANGEMENT, THE PARTIES DO NOT INTEND TO CREATE ADDITIONAL CONTRACTUAL OBLIGATIONS OR MODIFY THE LEGAL RELATIONSHIPS WHICH MAY OTHERWISE EXIST.”

ARTICLE 2- OWNER:

INFORMATION AND SERVICES REQUIRED OF THE OWNER

SUBSECTION 2.2.3 SHALL BE REVISED TO READ AS FOLLOWS:

“ EXCEPT WHERE SPECIFICALLY REQUIRED OF A CONTRACTOR, THE OWNER SHALL FURNISH SURVEYS DESCRIBING THE SITE OF THE PROJECT. THE OWNER MAKES NO REPRESENTATIONS CONCERNING THE ACCURACY OR COMPLETENESS OF THIS SURVEY. SUCH SURVEYS MAY CONTAIN DESCRIPTIONS OF PHYSICAL CHARACTERISTICS, LEGAL LIMITATIONS, UTILITY LOCATIONS, PERMANENT BENCHMARKS, EXISTING STRUCTURES, SLOPES AND CONTOURS, LEGAL DESCRIPTIONS AND OTHER SUCH PERTINENT INFORMATION. SUCH OWNER-FURNISHED SURVEYS MAY BE BOUND WITH THE DRAWINGS OR MAY BE FULLY OR PARTIALLY TRANSCRIBED ON THE PLOT PLAN OR SITE PLAN DRAWING. ANY SUCH SURVEY SHALL NOT BE A PART OF THE CONTRACT DOCUMENTS, BUT WILL BE PROVIDED FOR INFORMATION PURPOSES.”

ADD THE FOLLOWING CLAUSE 2.2.4.1 TO SECTION 2.2.4:

“THE OWNER WILL SELECT THE APPROPRIATE TESTING LABORATORY FOR STRUCTURAL TESTS AND SPECIAL INSPECTIONS AS REQUIRED BY THE APPLICABLE BUILDING CODE.”

DELETE SECTION 2.2.5 AND SUBSTITUTE THE FOLLOWING SECTION 2.2.5:

“THE CONTRACTOR WILL BE FURNISHED, FREE OF CHARGE, ONE ELECTRONIC (PDF FILES) OF DRAWINGS AND PROJECT MANUAL IN ACCORDANCE WITH SECTION 013310. CONTRACTOR AND SUBCONTRACTOR SHALL BE PROVIDED ACCESS TO REQUESTED DOCUMENTS IN ACCORDANCE WITH SECTION 01 3000.”

ARTICLE 3- CONTRACTOR:

REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY

CONTRACTOR:

CHANGE SECTION 3.2.2 AS FOLLOWS:

“IN THE SECOND SENTENCE CHANGE THE PHRASE 'REQUEST FOR INFORMATION' TO “REQUEST FOR INTERPRETATION”.

CHANGE SECTION 3.2.3 AS FOLLOWS:

IN THE FIRST SENTENCE CHANGE THE PHRASE 'REQUEST FOR INFORMATION' TO “REQUEST FOR INTERPRETATION”.

ADD THE FOLLOWING SUBSECTION 3.2.5 TO SECTION 3.2:

"THE OWNER SHALL BE ENTITLED TO DEDUCT FROM THE CONTRACT SUM AMOUNTS PAID TO THE ARCHITECT FOR THE ARCHITECT TO EVALUATE AND RESPOND TO THE CONTRACTOR'S REQUESTS FOR INTERPRETATION WHERE SUCH INFORMATION WAS AVAILABLE TO THE CONTRACTOR FROM A CAREFUL STUDY AND COMPARISON TO THE CONTRACT DOCUMENTS, FIELD CONDITIONS, OTHER OWNER-PROVIDED INFORMATION, CONTRACTOR-PREPARED COORDINATION DRAWINGS, OR PRIOR PROJECT CORRESPONDENCE OR DOCUMENTATION."

ADD THE FOLLOWING SECTION 3.2.6 TO SECTION 3.2:

" 3.2.6: THE CONTRACTOR SHALL PERFORM THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS AND SUBMITTALS APPROVED PURSUANT TO SECTION 3.1.2."

LABOR AND MATERIALS:

DELETE SECTION 3.4.2 AND SUBSTITUTE THE FOLLOWING SECTION 3.4.2 TO SECTION 3.4:

"AFTER THE CONTRACT HAS BEEN EXECUTED, THE OWNER AND ARCHITECT WILL CONSIDER A FORMAL REQUEST FOR THE SUBSTITUTION OF PRODUCTS IN PLACE OF THOSE SPECIFIED ONLY UNDER THE CONDITIONS SET FORTH IN THE DIVISION 1 OF THE SPECIFICATIONS".

FOR SUBSTITUTIONS, THE CONTRACTOR:

REPRESENTS THAT THE CONTRACTOR OR SUB-CONTRACTOR HAS PERSONALLY INVESTIGATED THE SUBSTITUTE PRODUCT AND DETERMINED THAT IT IS EQUAL OR SUPERIOR IN ALL RESPECTS TO THAT SPECIFIED.

REPRESENTS THAT THE CONTRACTOR OR SUB-CONTRACTOR WILL PROVIDE THE SAME WARRANTY FOR THE SUBSTITUTION THAT THE CONTRACTOR WOULD FOR THAT SPECIFIED;

CERTIFIES THAT THE COST DATA PRESENTED IS COMPLETE AND INCLUDES ALL RELATED COSTS UNDER THIS CONTRACT EXCEPT THE ARCHITECT'S REDESIGN COSTS, AND WAIVES ALL CLAIMS FOR ADDITIONAL COSTS RELATED TO THE SUBSTITUTION WHICH SUBSEQUENTLY BECOME APPARENT; AND WILL COORDINATE THE INSTALLATION OF THE ACCEPTED SUBSTITUTE, MAKING SUCH CHANGES AS MAY BE REQUIRED FOR THE WORK TO BE COMPLETE IN ALL RESPECTS."

ADD THE FOLLOWING SUBSECTION 3.4.4 TO SECTION 3.4:

TAXES:

ADD THE FOLLOWING SECTION 3.6.1 TO SECTION 3.6:

"THE CONTRACTOR ASSUMES FULL RESPONSIBILITY FOR THE PAYMENT OF ALL CONTRIBUTIONS AND PAYROLL TAXES (STATE AND FEDERAL) AS TO ALL SUBCONTRACTORS AND EMPLOYEES ENGAGED IN THE PERFORMANCE OF WORK PURSUANT HERETO, AND FURTHER AGREES TO CHECK AND MEET ALL REQUIREMENTS THAT MIGHT BE SPECIFIED UNDER REGULATIONS OF THE ADMINISTRATIVE OFFICIAL OR BOARD CHARGED WITH THE ENFORCEMENT OF ANY STATE OR FEDERAL ACT ON THE SUBJECT REFERRED TO. CONTRACTOR AGREES TO FURNISH THE OWNER, UPON REQUEST, A CERTIFICATE OR OTHER EVIDENCE OF COMPLIANCE THEREWITH."

PERMITS, FEES AND NOTICES:

ADD THE FOLLOWING TO SECTION 3.7.2:

ADD THE FOLLOWING TO SECTION 3.7.3:

ALLOWANCES:

DELETE THE PERIOD AT THE END OF CLAUSE 3.8.2.3 AND ADD THE FOLLOWING:

"EXCEPT THAT IF THE INSTALLATION IS INCLUDED AS PART OF AN ALLOWANCE IN DIVISIONS 1-49 OF THE SPECIFICATIONS, THE INSTALLATION AND LABOR COST FOR GREATER OR LESSER QUANTITIES OF WORK SHALL BE DETERMINED IN ACCORDANCE WITH SECTION 7.3.7."

ADD THE FOLLOWING SUBSECTION 3.9.4 TO SECTION 3.9:

"THE CONTRACTOR SHALL EMPLOY A FULL TIME SUPERINTENDENT OR AN ASSISTANT TO THE SUPERINTENDENT WHO WILL PERFORM AS A COORDINATOR FOR MECHANICAL AND ELECTRICAL. THE COORDINATOR SHALL BE KNOWLEDGEABLE IN MECHANICAL AND ELECTRICAL SYSTEMS AND CAPABLE OF READING, INTERPRETING AND COORDINATING DRAWINGS, SPECIFICATIONS, AND SHOP DRAWINGS PERTAINING TO SUCH SYSTEMS. THE COORDINATOR SHALL ASSIST THE SUBCONTRACTORS IN ARRANGING SPACE CONDITIONS TO ELIMINATE INTERFERENCE BETWEEN THE MECHANICAL AND ELECTRICAL SYSTEMS AND OTHER WORK AND SHALL SUPERVISE THE PREPARATION OF COORDINATION DRAWINGS DOCUMENTING THE SPATIAL ARRANGEMENTS FOR SUCH SYSTEMS WITHIN RESTRICTED SPACES. THE COORDINATOR SHALL ASSIST IN PLANNING AND EXPEDITING THE PROPER SEQUENCE OF DELIVERY OF MECHANICAL AND ELECTRICAL EQUIPMENT TO THE SITE."

CONTRACTOR'S CONSTRUCTION SCHEDULES:

ADD THE FOLLOWING SECTION 3.10.4 TO SECTION 3.10:

"NOTHING OF THE REQUIREMENT TO SUBMIT CONSTRUCTION SCHEDULES, OR TO REVISE SUCH SCHEDULES OR ANY REVIEW OF SUCH SCHEDULES BY THE OWNER OR ARCHITECT, SHALL GIVE RISE TO A DUTY, OBLIGATION, OR RESPONSIBILITY OF THE OWNER OR ARCHITECT TO THE CONTRACTOR, SUBCONTRACTOR, MATERIAL SUPPLIER OR ANY OTHER ENTITY INVOLVED IN THE WORK TO ENSURE COMPLETION OF THE WORK WITHIN THE CONTRACT TIME. IT IS THE SOLE DUTY, RESPONSIBILITY, AND OBLIGATION OF THE CONTRACTOR TO COMPLETE THE WORK WITHIN THE CONTRACT TIME."

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

ADD THE FOLLOWING SENTENCE TO SECTION 3.12.5:

"SUBMITTALS WHICH ARE NOT MARKED AS REVIEWED FOR COMPLIANCE WITH THE CONTRACT DOCUMENTS AND APPROVED BY THE CONTRACTOR MAY BE RETURNED BY THE ARCHITECT WITHOUT ACTION."

ADD THE FOLLOWING SENTENCE TO SUBSECTION 3.12.9:

"SPECIFIC ATTENTION IN WRITING SHALL BE DEFINED AS A LETTER SUBMITTED WITH THE SHOP DRAWINGS, PRODUCT DATA, SAMPLE OR SIMILAR SUBMITTAL WHICH SHALL CONTAIN THE FOLLOWING PHRASE: "YOUR ATTENTION IS DIRECTED TO THE FOLLOWING REVISIONS WHICH ARE IN ADDITION TO THOSE REVISIONS THAT YOU REQUESTED", FOLLOWED BY A DETAILED WRITTEN LISTING OF ALL SUCH REVISIONS."

ADD SECTION 3.12.11 TO SECTION 3.12:

"THE ARCHITECT'S REVIEW OF CONTRACTOR'S SUBMITTALS WILL BE LIMITED TO EXAMINATION OF AN INITIAL SUBMITTAL AND ONE (1) RE-SUBMITTAL. THE ARCHITECT'S REVIEW OF ADDITIONAL SUBMITTALS WILL BE MADE ONLY WITH THE CONSENT OF THE OWNER AFTER NOTIFICATION BY THE ARCHITECT. THE OWNER SHALL BE ENTITLED TO DEDUCT FROM THE CONTRACT SUM AMOUNTS PAID TO THE ARCHITECT FOR EVALUATION OF SUCH ADDITIONAL RE-SUBMITTALS."

INDEMNIFICATION:

MODIFY SECTION 3.18.1 AS FOLLOWS:

"TO THE FULLEST EXTENT PERMITTED BY LAW, THE CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS THE OWNER, ARCHITECT, AND THEIR CONSULTANTS, AGENTS AND EMPLOYEES OF ANY OF THEM, FROM AND AGAINST ALL CLAIMS, DAMAGES, LOSSES AND EXPENSES, INCLUDING, BUT NOT LIMITED TO, ATTORNEYS' FEES, ARISING OUT OF OR RESULTING FROM THE PERFORMANCE OR NON-PERFORMANCE OF THE WORK, TO THE EXTENT CAUSED IN WHOLE OR IN PART BY THE NEGLIGENT ACTS OR OMISSIONS, OR FAILURE TO FOLLOW THE CONTRACT DOCUMENTS, OF THE CONTRACTOR, A SUBCONTRACTOR, ANYONE DIRECTLY OR INDIRECTLY EMPLOYED BY THEM, OR ANYONE FOR WHOSE ACTS MAY BE LIABLE, REGARDLESS OF WHETHER OR NOT SUCH CLAIM, DAMAGE, LOSS OR EXPENSE IS CAUSED IN PART BY ANY PARTY INDEMNIFIED HEREUNDER. SUCH OBLIGATION SHALL NOT BE CONSTRUED TO NEGATE, ABRIDGE, OR REDUCE OTHER RIGHTS OR OBLIGATIONS OF INDEMNITY WHICH WOULD OTHERWISE EXIST TO A PARTY OR PERSON DESCRIBED IN THIS PARAGRAPH. IN ADDITION TO OTHER REMEDIES, THE OWNER IS ENTITLED TO WITHHOLD PAYMENTS DUE UNDER THIS CONTRACT TO REIMBURSE THE PARTIES INDEMNIFIED UNDER THIS SECTION."

ARTICLE 4- ARCHITECT:

ADMINISTRATION OF THE CONTRACT

DELETE SECTION 4.2.1 AND SUBSTITUTE THE FOLLOWING MODIFIED SECTION 4.2.1 TO SECTION 4.2:

"THE ARCHITECT WILL PROVIDE ADMINISTRATION OF THE CONTRACT AS DESCRIBED IN THE CONTRACT DOCUMENTS, AND WILL BE THE OWNER'S REPRESENTATIVES (1) DURING CONSTRUCTION, (2) UNTIL FINAL PAYMENT IS DUE AND (3) WITH THE OWNER'S CONCURRENCE FROM TIME TO TIME DURING THE CORRECTION PERIOD DESCRIBED IN SECTION 12.2. THE ARCHITECT WILL ADVISE AND CONSULT WITH THE OWNER AND WILL HAVE AUTHORITY TO ACT ON BEHALF OF THE OWNER ONLY TO THE EXTENT PROVIDED IN THE CONTRACT DOCUMENTS UNLESS OTHERWISE MODIFIED BY WRITTEN INSTRUMENT IN ACCORDANCE WITH OTHER PROVISIONS OF THE CONTRACT."

ADD THE FOLLOWING CLAUSE 4.2.2.1 TO SUBSECTION 4.2.2:

"THE CONTRACTOR SHALL REIMBURSE THE OWNER FOR COMPENSATION PAID TO THE ARCHITECT FOR ADDITIONAL SITE VISITS MADE NECESSARY BY THE FAULT, NEGLIGENCE OR REQUEST OF THE CONTRACTOR."

DELETE SUBSECTION 4.2.4 AND SUBSTITUTE THE FOLLOWING NEW SUBSECTION 4.2.4 TO SECTION 4.2:

"THE CONTRACTOR WILL DETERMINE IN GENERAL THAT THE WORK IS BEING PERFORMED IN ACCORDANCE WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, WILL KEEP THE OWNER INFORMED OF THE PROGRESS OF THE WORK AND WILL ENDEAVOR TO GUARD THE OWNER AGAINST DEFECTS AND DEFICIENCIES IN THE WORK."

ARTICLE 5- SUBCONTRACTORS

AWARD OF SUBCONTRACTS & OTHER CONTRACTS FOR PORTIONS OF THE WORK:

DELETE SECTION 5.2.3 AND SUBSTITUTE THE FOLLOWING MODIFIED SECTION 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 SHALL BE INCREASED OR DECREASED BY THE DIFFERENCE IN COST OCCASIONED BY SUCH CHANGE AND AN APPROPRIATE CHANGE ORDER SHALL 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."

DELETE SECTION 5.2.4 AND SUBSTITUTE THE FOLLOWING MODIFIED SECTION 5.2.4:"THE CONTRACTOR SHALL NOT CHANGE A SUBCONTRACTOR, PERSON OR ENTITY PREVIOUSLY SELECTED IF THE OWNER OR ARCHITECT MAKES REASONABLE OBJECTION TO SUCH CHANGE."

CONTINGENT ASSIGNMENT OF SUB-CONTRACTS:

DELETE SECTION 5.4.2 AND SUBSTITUTE THE FOLLOWING MODIFIED SECTION 5.4.2:

"IF THE WORK HAS BEEN SUSPENDED FOR MORE THAN THIRTY (30) DAYS, THE SUBCONTRACTOR'S COMPENSATION SHALL BE EQUITABLY ADJUSTED TO REFLECT THE WORK COMPLETED BY EACH SUBCONTRACTOR."

ARTICLE 6 – CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

ADD NEW SUBSECTION 6.2.6 IMMEDIATELY FOLLOWING SUBSECTION 6.2.5 TO READ AS FOLLOWS:

"SHOULD A CLAIM AGAINST THE OWNER BE FILED BY A SEPARATE CONTRACTOR ALLEGING DAMAGE CAUSED BY THE CONTRACTOR, THE OWNER SHALL NOTIFY THE CONTRACTOR OF SUCH CLAIM. THE CONTRACTOR SHALL DEFEND THE OWNER IN ALL CLAIM PROCEEDINGS AT THE CONTRACTOR'S EXPENSE. SHOULD AN AWARD OR JUDGMENT AGAINST THE OWNER BE SECURED BY THE SEPARATE CONTRACTOR, THE CONTRACTOR SHALL PAY OR SATISFY SAID AWARD OR JUDGMENT AND SHALL REIMBURSE THE OWNER FOR ALL ATTORNEY'S FEES, COURT COSTS, AND ALL OTHER COSTS OR EXPENSES WHICH THE OWNER HAS INCURRED."

ARTICLE 7 – CHANGES IN THE WORK:

MODIFY SUBSECTION 7.3.7 AS FOLLOWS: DELETE THE PHRASE "IN CASE OF AN INCREASE IN THE CONTRACTSUM" FROM THE FIRST SENTENCE

MODIFY SUBSECTION 7.3.8 TO READ AS FOLLOWS:

"THE AMOUNT OF CREDIT OR ADDITION FOR A CHANGE WHICH RESULTS IN A NET INCREASE OR DECREASE IN THE CONTRACT SUM SHALL BE ACTUAL NET COST AS CONFIRMED BY THE ARCHITECT TO INCLUDE A REASONABLE CORRESPONDING ADJUSTMENT FOR OVERHEAD AND PROFIT. WHEN BOTH ADDITIONS AND CREDITS ARE INVOLVED IN A CHANGE, THE OVERHEAD AND NET PROFIT ALLOWANCE SHALL BE CALCULATED ON THE BASIS OF THE NET CHANGE."

ADD NEW SUBSECTION 7.3.11 IMMEDIATELY FOLLOWING SUBSECTION 7.3.10; TO READ AS FOLLOWS:

"7.3.11 PRIOR TO FINAL PAYMENT, ALL CONSTRUCTION CHANGE DIRECTIVES ISSUED DURING THE PROGRESS OF THE WORK SHALL BE CONVERTED IN CHANGE ORDERS AND SIGNED BY THE CONTRACTOR, ARCHITECT AND OWNER. SHOULD THE PARTIES FAIL TO AGREE WITH THE DETERMINATION MADE BY THE ARCHITECT CONCERNING ADJUSTMENTS IN THE CONTRACT SUM AND THE CONTRACT TIME, OR OTHERWISE FAIL TO REACH AGREEMENTS UPON THE ADJUSTMENTS, THAT PORTION OF THE FINAL PAYMENT WHICH IS AFFECTED BY THE DISPUTE, IF ANY, SHALL BE WITHHELD PENDING FINAL JUDGMENT ISSUED BY A COURT OF COMPETENT JURISDICTION."

ADD NEW SECTION, 7.5 EXPEDITING CHANGES IN THE WORK, IMMEDIATELY FOLLOWING SECTION 7.4 TO READ AS FOLLOWS:

"7.5 EXPEDITING CHANGES IN THE WORK:

THE CONTRACTOR SHALL NOT PROCEED WITH CHANGES IN THE WORK AUTHORIZED UNDER PARAGRAPHS 7.2 OR 7.3 UNTIL RECEIPT OF THE APPROPRIATE SIGNED DOCUMENTS."

ARTICLE 8 – TIME:

DELETE SUBSECTION 8.2.1 AND SUBSTITUTE THE FOLLOWING NEW SUBSECTION 8.2.1:

"TIME LIMITS AND TIME FOR PERFORMANCE AS STATED IN THE CONTRACT

DOCUMENTS ARE THE ESSENCE OF THE CONTRACT. HOWEVER, IF THE LAST DAY TO PERFORM, FALLS ON A HOLIDAY, SATURDAY OR SUNDAY, THE TIME TO ACT WILL BE EXTENDED TO THE NEXT BUSINESS DAY. BY EXECUTING THE AGREEMENT, THE CONTRACTOR CONFIRMS THAT THE CONTRACT TIME IS REASONABLE PERIOD FOR PERFORMING SUCH WORK, INCLUDING DELAYS CAUSED BY ANTICIPATED ADVERSE WEATHER DAYS."

DELAYS AND EXTENSIONS OF TIME:

DELETE SECTION 8.3.1 AND SUBSTITUTE THE FOLLOWING NEW SECTION 8.3.1:

"8.3.1: IF THE CONTRACTOR IS DELAYED AT ANY TIME IN PROGRESS OF THE WORK BY AN ACT OR NEGLECT OF THE OWNER, ARCHITECT, ANY OF THE OTHER CONTRACTORS OR ANY EMPLOYEE OF ANY OF THEM, OR BY CHANGES ORDERED IN THE WORK, OR BY LABOR DISPUTES, FIRE, UNUSUAL DELAY IN DELIVERIES, UNAVOIDABLE CASUALTIES, OR OTHER CAUSES BEYOND THE CONTRACTOR'S CONTROL, OR BY DELAY AUTHORIZED BY THE OWNER PENDING RESOLUTION OF CLAIMS, OR BY OTHER CAUSES WHICH THE ARCHITECT DETERMINES MAY JUSTIFY DELAY, THEN THE CONTRACT TIME MAY BE EXTENDED BY CHANGE ORDER FOR SUCH REASONABLE TIME AS THE ARCHITECT MAY DETERMINE. ARCHITECT SHALL NOTIFY OWNER OF ALL DELAYS IN PROGRESS. IF ANY DELAY WILL CAUSE THE POSTPONEMENT OF OCCUPANCY OF THE FACILITY, ARCHITECT SHALL NOTIFY OWNER IN ADVANCE OF AUTHORIZING SUCH DELAY, AND CONTRACTOR, ARCHITECT AND OWNER SHALL MEET TO DETERMINE ALTERNATIVES TO AVOID DELAY IN OPENING THE FACILITY."

ARTICLE 9 – PAYMENTS AND COMPLETION:

SCHEDULE OF VALUES:

ADD THE SECTION NUMBER 9.2.1.1 AT THE BEGINNING OF THE FIRST SENTENCE OF SECTION 9.2 AND ADD THE FOLLOWING CLAUSE 9.2.1 TO SECTION 9.2.1:

"9.2.1.1: THE SCHEDULE OF VALUES SHALL BE SUFFICIENT OF DETAIL TO PERMIT THE OWNER REASONABLE ACCURATE VERIFICATION OF COMPLETION; DIVIDING LARGE DIVISIONS OF THE WORK AND GROUPING SMALL DIVISIONS OF THE WORK BY SEQUENCED EVENTS IN DELIVERY OF PRODUCTS TO THE SITE AND EXECUTION OF THE WORK."

APPLICATIONS FOR PAYMENT

ADD THE FOLLOWING SENTENCE TO SECTION 9.3.1

"THE FORM OF APPLICATION FOR PAYMENT, DULY NOTARIZED, SHALL BE A CURRENT AUTHORIZED EDITION OF AIA DOCUMENT G702 TM APPLICATION AND CERTIFICATE FOR PAYMENT, SUPPORTED BY A CURRENT AUTHORIZED EDITION OF AIA DOCUMENT G703TM, CONTINUATIONSHEET."

ADD NEW CLAUSE 9.3.1.3 IMMEDIATELY FOLLOWING CLAUSE 9.3.1.2, TO READ AS FOLLOWS:

"9.3.1.3 THE OWNER SHALL PAY NINETY FIVE PERCENT (95%) OF THE AMOUNT DUE THE CONTRACTOR ON ACCOUNT OF PROGRESS PAYMENTS FOR THE FIRST 50% OF THE CONTRACT AMOUNT. HENCEFORTH 97.5% OF THE CONTRACT AMOUNT. THE REMAINING TWO AND ONE HALF PERCENT (2.5%) SHALL CONSTITUTE "RETAINAGE." UPON FINAL COMPLETION, IN ACCORDANCE WITH STATE STATUTES THE OWNER SHALL PAY THE BALANCE OF THE RETAINAGE TO THE CONTRACTOR.

ADD NEW CLAUSE 9.3.2.1 IMMEDIATELY FOLLOWING SUBSECTION 9.3.2 TO READ AS FOLLOWS:

"9.3.2.1. ACCOMPANYING EACH APPLICATION AND CERTIFICATE FOR PAYMENT UPON WHICH THE CONTRACTOR APPLIES FOR PAYMENT FOR MATERIALS NOT YET INCORPORATED INTO THE WORK, THE CONTRACTOR SHALL INCLUDE A STATEMENT AS FOLLOWS: "AT TIME OF PAYMENT, FOR VALUE RECEIVED, THE CONTRACTOR AND APPLICABLE SUBCONTRACTORS AND MATERIAL SUPPLIERS JOINTLY AND SEVERALLY HEREBY SELL, ASSIGN OR TRANSFER UNTO THE OWNER THE PROPERTY DESCRIBED AS STORED MATERIALS IN THIS APPLICATION AND CERTIFICATE FOR PAYMENT AND DO HEREBY WARRANT THE TITLE TO SAID PROPERTY, AND DO HEREBY CERTIFY THAT SAID PROPERTY IS FREE OF ALL LIENS AND ENCUMBRANCES." SHOULD THIS STATEMENT NOT BE INCLUDED WITH THE APPLICATION AND CERTIFICATE FOR PAYMENT, IT IS INCLUDED BY REFERENCE WITH THE SAME FORCE AND EFFECT AS IF IT HAD BEEN WRITTEN THEREON."

CERTIFICATES FOR PAYMENT

DELETE SECTION 9.4.1 AND SUBSTITUTE THE FOLLOWING SECTION 9.4.1:

"9.4.1. THE GENERAL CONTRACTOR WILL ASSEMBLE A PROJECT APPLICATION FOR PAYMENT BY COMBINING THE GENERAL CONTRACTOR'S APPLICATIONS WITH SIMILAR APPLICATIONS FOR PROGRESS PAYMENTS FROM SUB CONTRACTORS AND AFTER CERTIFYING THE AMOUNTS DUE ON SUCH APPLICATIONS, FORWARD THEM TO THE ARCHITECT WITHIN SEVEN DAYS. THE OWNER RESERVES THE RIGHT TO DISAPPROVE ANY CERTIFICATE FOR PAYMENT IF OWNER HAS REJECTED THE WORK FOR WHICH THE CERTIFICATE FOR PAYMENT REPRESENTS, IN WHOLE OR IN PART. OWNER IS REQUIRED TO APPROVE ALL CERTIFICATES FOR PAYMENT PRIOR TO PAYMENT OF SAME."

DECISIONS TO WITHHOLD CERTIFICATION:

ADD THE FOLLOWING SENTENCE TO SECTION 9.5.1:

"THE FOREGOING IS SUBJECT TO THE RIGHTS OF THE OWNER TO APPROVE PAYMENTS TO GENERAL CONTRACTOR AS PROVIDED ELSEWHERE IN THIS AGREEMENT AND THE ARCHITECTURAL SERVICES AGREEMENT."

PROGRESS PAYMENTS:

ADD THE FOLLOWING PHRASE TO 9.6.4:

"BUT THE OWNER MAY MAKE DIRECT PAYMENTS TO SUBCONTRACTORS IF DEEMED APPROPRIATE BY OWNER TO PROTECT THE WORK AND OWNER'S INTERESTS.

DELETE SECTION 9.9.2 AND SUBSTITUTE THE FOLLOWING MODIFIED SECTION 9.9.2:

"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."

FINAL COMPLETION AND FINAL PAYMENT:

ARTICLE 10 – PROTECTION OF PERSONS AND PROPERTY

SAFETY OF PERSONS AND PROPERTY

ADD THE FOLLOWING CLAUSE 10.2.4.1 TO SECTION 10.2.4:

"10.2.4.1 WHEN USE OR STORAGE OF EXPLOSIVES OR OTHER HAZARDOUS MATERIALS, SUBSTANCES OR EQUIPMENT, OR UNUSUAL METHODS ARE NECESSARY FOR EXECUTION OF THE WORK, THE CONTRACTOR SHALL GIVE THE OWNER REASONABLE ADVANCE NOTICE."

ADD THE FOLLOWING CLAUSE 10.2.4.2 TO SECTION 10.2.4:

"10.4.4.2 IF THE CONTRACT DOCUMENTS REQUIRE THE CONTRACTOR TO HANDLE MATERIALS OR SUBSTANCES THAT UNDER CERTAIN CIRCUMSTANCES MAY BE DESIGNED AS HAZARDOUS, THE CONTRACTOR SHALL HANDLE SUCH MATERIALS IN AN APPROPRIATE MANNER AND IN ACCORDANCE WITH APPLICABLE STATE AND FEDERAL REGULATIONS."

ADD THE FOLLOWING PROVISIONS TO SECTION 10.2.5:

"THE EXCEPTION FOUND WITHIN THE PARENTHESES IN LINES ONE AND TWO OF THE SUBPARAGRAPH SHALL NOT APPLY TO DAMAGE AND LOSS CAUSED BY CONTRACTOR, ITS OWNERS, OFFICERS, DIRECTORS, AGENTS OR EMPLOYEES. OWNER MAY DEDUCT OR WITHHOLD FROM ANY PAYMENT TO THE CONTRACTOR UNDER THE CONTRACT DOCUMENTS FOR CONTRACTOR'S FAILURE, OR ANTICIPATED INABILITY TO REMEDY ANY SUCH DAMAGE OR LOSS. THE FACT THAT SUCH DAMAGE OR LOSS MAY HAVE OCCURRED PRIOR TO A PAYMENT, WHICH WAS NOT DIMINISHED BY OWNER, SHALL NOT BE CONSIDERED A WAIVER OF OWNER'S RIGHT TO DEDUCT OR WITHHOLD PAYMENT FOR DAMAGE OR LOSS FROM ANY SUBSEQUENT PAYMENT."

EMERGENCIES:

DELETE SECTION 10.4 AND SUBSTITUTE THE FOLLOWING MODIFIED SECTION 10.4.1:

"10.4.1 IN AN EMERGENCY AFFECTING THE SAFETY OF PERSONS OR PROPERTY AT THE WORK SITE OR OFF SITE STORAGE, IF ANY, THE CONTRACTOR SHALL TAKE WHATEVER STEPS THE CONTRACTOR REASONABLY BELIEVES UNDER THE CIRCUMSTANCES WILL PREVENT OR LESSEN SUCH ANTICIPATED DAMAGE, INJURY OR LOSS. CONTRACTOR SHALL ACT WITH REASONABLE CARE IN LIGHT OF ALL THE CIRCUMSTANCES EXISTING AT THE TIME OF THE EMERGENCY. ADDITIONAL COMPENSATION OR EXTENSION OF TIME CLAIMED BY THE CONTRACTOR ON ACCOUNT OF AN EMERGENCY SHALL BE DETERMINED AS PROVIDED IN ARTICLE 7."

ARTICLE 11 – INSURANCE AND BONDS:

CONTRACTOR'S LIABILITY INSURANCE:

DELETE SECTION 11.1.2 AND SUBSTITUTE THE FOLLOWING MODIFIED SECTION 11.1.2 ALONG WITH THE FOLLOWING CLAUSES 1 THROUGH 9:

THE CONTRACTOR SHALL MAINTAIN SUCH INSURANCE, WHICH SHALL PROTECT HIM, THE OWNER AND THE ARCHITECT FROM CLAIMS UNDER:

WORKER'S COMPENSATION

STATUTORY LIMITS

COMPREHENSIVE GENERAL LIABILITY

\$1,000,000 GENERAL AGGREGATE

\$1,000,000 PRODUCTS- COMP/OP AGG

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**\$ 500,000 PERSONAL & ADV INJURY
\$ 500,000 EACH OCCURRENCE
\$ 50,000 FIRE DAMAGE
\$ 5,000 MED EXP
\$1,000,000 COMBINED SINGLE LIMIT**

COMPREHENSIVE AUTOMOBILE LIABILITY \$1,000,000 COMBINED SINGLE LIMIT (ANY AUTO)

THE POLICY MUST INCLUDE ALL OWNED, NON-OWNED AND HIRED VEHICLE AND EQUIPMENT EXPOSURE.

COMPLETED OPERATIONS LIABILITY: COVERAGE FOR HEREIN BEFORE SPECIFIED INSURANCE SHALL REMAIN IN FORCE FOR A PERIOD OF ONE YEAR AFTER COMPLETION AND ACCEPTANCE OF THE WORK.

CONTRACTOR AND SUBCONTRACTOR'S INSURANCE MUST PROVIDE BLANKET CONTRACTUAL INSURANCE, PERSONAL INJURY INSURANCE; PROVIDE COVERAGE FOR EXPLOSION, COLLAPSE AND UNDERGROUND DAMAGE. IN ADDITION, THIRTY (30) DAYS NOTICE OF CANCELLATION MUST BE GIVEN TO THE OWNER AND ARCHITECT FOR ALL INSURANCE COVERAGE. ALL CERTIFICATES OF INSURANCE MUST INDICATE THE NATURE AND EXTENT OF COVERAGE. CONTRACTOR SHALL PROVIDE COPIES OF ALL CERTIFICATES OF INSURANCE FOR ITSELF AND ITS SUBCONTRACTORS TO THE ARCHITECT BEFORE WORK IS COMMENCED BY THAT ENTITY. THE CONTRACTOR SHALL EITHER: (1) REQUIRE EACH OF HIS SUBCONTRACTORS TO PROCURE AND MAINTAIN DURING THE TERM OF THIS SUBCONTRACT, SUBCONTRACTOR'S PUBLIC LIABILITY AND PROPERTY DAMAGE INSURANCE OF THE TYPE AND AMOUNTS AS REQUIRED BY THIS CONTRACT, OR (2) INSURE THE ACTIVITIES OF HIS SUBCONTRACTORS IN HIS OWN POLICY. IF ANY SUBCONTRACTOR DOES NOT CARRY ALL FORMS OF INSURANCE LISTED OR COVERAGE IN THE AMOUNTS DESIGNATED, CONTRACTOR SHALL INFORM THE ARCHITECT. OWNER MAY MODIFY THESE REQUIREMENTS FOR SUBCONTRACTORS ON A CASE-BY-CASE BASIS."

PROPERTY INSURANCE:

ADD THE FOLLOWING SENTENCE TO SECTION 11.3.1.1:

"THE FORM OF POLICY SHALL BE 'COMPLETED VALUE'."

DELETE CLAUSE 11.3.1.3 AND IN ITS PLACE, THE FOLLOWING SENTENCE SHALL BE SUBSTITUTED:

"THE CONTRACTOR SHALL PAY ALL COSTS NOT COVERED UNDER THE PROPERTY INSURANCE POLICIES BECAUSE OF DEDUCTIBLES IDENTIFIED IN THE CONTRACT DOCUMENTS."

DELETE SECTION 11.3.3 AND SUBSTITUTE THE FOLLOWING MODIFIED SECTION 11.3.3:

"CONTRACTOR IS RESPONSIBLE FOR AND MAY OBTAIN INSURANCE TO COVER ANY LOSS OF USE INCURRED BY OWNER AS A RESULT OF CONTRACTOR NOT TIMELY COMPLETING THE WORK. SUCH LOSS MAY INCLUDE, BUT IS NOT LIMITED TO, THE COST OF RENTAL OF SUBSTITUTE FACILITIES."

DELETE SECTION 11.3.5

DELETE SECTION 11.3.6

PERFORMANCE BOND AND PAYMENT BOND:

DELETE SECTION 11.4.1 AND SUBSTITUTE THE FOLLOWING MODIFIED SECTION 11.4.1:

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"THE CONTRACTOR SHALL FURNISH BONDS COVERING FAITHFUL PERFORMANCE OF THE CONTRACT AND PAYMENT OF OBLIGATIONS ARISING THEREUNDER AS STIPULATED IN BIDDING REQUIREMENTS, OR SPECIFICALLY REQUIRED IN THE CONTRACT DOCUMENTS ON THE DATE OF THE EXECUTION OF THE CONTRACT IN THE AMOUNT OF THE CONTRACT PRICE."

ARTICLE 12 – UNCOVERING AND CORRECTION OF WORK:

CORRECTION OF WORK:

MODIFY SECTION 12.2.1 AS FOLLOWS:

AT THE END OF THE SECTION ADD THE FOLLOWING STATEMENT: "THE OWNER RESERVES THE RIGHT, IN ADDITION TO OTHER REMEDIES, TO WITHHOLD PAYMENT TO THE CONTRACTOR FOR ANY WORK REJECTED BY THE ARCHITECT OR OWNER FROM ANY PROGRESS OR FINAL PAYMENTS, AND RETAIN SUCH UNTIL THE WORK IS ACCEPTABLE."

MODIFY SECTION 12.2.3 AS FOLLOWS:

AFTER THE WORD "REMOVE" ON THE FIRST LINE OF THE SECTION ADD THE FOLLOWING WORDS "WITHOUT ADDITIONAL COMPENSATION."

DELETE SECTION 12.2.4 AND SUBSTITUTE THE FOLLOWING MODIFIED SECTION 12.2.4:

IF THE CONTRACTOR FAILS TO CORRECT NON-CONFORMING WORK WITHIN A REASONABLE TIME, THE OWNER MAY CORRECT IT IN ACCORDANCE WITH PARAGRAPH 2.4. IF THE CONTRACTOR DOES NOT PROCEED WITH CORRECTION OF SUCH NON-CONFORMING WORK WITHIN A REASONABLE TIME FIXED BY WRITTEN NOTICE FROM THE ARCHITECT, THE OWNER MAY REMOVE THE NON-CONFORMING WORK AND STORE THE SALVAGEABLE MATERIALS OR EQUIPMENT AT THE CONTRACTOR'S EXPENSE, WITHOUT LIABILITY TO CONTRACTOR. IF THE CONTRACTOR DOES NOT PAY COSTS OF SUCH REMOVAL AND STORAGE WITHIN TEN (10) DAYS AFTER WRITTEN NOTICE, THE OWNER MAY, WITHOUT LIABILITY TO THE CONTRACTOR EXCEPT FOR ACCOUNTING FOR THE PROCEEDS THEREOF, DISPOSE OF SUCH EQUIPMENT BY SUCH MEANS AS OWNER DEEMS APPROPRIATE. OWNER SHALL ACCOUNT FOR THE PROCEEDS THEREOF, AND IF AFTER DEDUCTING COSTS AND DAMAGES THAT SHOULD HAVE BEEN BORNE BY THE CONTRACTOR, INCLUDING COMPENSATION FOR THE ARCHITECT'S AND OWNER'S SERVICES AND EXPENSES, INCLUDING ATTORNEY FEES MADE NECESSARY BY CONTRACTOR'S ACTIONS, THE PROCEEDS DO NOT COVER THE COSTS WHICH THE CONTRACTOR SHOULD HAVE BORNE, THE CONTRACT SUM SHALL BE REDUCED BY THE DEFICIENCY. IF THE PAYMENTS THEN AND THEREAFTER DUE THE CONTRACT ARE NOT SUFFICIENT TO COVER SUCH AMOUNT, THE CONTRACTOR SHALL PAY THE DIFFERENCE TO THE OWNER. IN THE EVENT THAT THE PROCEEDS EXCEED THE COSTS, SUCH EXCESS SHALL BE PAID TO THE CONTRACTOR."

ARTICLE 13 – MISCELLANEOUS PROVISIONS:

ADD THE FOLLOWING SUBSECTION 13.1.1:

ALL CONTRACTORS AND SUBCONTRACTORS EMPLOYED UPON THE WORK SHALL CONFORM TO THE LABOR LAWS OF THE STATE IN WHICH THE PROJECT IS LOCATED AND THE VARIOUS ACTS AMENDATORY AND SUPPLEMENTARY THERETO; AND TO ALL OTHER LAWS, ORDINANCES AND LEGAL REQUIREMENTS APPLICABLE THERETO

TESTS AND INSPECTIONS:

ADD THE FOLLOWING SECTION 13.5.7 TO SECTION 13.5:

"UNDER THIS CONTRACT THE PHRASES SUCH AS 'PERSISTENTLY OR REPEATEDLY REFUSES', OR 'REPEATEDLY REFUSES', OR 'REPEATEDLY FAILS' WILL MEAN ON AT LEAST THREE (3) SEPARATE OCCASIONS."

ADD THE FOLLOWING SECTION 13.5.8 TO SECTION 13.5:

"13.5.8 IN THE EVENT THAT THE OWNER IS REQUIRED TO BRING AN ACTION TO ENFORCE ITS RIGHTS UNDER THE CONTRACT DOCUMENTS, OWNER SHALL ALSO BE ENTITLED TO RECOVER ITS COSTS INCLUDING ITS REASONABLE ATTORNEY'S AND ARCHITECT'S FEES."

ARTICLE 14 – TERMINATION OR SUSPENSION OF CONTRACT

TERMINATION BY THE OWNER FOR CAUSE

ADD NEW CLAUSE 14.2.1.5 TO SUBSECTION 14.2.1 IMMEDIATELY FOLLOWING CLAUSE 14.2.1.4 TO READ AS FOLLOWS:

"14.2.1.5 IS ADJUDGED BANKRUPT, OR IF HE MAKES A GENERAL ASSIGNMENT FOR THE BENEFIT OF HIS CREDITORS OR IF A RECEIVER IS APPOINTED ON ACCOUNT OF HIS INSOLVENCY."

ADD THE FOLLOWING SENTENCE TO SECTION 14.2.3: "THE CONTRACTOR IS NOT ENTITLED TO DAMAGES."

ADD THE FOLLOWING PROVISIONS TO SECTION 14.2.4:

"IN REGARD TO REASONS SET FORTH IN SECTION 14.2.1, IF THE COSTS OF FINISHING THE WORK EXCEED THE UNPAID BALANCE, THE CONTRACTOR SHALL PAY THE DIFFERENCE TO THE OWNER. IN THE EVENT THAT THE COSTS OF COMPLETION DO NOT EXCEED THE UNPAID BALANCE, CONTRACTOR SHALL BE PAID ONLY FOR THE WORK COMPLETED AND ACCEPTED BY OWNER AND ARCHITECT."

SUSPENSION BY THE OWNER FOR CONVENIENCE:

ADD THE FOLLOWING SECTION 14.3.3 TO SECTION 14.3:

"14.3.3 CONTRACTOR SHALL BE PAID FOR ALL WORK PERFORMED AT THE TIME NOTICE OF SUSPENSION WAS RECEIVED BY CONTRACTOR."

MODIFY SECTION 14.4.3 AS FOLLOWS:

DELETE THE PHRASE "ALONG WITH REASONABLE OVERHEAD AND PROFIT ON WORK NOT EXECUTED."

ARTICLE 15 – CLAIMS AND DISPUTES:

CLAIMS

ADD THE FOLLOWING CLAUSE 15.1.5.3 TO SECTION 15.1.5:

"15.1.5.3 CLAIMS FOR INCREASE IN THE CONTRACT TIME SHALL SET FORTH IN DETAIL THE CIRCUMSTANCES THAT FORM THE BASIS FOR THE CLAIM, THE DATE UPON WHICH EACH CAUSE OF DELAY BEGAN TO AFFECT THE PROGRESS OF THE WORK, THE DATE UPON WHICH EACH CAUSE OF DELAY CEASED TO AFFECT THE PROGRESS OF THE WORK AND THE NUMBER OF DAYS' INCREASE IN THE CONTRACT TIME CLAIMED AS A CONSEQUENCE OF EACH SUCH CAUSE OF DELAY. THE CONTRACTOR SHALL PROVIDE SUCH SUPPORTING DOCUMENTATION AS THE OWNER MAY REQUIRE INCLUDING, WHERE APPROPRIATE, A REVISED CONSTRUCTION SCHEDULE INDICATING ALL THE ACTIVITIES AFFECTED BY THE CIRCUMSTANCES FORMING THE BASIS OF THE CLAIM."

ADD THE FOLLOWING CLAUSE 15.1.5.4 TO SECTION 15.1.5:

"15.1.5.4 THE CONTRACTOR SHALL NOT BE ENTITLED TO A SEPARATE INCREASE IN THE CONTRACT TIME FOR EACH ONE OF THE NUMBER CAUSES OF DELAY WHICH MAY HAVE CONCURRENT OR INTERRELATED EFFECTS ON THE PROGRESS OF THE WORK, OR FOR CONCURRENT DELAYS DUE TO THE FAULT OF THE CONTRACTOR."

DELETE SECTION 15.1.6 IN ITS ENTIRETY.

**DELETE SUBSECTION 15.2.6, CLAUSE 15.2.6.1, SUBSECTION 15.2.7, SUBSECTION 15.2.8,
SECTION 15.3 MEDIATION, SECTION 15.4 ARBITRATION, AND SUBSECTION 15.4.4
CONSOLIDATION OR JOINDER IN THEIR ENTIRETY.**

END OF SECTION

**SECTION 01 1000
SUMMARY**

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: Evergreen Baptist Church Phase 5
- B. Owner's Name: Evergreen Baptist Church.
- C. The Project consists of the construction of a two story Addition to the existing building..

1.02 CONTRACT DESCRIPTION

- A. Contract Type: A single prime contract based on the cost of the work plus a fixed fee.

1.03 DESCRIPTION OF ALTERATIONS WORK

- A. Scope of demolition and removal work is indicated on drawings and specified in Section 02 4100.
- B. Scope of alterations work is indicated on drawings.

1.04 OWNER OCCUPANCY

- A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
- B. Owner intends to occupy the Project upon Substantial Completion.
- C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- D. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings.
 - 1. Locate and conduct construction activities in ways that will limit disturbance to site.
- B. Arrange use of site and premises to allow:
 - 1. Owner occupancy.
- C. Provide access to and from site as required by law and by Owner:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- D. Existing building spaces may not be used for storage.
- E. Utility Outages and Shutdown:
 - 1. Limit disruption of utility services to hours the building is unoccupied.
 - 2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
 - 3. Prevent accidental disruption of utility services to other facilities.

END OF SECTION

**SECTION 01 2500
SUBSTITUTION PROCEDURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

1.02 DEFINITIONS

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
 - a. Unavailability.
 2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
 - a. Substitution requests offering advantages solely to the Contractor will not be considered.

1.03 REFERENCE STANDARDS

- A. CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage); Current Edition.
- B. CSI/CSC Form 13.1A - Substitution Request (After the Bidding/Negotiating Phase); Current Edition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 2. Agrees to provide the same warranty for the substitution as for the specified product.
 3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
 4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
 5. Waives claims for additional costs or time extension that may subsequently become apparent.
 6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- B. A Substitution Request for specified installer constitutes a representation that the submitter:
1. Has acted in good faith to obtain services of specified installer, but was unable to come to commercial, or other terms.
- C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
- D. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
1. Forms indicated in the Project Manual are adequate for this purpose, and must be used.
- E. Limit each request to a single proposed substitution item.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

- A. Requests for substitution will be received up to seven days prior to bid opening. Requests received after that date will be returned without action.
- B. Submittal Form (before award of contract):
 - 1. Submit substitution requests by completing CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage). See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Submittal Form (after award of contract):
 - 1. Submit substitution requests by completing CSI/CSC Form 13.1A - Substitution Request. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.
- B. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
- C. Substitutions will not be considered under one or more of the following circumstances:
 - 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
 - 2. Without a separate written request.
 - 3. When acceptance will require revisions to Contract Documents.

3.04 RESOLUTION

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.

3.05 ACCEPTANCE

- A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

END OF SECTION

**SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Electronic document submittal service.
- C. Preconstruction meeting.
- D. Site mobilization meeting.
- E. Progress meetings.
- F. Construction progress schedule.
- G. Coordination drawings.
- H. Submittals for review, information, and project closeout.
- I. Requests for Interpretation (RFI) procedures.
- J. Submittal procedures.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements: General product requirements.
- B. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.
- C. Section 01 7800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 REFERENCE STANDARDS

- A. AIA G716 - Request for Information; 2004.
- B. AIA G810 - Transmittal Letter; 2001.
- C. CSI/CSC Form 12.1A - Submittal Transmittal; Current Edition.
- D. CSI/CSC Form 13.2A - Request for Information; Current Edition.

1.04 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 01 7000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect:
 - 1. Requests for Interpretation (RFI).
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. Applications for payment and change order requests.
 - 8. Progress schedules.
 - 9. Correction Punch List and Final Correction Punch List for Substantial Completion.
 - 10. Closeout submittals.

1.05 PROJECT COORDINATOR

- A. Project Coordinator: Construction Manager.

- B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for designated access, traffic, and parking facilities.
- C. During construction, coordinate use of site and facilities through the Project Coordinator.
- D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01 1000 - Summary.
- F. Coordinate field engineering and layout work under instructions of the Project Coordinator.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
 - 1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
 - 2. Contractor and Architect are required to use this service.
 - 3. It is Contractor's responsibility to submit documents in allowable format.
 - 4. Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no extra charge.
 - 5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
 - 6. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
- B. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 PRECONSTRUCTION MEETING

- A. Schedule meeting after Notice of Award.
- B. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Contractor.
- C. Agenda:
 - 1. Distribution of Contract Documents.
 - 2. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 - 3. Designation of personnel representing the parties to Contract, _____ and <1|A/E|>.

4. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 5. Scheduling.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 SITE MOBILIZATION MEETING

- A. Project Coordinator will schedule meeting at the Project site prior to Contractor occupancy.
- B. Attendance Required:
1. Contractor.
 2. Owner.
 3. Architect.
 4. Special consultants.
 5. Contractor's superintendent.
 6. Major subcontractors.
- C. Agenda:
1. Use of premises by Owner and Contractor.
 2. Owner's requirements.
 3. Survey and building layout.
 4. Security and housekeeping procedures.
 5. Schedules.
 6. Application for payment procedures.
 7. Procedures for testing.
 8. Procedures for maintaining record documents.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at maximum weekly intervals or as agreed during construction.
- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required:
1. Contractor.
 2. Owner.
 3. Architect.
 4. Contractor's superintendent.
- D. Agenda:
1. Review minutes of previous meetings.
 2. Review of work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems that impede, or will impede, planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Review of RFIs log and status of responses.
 7. Maintenance of progress schedule.
 8. Planned progress during succeeding work period.
 9. Effect of proposed changes on progress schedule and coordination.
 10. Other business relating to work.

- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.05 REQUESTS FOR INTERPRETATION (RFI)

- A. Definition: A request seeking one of the following:
 - 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in the Contract Documents.
 - 2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of the Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
 - 1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.
 - 2. Prepare using software provided by the Electronic Document Submittal Service.
- C. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
 - 1. Unacceptable Uses for RFIs: Do not use RFIs to request the following:
 - a. Approval of submittals (use procedures specified elsewhere in this section).
 - b. Approval of substitutions (see Section - 01 6000 - Product Requirements)
 - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
 - d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
 - 2. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
 - 3. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, the Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
- D. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- E. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 - 1. Indicate current status of every RFI. Update log promptly and on a regular basis.
 - 2. Note dates of when each request is made, and when a response is received.
 - 3. Highlight items requiring priority or expedited response.
 - 4. Highlight items for which a timely response has not been received to date.
- F. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
 - 1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- G. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to

lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.

1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
2. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
3. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.06 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in the contract documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.07 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 1. Design data.
 2. Certificates.
 3. Test reports.
 4. Inspection reports.
 5. Manufacturer's instructions.
 6. Manufacturer's field reports.
 7. Other types indicated.

3.08 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:
 1. Project record documents.
 2. Operation and maintenance data.
 3. Warranties.
 4. Bonds.
 5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

3.09 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

- B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.

3.10 SUBMITTAL PROCEDURES

- A. General Requirements:
1. Use a separate transmittal for each item.
 2. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
 3. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 4. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 5. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
 6. Provide space for Contractor and Architect review stamps.
 7. When revised for resubmission, identify all changes made since previous submission.
 8. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
 9. Submittals not requested will not be recognized or processed.
- B. Product Data Procedures:
1. Submit only information required by individual specification sections.
 2. Collect required information into a single submittal.
 3. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related work.
 2. Do not reproduce the Contract Documents to create shop drawings.
 3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
1. Transmit related items together as single package.
 2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

3.11 SUBMITTAL REVIEW

- A. Submittals for Review: Architect will review each submittal and denote appropriate action.
- B. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.
- C. Architect's actions on items submitted for review:
1. "Reviewed-No exceptions taken".
 2. "Reviewed-Note exceptions taken".
 3. "Reviewed-Resubmit".
 4. "Reviewed-Rejected".
 5. "Not reviewed".
 - a. Not Authorizing fabrication, delivery, and installation:

- D. Architect's and consultants' actions on items submitted for information:
1. Items for which no action was taken:
 - a. "Received" - to notify the Contractor that the submittal has been received for record only.
 2. Items for which action was taken:
 - a. ""Reviewed Only"" - no further action is required from Contractor.

END OF SECTION

**SECTION 01 3320
ELECTRONIC DATA WAIVER, RELEASE AND INDEMNITY AGREEMENT**

Evergreen Baptist Church
Phase 5
Broken Arrow, Oklahoma
March 3, 2025

ELECTRONIC DATA WAIVER,
RELEASE AND INDEMNITY
AGREEMENT
01 3320
1
Construction Documents

Reed Architecture and Interiors
18 East Hobson Avenue
Sapulpa, Oklahoma

THE USE OF THE REQUESTED ELECTRONIC DATA IS RESTRICTED TO THIS SPECIFIC PROJECT AND CONTAINS INTELLECTUAL PROPERTY THAT IS SOLELY OWNED BY REED ARCHITECTURE AND INTERIORS LLC. ANY ELECTRONIC FILES THAT ARE PROVIDED BY REED ARCHITECTS AND INTERIORS, LLC ARE ONLY FOR THE SPECIFIC USE THAT IS IDENTIFIED WITHIN THIS REQUEST FORM BY THE USER.

WHEREAS, REED ARCHITECTURE AND INTERIORS, LLC, HEREAFTER "ARCHITECT" HAS UTILIZED CERTAIN ELECTRONIC COMPUTER AIDED DRAFTING(CAD) FILES AND BUILDING INFORMATION MODELING (BIM) FILES IN PREPARATION OF DRAWINGS FOR SPECIFIC PROJECTS, AND WHEREAS, THE USER DESIRES TO OBTAIN COPIES OF THE ARCHITECT'S CAD AND/OR BIM FILES CONSISTING OF ATTACHED COMPRESSED FILES HEREINAFTER, "ELECTRONIC DATA", AND WHEREAS, ARCHITECT IS THE SOLE OWNER OF SAID ELECTRONIC DATA AND IS WILLING TO PROVIDE COPIES FOR THE CONVENIENCE OF THE REQUESTING "USER" ONLY UNDER CERTAIN EXPRESS CONDITIONS OF UNDERSTANDING, ACKNOWLEDGMENT AND COVENANTS OF PROTECTION, WHICH THE USER ACCEPTS WITHOUT RESERVATION AND COVENANTS AS HEREINAFTER PROVIDED WITHOUT QUALIFICATION.

NOW THEREFORE, ARCHITECT AND THE USER AGREE AS FOLLOWS:

ACKNOWLEDGMENT AND LIMITATIONS:

IT IS ACKNOWLEDGED THAT

(1) ARCHITECT'S INSTRUMENTS OF PROFESSIONAL SERVICES ARE THE HARD COPY DRAWINGS AND SPECIFICATIONS ISSUED AND SEALED BY ARCHITECT, HEREINAFTER "INSTRUMENTS,"

(2) THE ELECTRONIC DATA ARE NOT SUBSTITUTIONS FOR SAID INSTRUMENTS,

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BUILDING INFORMATION MODELING (BIM):

Evergreen Baptist Church
Phase 5
Broken Arrow, Oklahoma
March 3, 2025

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IT IS EXPRESSLY UNDERSTOOD THAT THE BIM FILES ARE BEING ISSUED ONLY AS SUPPLEMENTAL INFORMATION FOR CONVENIENCE TO THE CONTRACTOR. BIM FILES, LIKE ANY ELECTRONIC DATA, TRANSFERRED IN ANY MANNER OR TRANSLATED FROM THE SYSTEM AND FORMAT USED BY ALL OF THE DESIGN PROFESSIONALS ON THIS PROJECT ("DESIGN TEAM") TO ANOTHER SYSTEM OR FORMAT ARE SUBJECT TO ERRORS AND MODIFICATIONS THAT MAY AFFECT THE ACCURACY AND RELIABILITY OF THE DATA, AND, IN ADDITION, THAT ELECTRONIC DATA MAY BE ALTERED OR CORRUPTED WHETHER INADVERTENTLY OR OTHERWISE. AS A RESULT, NO REPRESENTATIONS OR WARRANTIES, WHETHER EXPRESSED OR IMPLIED, AS TO THE ACCURACY OF THE BIM FILES TRANSFERRED ARE MADE HEREIN. AS THE ACCURACY OF THE BIM FILES CANNOT BE WARRANTED OR GUARANTEED, IT IS ISSUED AS SUPPLEMENTAL INFORMATION ONLY AND MUST BE READ IN CONJUNCTION THE CONTRACT DOCUMENTS, AND THE TO THE EXTENT THERE ARE ANY DISCREPANCIES BETWEEN THE BIM FILES AND THE CONTRACT DOCUMENTS, THE PHYSICAL CONTRACT DOCUMENTS MUST BE RELIED UPON.

BY SIGNING THE RELEASE BELOW YOU ARE ACKNOWLEDGING THAT:

- 1) ("OWNER") AND THE DESIGN TEAM SHALL BE HELD HARMLESS FROM ANY AND ALL CLAIMS, LIABILITIES, DAMAGES, LOSSES, OR EXPENSES ARISING OUT THE CONTRACTOR'S USE OF THE BIM FILES AND CANNOT BE HELD RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WITHIN THE BIM FILES,
- 2) THE BIM FILES ARE TO BE READ IN CONJUNCTION WITH ALL CONSTRUCTION DOCUMENTS, ADDENDA AND SUPPLEMENTAL CONTRACT DOCUMENTS, AND
- 3) THE BIM FILES ARE NOT TO BE USED FOR FABRICATION OR CONSTRUCTION OF ANY KIND.

WAIVER AND RELEASE:

THE USER ACCEPTS ALL RISK OF INCOMPLETE, INACCURATE, DEFECTIVE AND VARIANT INFORMATION CONTAINED IN THE ELECTRONIC DATA, AND WAIVES, QUILTS, AND FOREVER DISCHARGES AND RELEASES ARCHITECT AND THEIR OFFICERS, DIRECTORS, EMPLOYEES AND SUCCESSORS FROM EVERY CLAIM ARISING OUT OF OR RELATED TO ANY ERROR, DISCREPANCY, INACCURACY, VARIATION OR OTHER DEFECT IN THE ELECTRONIC DATA, WHETHER OR NOT RESULTING IN WHOLE OR IN PART FROM AN ACT, ERROR OR OMISSION OF ARCHITECT AND WHETHER OR NOT SUCH CLAIM IS KNOWN OR UNKNOWN AS OF THE DATE OF THIS WAIVER AND RELEASE.

REUSE:

THE ELECTRONIC DATA IS NOT SUITABLE FOR REUSE IN ANY WAY, WITHOUT COMPLETE VERIFICATION BY AN APPROPRIATE ARCHITECT ON ANY PROJECT, INCLUDING WITHOUT LIMITATION, ADDITIONS OR EXTENSIONS OF THE PROJECTS IDENTIFIED TO THE ELECTRONIC DATA. ARCHITECT DOES NOT AUTHORIZE RELEASE OF THE ELECTRONIC DATA TO ANY PERSON OR PARTY, AND THE USER AGREES AND COVENANTS NOT TO RELEASE THE ELECTRONIC DATA TO ANY OTHER PARTY. ANY SUCH RELEASE SHALL CONSTITUTE A BREACH OF THIS AGREEMENT AND ARCHITECT WILL AT SUCH TIME DEMAND RETURN OF ITS PROPERTY AND MAY SEEK LEGAL RECOURSE AND THE COST OF REASONABLE FEES.

INDEMNIFICATION:

Evergreen Baptist Church
Phase 5
Broken Arrow, Oklahoma
March 3, 2025

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FEES:

FOR EACH REQUEST OF CAD FILE TRANSFERS THERE IS AN ASSOCIATED FIXED FEE OF \$125.00 (ONE HUNDRED TWENTY-FIVE DOLLARS).

FOR EACH REQUEST FOR A BIM MODEL TRANSFER THERE IS AN ASSOCIATED FIXED FEE OF \$250.00 (TWO HUNDRED FIFTY DOLLARS).

DISPUTES:

USER SHALL ATTACH A WRITTEN DESCRIPTION OF THIS AGREEMENT OUTLINING THE DATA REQUESTED INCLUDING SUCH INFORMATION AS SHEET NUMBER AND SHEET TITLE, AND A DESCRIPTION OF THE INTENDED USE OF THE DATA.

USER'S ACCEPTANCE OF THESE TERMS, WHICH IS COMMUNICATED BY SIGNATURE OF THIS AGREEMENT, CONSTITUTES A WAIVER OF LIABILITY AND THE ACCEPTANCE OF RESPONSIBILITIES FOR THE COORDINATION OF ANY REVISIONS MADE TO THE INFORMATION TRANSMITTED. ACCEPTANCE OF THESE TERMS MAY HAVE LEGAL IMPLICATIONS AND SHOULD BE REVIEWED WITH USER'S LEGAL COUNSEL. ELECTRONIC DATA WILL NOT BE PROVIDED UNTIL ARCHITECT HAS RECEIVED A SIGNED ORIGINAL OF THIS AGREEMENT AND THE ASSOCIATED FIXED FEE.

SIGNATURE

DATE _____

END OF SECTION

Evergreen Baptist Church
Phase 5
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ELECTRONIC DATA WAIVER,
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**SECTION 01 4000
QUALITY REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submittals.
- B. Quality assurance.
- C. References and standards.
- D. Testing and inspection agencies and services.
- E. Control of installation.
- F. Mock-ups.
- G. Defect Assessment.

1.02 RELATED REQUIREMENTS

- A. Document 00 3100 - Available Project Information: Soil investigation data.
- B. Document 00 7200 - General Conditions: Inspections and approvals required by public authorities.
- C. Section 01 3000 - Administrative Requirements: Submittal procedures.

1.03 REFERENCE STANDARDS

- A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2023).
- B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2024.
- C. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2023.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents, or for Owner's information.
- C. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Compliance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.
 - 2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept

expressed in the contract documents, or for Owner's information.

- D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
 - 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
 - 1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.

1.06 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- E. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.07 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. As indicated in individual specification sections, Owner or Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

- A. Construct stand alone mock ups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Exterior Product Systems Mock-ups: Construct stand alone mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
- D. Room Mock-ups: Construct room mock-ups as indicated on drawings. Coordinate installation of materials, products, and assemblies as required in specification sections; finish according to requirements. Provide required lighting and any supplemental lighting where required to enable Architect to evaluate quality of the mock-up.
- E. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be constructed.
- F. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- G. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- H. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- I. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
- J. Accepted mock-ups shall be a comparison standard for the remaining Work.
- K. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.
- L. Where possible salvage and recycle the demolished mock-up materials.

3.03 TESTING AND INSPECTION

- A. See individual specification sections for testing and inspection required.
- B. Testing Agency Duties:
 - 1. Test samples of mixes submitted by Contractor.
 - 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified standards.
 - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
 - 6. Perform additional tests and inspections required by Architect.
 - 7. Submit reports of all tests/inspections specified.

- C. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 - 3. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 - 4. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 - 5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.04 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.

END OF SECTION

SECTION 01 4533
CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Code-required special inspections.
- B. Testing services incidental to special inspections.
- C. Submittals.
- D. Manufacturers' field services.
- E. Fabricators' field services.

1.02 RELATED REQUIREMENTS

- A. Document 00 7200 - General Conditions: Inspections and approvals required by public authorities.
- B. Section 01 3000 - Administrative Requirements: Submittal procedures.
- C. Section 01 4000 - Quality Requirements.
- D. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.03 ABBREVIATIONS AND ACRONYMS

- A. AHJ: Authority having jurisdiction.
- B. IAS: International Accreditation Service, Inc.
- C. NIST: National Institute of Standards and Technology.

1.04 DEFINITIONS

- A. Code or Building Code: ICC (IBC) 2018, Edition of the International Building Code and specifically, Chapter 17 - Special Inspections and Tests.
- B. Authority Having Jurisdiction (AHJ): Agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located.
- C. Special Inspection:
 - 1. Special inspections are inspections and testing of materials, installation, fabrication, erection or placement of components and connections mandated by the AHJ that also require special expertise to ensure compliance with the approved Contract Documents and the referenced standards.
 - 2. Special inspections are separate from and independent of tests and inspections conducted by Owner or Contractor for the purposes of quality assurance and contract administration.

1.05 REFERENCE STANDARDS

- A. ACI 318 - Building Code Requirements for Structural Concrete; 2019 (Reapproved 2022).
- B. AISC 341 - Seismic Provisions for Structural Steel Buildings; 2022.
- C. AISC 360 - Specification for Structural Steel Buildings; 2022.
- D. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

Evergreen Baptist Church
Phase 5
Broken Arrow, Oklahoma
March 3, 2025

Code-Required Special
Inspections and Procedures
01 4533
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- F. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2024.
- G. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete; 2017.
- H. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.
- I. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2023.
- J. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2021.
- K. ASTM E605/E605M - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 2019 (Reapproved 2023).
- L. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2019 (Reapproved 2023).
- M. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems; 2020a.
- N. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2020a.
- O. ASTM E2570/E2570M - Standard Test Methods for Evaluating Water-Resistive Barrier (WRB) Coatings Used Under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage; 2007 (Reapproved 2019).
- P. AWCI 117 - Technical Manual 12-B; Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire-Resistive Materials; an Annotated Guide; 2014.
- Q. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- R. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).
- S. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars; 2018, with Amendment (2020).
- T. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2021.
- U. IAS AC291 - Accreditation Criteria for Special Inspection Agencies AC291; 2019.
- V. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- W. ICC (IBC)-2015 - International Building Code; 2015.
- X. SDI (QA/QC) - Standard for Quality Control and Quality Assurance for Installation of Steel Deck; 2017.
- Y. SJI 100 - Standard Specifications for K-Series, LH-Series, and DLH-Series Open Web Steel Joists, and for Joist Girders; 2020.
- Z. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

1.06 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency is required to:
 - 1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of

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- remedies of any deficiencies reported by the inspection.
3. Submit certification that Special Inspection Agency is acceptable to AHJ.
 4. Submit documentation that Special Inspection Agency is accredited by IAS according to IAS AC291.
- C. Manufacturer's Qualification Statement: Manufacturer is required to submit documentation of manufacturing capability and quality control procedures.
- D. Fabricator's Qualification Statement: Fabricator is required to submit documentation of fabrication facilities and methods as well as quality control procedures.
- E. Special Inspection Reports: After each special inspection, Special Inspector is required to promptly submit at least two copies of report; one to Architect and one to the AHJ.
1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of Special Inspector.
 - d. Date and time of special inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of special inspection.
 - h. Date of special inspection.
 - i. Results of special inspection.
 - j. Compliance with Contract Documents.
 2. Final Special Inspection Report: Document special inspections and correction of discrepancies prior to the start of the work.
- F. Fabricator Special Inspection Reports: After each special inspection of fabricated items at the Fabricator's facility, Special Inspector is required to promptly submit at least two copies of report; one to Architect and one to AHJ.
1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of Special Inspector.
 - d. Date and time of special inspection.
 - e. Identification of fabricated item and specification section.
 - f. Location in the Project.
 - g. Results of special inspection.
 - h. Verification of fabrication and quality control procedures.
 - i. Compliance with Contract Documents.
 - j. Compliance with referenced standard(s).
- G. Test Reports: After each test or inspection, promptly submit at least four copies of report; one to Architect, one to contractor, one to owner and one to AHJ.
1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test or inspection.
 - h. Date of test or inspection.

- i. Results of test or inspection.
 - j. Compliance with Contract Documents.
- H. Certificates: When specified in individual special inspection requirements, Special Inspector shall submit certification by the manufacturer, fabricator, and installation subcontractor to Architect and AHJ, in quantities specified for Product Data.
 - 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect and AHJ.

1.07 SPECIAL INSPECTION AGENCY

- A. Owner or Contractor will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by the building code.
- B. The Special Inspection Agency may employ and pay for services of an independent testing agency to perform testing and sampling associated with special inspections and required by the building code.
- C. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.08 TESTING AND INSPECTION AGENCIES

- A. Owner may employ services of an independent testing agency to perform additional testing and sampling associated with special inspections but not required by the building code.
- B. Employment of agency in no way relieves Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.09 QUALITY ASSURANCE

- A. Special Inspection Agency Qualifications:
 - 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
 - 2. Accredited by IAS according to IAS AC291.
- B. Testing Agency Qualifications:
 - 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
 - 2. Accredited by IAS according to IAS AC89.
- C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SCHEDULE OF SPECIAL INSPECTIONS, GENERAL

- A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
 - 1. Continuous Special Inspection: Special Inspection Agency is required to be present in the area where the work is being performed and observe the work at all times the work is in progress.
 - 2. Periodic Special Inspection: Special Inspection Agency is required to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

3.02 SPECIAL INSPECTIONS FOR STEEL CONSTRUCTION

- A. Structural Steel: Comply with quality assurance inspection requirements of ICC (IBC).
- B. Cold-Formed Steel Deck: Comply with quality assurance inspection requirements of SDI (QA/QC).
- C. Open-Web Joists and Joist Girders: Comply with requirements of ICC (IBC), Table 1705.2.3.
 - 1. End Connections - Welding or Bolted: Comply with requirements of SJI 100; periodic.
 - 2. Bridging - Horizontal or Diagonal:
 - a. Standard Bridging: Comply with requirements of SJI 100; periodic.
 - b. Bridging That Differs From the SJI Specifications: Periodic inspection.
- D. Cold-Formed Steel Trusses Spanning 60 feet or Greater: Special Inspector is required to verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

3.03 SPECIAL INSPECTIONS FOR CONCRETE CONSTRUCTION

- A. Reinforcing Steel, Including Prestressing of Tendons and Placement: Verify compliance with approved Contract Documents and ACI 318, Sections 3.5 and 7.1 through 7.7; periodic.
- B. Reinforcing Bar Welding: Verify compliance with AWS D1.4/D1.4M and ACI 318, 26.6.4; periodic.
 - 1. Inspect all other welds; continuous.
- C. Bolts Installed in Concrete: Where allowable loads have been increased or where strength design is used, verify compliance with approved Contract Documents and ACI 318, Sections 8.1.3 and 21.2.8 prior to and during placement of concrete; continuous.
- D. Anchors Post-Installed in Hardened Concrete: Verify compliance with ACI 318.
 - 1. Adhesive Anchors: Verify horizontally or upwardly-inclined orientation installations resisting sustained tension loads - Section 17.8.2.4; continuous.
- E. Design Mix: Verify plastic concrete complies with the design mix in approved Contract Documents and with ACI 318, Chapter 19, 16.4.3, 26.4.4; periodic.
- F. Design Mix: Verify plastic concrete complies with the design mix in approved Contract Documents and with ACI 318, Chapter 4 and 5.2; periodic.
- G. Concrete Sampling Concurrent with Strength Test Sampling: Each time fresh concrete is sampled for strength tests, verify compliance with ASTM C172/C172M, ASTM C31/C31M and ACI 318, Chapter 26.5, 26.12, and record the following, continuous:
 - 1. Slump.
 - 2. Air content.
 - 3. Temperature of concrete.
- H. Specified Curing Temperature and Techniques: Verify compliance with approved Contract Documents and ACI 318, Sections 5.11 through 5.13; periodic.
- I. Precast Concrete Members: Verify erection techniques and placement comply with approved Contract Documents and ACI 318, Chapter 26.9; periodic.
- J. Precast Concrete Members: Verify erection techniques and placement comply with approved Contract Documents and ACI 318, Chapter 16; periodic.
- K. Formwork Shape, Location and Dimensions: Verify compliance with approved Contract Documents and ACI 318, Chapter 26.11.1.2(b); periodic.
- L. Formwork Shape, Location and Dimensions: Verify compliance with approved Contract Documents and ACI 318, Section 6.1.1; periodic.

- M. Welding of Reinforcing Bars: Conduct special inspections and verify Special Inspector's qualifications in accordance with requirements of AWS D1.4/D1.4M.
- N. Materials: If the Contractor cannot provide sufficient data or documentary evidence that concrete materials comply with the quality standards of ACI 318, the AHJ will require testing of materials in accordance with the appropriate standards and criteria in ACI 318, Chapters 19 and 20.

3.04 SPECIAL INSPECTIONS FOR MASONRY CONSTRUCTION

- A. Masonry Structures Subject to Special Inspection:
 - 1. Empirically designed masonry and masonry veneer in structures designated as "essential facilities".
 - a. Perform inspections in accordance with Level B Quality Assurance.
 - 2. Engineered masonry in structures classified as "low hazard..." and "substantial hazard to human life in the event of failure".
- B. Verify each item below complies with approved Contract Documents and the applicable articles of TMS 402/602.
 - 1. Inspections and Approvals:
 - a. Verify compliance with the required inspection provisions of the approved Contract Documents; periodic.
 - b. Verify approval of submittals required by Contract Documents; periodic.
 - 2. Compressive Strength of Masonry: Verify compressive strength of masonry units prior to start of construction unless specifically exempted by code; periodic.
 - 3. Slump Flow and Visual Stability Index (VSI): Verify compliance as self consolidating grout arrives on site; continuous.
 - 4. Joints and Accessories: When masonry construction begins, verify:
 - a. Proportions of site prepared mortar; periodic.
 - b. Construction of mortar joints; periodic.
 - c. Location of reinforcement, connectors, prestressing tendons, anchorages, etc; periodic.
 - 5. Structural Elements, Joints, Anchors, Protection: During masonry construction, verify:
 - a. Size and location of structural elements; periodic.
 - b. Type, size and location of anchors, including anchorage of masonry to structural members, frames or other construction; periodic.
 - c. Size, grade and type of reinforcement, anchor bolts and prestressing tendons and anchorages; periodic.
 - d. Welding of reinforcing bars; continuous.
 - 6. Grouting Preparation: Prior to grouting, verify:
 - a. Grout space is clean; periodic.
 - b. Correct placement of reinforcing, connectors, prestressing tendons and anchorages; periodic.
 - c. Correctly proportioned site prepared grouts and prestressing grout for bonded tendons; periodic.
 - d. Correctly constructed mortar joints; periodic.
 - 7. Preparation of Grout Specimens, Mortar Specimens and Prisms: Observe preparation of specimens; periodic.

3.05 SPECIAL INSPECTIONS FOR SOILS

- A. Materials and Placement: Verify each item below complies with approved construction documents and approved geotechnical report.
 - 1. Design bearing capacity of material below shallow foundations; periodic.

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2. Design depth of excavations and suitability of material at bottom of excavations; periodic.
 3. Materials, densities, lift thicknesses; placement and compaction of backfill: continuous.
 4. Subgrade, prior to placement of compacted fill verify proper preparation; periodic.
- B. Testing: Classify and test excavated material; periodic.

3.06 SPECIAL INSPECTIONS FOR SPRAYED FIRE RESISTANT MATERIALS

- A. Sprayed Fire Resistant Materials, General:
1. Verify compliance of sprayed-fire resistant materials with specific fire-rated assemblies indicated in approved Contract Documents, and with applicable requirements of the building code.
 2. Perform special inspections after rough installation of electrical, mechanical, plumbing, automatic fire sprinkler and suspension systems for ceilings.
- B. Physical and visual tests: Verify compliance with fire resistance rating.
1. Condition of substrates; periodic.
 2. Thickness of sprayed fire resistant material; periodic.
 3. Density of sprayed fire resistant material in pounds per cubic foot; periodic.
 4. Bond strength (adhesion and cohesion); periodic.
 5. Condition of finished application; periodic.
- C. Structural member surface conditions:
1. Inspect structural member surfaces before application of sprayed fire resistant materials; periodic.
 2. Verify preparation of structural member surfaces complies with approved Contract Documents and manufacturer's written instructions; periodic.
- D. Application:
1. Ensure minimum ambient temperature before and after application complies with the manufacturer's written instructions; periodic.
 2. Verify area where sprayed fire resistant material is applied is ventilated as required by the manufacturer's written instructions during and after application; periodic.
- E. Thickness: Verify that no more than 10 percent of thickness measurements taken from sprayed fire resistant material are less than thickness required by fire resistance design in approved Contract Documents. In no case shall the thickness of the sprayed fire resistant material be less than the minimum below.
1. Minimum Allowable Thickness: Tested according to ASTM E605/E605M, periodic.
 - a. Design thickness 1 inch or greater: Design thickness minus 1/4 inch.
 - b. Design thickness greater than 1 inch: Design thickness minus 25 percent.
 2. Floor, Roof and Wall Assemblies: Test thickness according to ASTM E605/E605M with no less than four measurements per 1,000 square feet of sprayed area on each story of the structure or portion thereof; periodic.
 - a. Fluted Decks: Measure thickness within a single 12 inch by 12 inch area. Make a minimum of four measurements arranged symmetrically in testing area and include one example each of valley, crest and sides. Report the average of the four measurements.
 3. Structural Members: Test according to ASTM E605/E605M. Test no less than 25 percent of structural members on each story of the structure or portion thereof; periodic.
- F. Density: Verify density of sprayed fire resistant material is no less than density required by the fire resistance design in the approved Contract Documents.
- G. Bond Strength: Verify adhesive and cohesive bond strength of sprayed fire resistant materials is no less than 150 pounds per square foot when in-place samples of the cured material are

tested according to ASTM E736/E736M and as described below.

1. Primer, paint and encapsulant bond tests: When sprayed fire resistant material is applied to a primed, painted or encapsulated surface for which acceptable material to substrate performance has not been determined, conduct bond test.

3.07 SPECIAL INSPECTIONS FOR MASTIC AND INTUMESCENT FIRE RESISTANT COATINGS

- A. Verify mastic and intumescent fire resistant coatings comply with AWCI 117, AWCI 12-B and the fire resistance rating indicated on approved Contract Documents.

3.08 SPECIAL INSPECTIONS FOR FIRE RESISTANT PENETRATIONS AND JOINTS

- A. Inspections of penetration firestop systems and fire resistant joint systems in accordance with ICC Section 7 in general and Section 714.3.1.2 and 714.4.2 specifically and in compliance with ASTM E2174 and ASTM E2393.

3.09 SPECIAL INSPECTIONS FOR FIRE RESISTANT PENETRATIONS AND JOINTS

- A. Verify penetration firestops in accordance with ASTM E2174.
- B. Verify fire resistant joints in accordance with ASTM E2393.

3.10 SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE

- A. Seismic Force-Resisting Systems: Comply with the quality assurance plan requirements of AISC 341.
- B. Cold Formed Steel Light Frame Construction:
 1. Field welding; periodic.
 2. Screw attachment, bolting, anchoring and other fastening of components within the main seismic force-resisting system; periodic.
- C. Architectural Components: Erection and fastening of components below; periodic.
 1. Exterior cladding.
 2. Interior and exterior veneer.
 3. Interior and exterior non-loadbearing walls and partitions.
- D. Mechanical and Electrical Components:
 1. Anchorage of electric equipment required for emergency or standby power systems; periodic.
 2. Installation and anchorage of other electrical equipment; periodic.
- E. Designated Seismic System Verification: Verify label, anchorage or mounting complies with certificate of compliance provided by manufacturer or fabricator.
- F. Structural Observations for Seismic Resistance: Visually observe structural system for general compliance with the approved Contract Documents; periodic.

3.11 SPECIAL INSPECTIONS FOR WIND RESISTANCE

- A. Cold-Formed Steel Light Frame Construction:
 1. Field welding; periodic.
 2. Screw attachment, bolting, anchoring and other fastening of components within the main wind force-resisting system; periodic
- B. Wind Resisting Components:
 1. Roof covering, roof deck, and floor framing connections; periodic.
 2. Exterior wall covering and wall connections to roof and floor diaphragms and framing; periodic.
- C. Structural Observations for Wind Resistance: Visually observe structural system for general compliance with the approved Contract Documents; periodic.

3.12 OTHER SPECIAL INSPECTIONS

- A. Provide for special inspection of work that is required by AHJ.
- B. Alternative Test Procedures: Where approved rules and standards do not exist, test materials and assemblies as required by AHJ or provide AHJ with documentation of quality and manner in which those materials and assemblies are used.

3.13 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

- A. Special Inspection Agency shall:
 - 1. Verify samples submitted by Contractor comply with the referenced standards and the approved Contract Documents.
 - 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified reference standards.
 - 4. Ascertain compliance of materials and products with requirements of Contract Documents.
 - 5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
 - 6. Perform additional tests and inspections required by Architect.
 - 7. Submit reports of all tests or inspections specified.
- B. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- C. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.14 TESTING AGENCY DUTIES AND RESPONSIBILITIES

- A. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests or inspections specified.
- B. Limits on Testing or Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the work.
- C. On instructions by Architect, perform re-testing required because of non-compliance with specified requirements, using the same agency.
- D. Contractor will pay for re-testing required because of non-compliance with specified requirements.

3.15 CONTRACTOR DUTIES AND RESPONSIBILITIES

- A. Contractor Responsibilities, General:

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1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
 2. Cooperate with agency and laboratory personnel; provide access to approved documents at project site and to the work.
 3. Provide incidental labor and facilities:
 - a. To provide access to work to be tested or inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
 - c. To facilitate tests or inspections.
 - d. To provide storage and curing of test samples.
 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
 5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- B. Contractor Responsibilities, Seismic Force-Resisting System, Designated Seismic System, and Seismic Force-Resisting Component: Submit written statement of responsibility for each item listed in the Statement of Special Inspections to AHJ and Owner prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.
- C. Contractor Responsibilities, Wind Force-Resisting System and Wind Force-Resisting Component: Submit written statement of responsibility for each item listed in the Statement of Special Inspections to AHJ and Owner prior to starting work. Statement of responsibility shall acknowledge awareness of special construction requirements and other requirements listed.

3.16 MANUFACTURERS' AND FABRICATORS' FIELD SERVICES

- A. When specified in individual specification sections, require material suppliers, assembly fabricators, or product manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, to test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

END OF SECTION

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Dewatering
- B. Temporary utilities.
- C. Temporary telecommunications services.
- D. Temporary sanitary facilities.
- E. Temporary Controls: Barriers, enclosures, and fencing.
- F. Security requirements.
- G. Vehicular access and parking.
- H. Waste removal facilities and services.
- I. Project identification sign.
- J. Field offices.

1.02 DEWATERING

- A. Provide temporary means and methods for dewatering all temporary facilities and controls.

1.03 TEMPORARY UTILITIES

- A. Owner will provide the following:
 - 1. Electrical power and metering, consisting of connection to existing facilities.
 - 2. Water supply, consisting of connection to existing facilities.
- B. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
- C. Existing facilities may not be used.

1.04 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
 - 1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
 - 2. Internet Connections: Minimum of one; DSL modem or faster.
 - 3. Email: Account/address reserved for project use.
 - 4. Facsimile Service: Minimum of one dedicated fax machine/printer, with dedicated phone line.

1.05 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.

1.06 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

- B. Provide barricades and walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Provide protection for plants designated to remain. Replace damaged plants.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 FENCING

1.08 EXTERIOR ENCLOSURES

- A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.09 INTERIOR ENCLOSURES

- A. Provide temporary partitions as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
- B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.10 SECURITY

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.
- B. Coordinate with Owner's security program.

1.11 VEHICULAR ACCESS AND PARKING

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.12 WASTE REMOVAL

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site periodically.
- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.13 PROJECT IDENTIFICATION

- A. Provide project identification sign of design and construction indicated on drawings.
- B. Erect on site at location indicated.
- C. No other signs are allowed without Owner permission except those required by law.

1.14 FIELD OFFICES

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.
- B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
- C. Locate offices a minimum distance of 30 feet from existing and new structures.

1.15 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore existing facilities used during construction to original condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 6000
PRODUCT REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary:
- B. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- C. Section 01 4000 - Quality Requirements: Product quality monitoring.

1.03 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.
- B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.
- C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

2.02 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by the Contract Documents.
- B. See Section 01 4000 - Quality Requirements, for additional source quality control requirements.
- C. Where other criteria are met, Contractor shall give preference to products that:
 - 1. If used on interior, have lower emissions.

2.03 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

- A. See Section 01 2500 - Substitution Procedures.

3.02 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

3.03 STORAGE AND PROTECTION

- A. Provide protection of stored materials and products against theft, casualty, or deterioration.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- E. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- F. Do not store products directly on the ground.
- G. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- H. Prevent contact with material that may cause corrosion, discoloration, or staining.

END OF SECTION

**SECTION 01 7000
EXECUTION AND CLOSEOUT REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Requirements for alterations work, including selective demolition.
- B. Pre-installation meetings.
- C. Starting of systems and equipment.
- D. Demonstration and instruction of Owner personnel.
- E. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- F. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.
- B. Section 01 4000 - Quality Requirements: Testing and inspection procedures.
- C. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures.
- D. Section 01 5000 - Temporary Facilities and Controls: Temporary interior partitions.
- E. Section 01 5100 - Temporary Utilities: Temporary heating, cooling, and ventilating facilities.
- F. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.
- G. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

1.03 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

1.04 QUALIFICATIONS

- A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

1.05 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- C. Perform dewatering activities, as required, for the duration of the project.
- D. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
 - 1. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.

- E. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
- F. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

1.06 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS NOT USED.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Notify Architect four days in advance of meeting date.

3.04 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Contractor shall locate and protect survey control and reference points.
- D. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- E. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:

3.05 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
 - 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
 - 2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
- D. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings.
 - 2. Relocate items indicated on drawings.
 - 3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 - 4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 - 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
 - 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - b. See Section 01 1000 for other limitations on outages and required notifications.
 - c. Provide temporary connections as required to maintain existing systems in service.
 - 4. Verify that abandoned services serve only abandoned facilities.
 - 5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- F. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
- G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
 - 1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
- H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- I. Refinish existing surfaces as indicated:
 - 1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
 - 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- J. Clean existing systems and equipment.
- K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- L. Do not begin new construction in alterations areas before demolition is complete.
- M. Comply with all other applicable requirements of this section.

3.07 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.08 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Prohibit traffic from landscaped areas.
- H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.09 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect and Owner seven days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable Contractor personnel in accordance with manufacturers' instructions.
- G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

3.11 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.12 FINAL CLEANING

- A. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- B. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

- C. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- D. Clean filters of operating equipment.
- E. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems, and elsewhere as required..
- F. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Architect and Owner.
- B. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
- C. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- D. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- E. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- F. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.14 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

END OF SECTION

**SECTION 01 7800
CLOSEOUT SUBMITTALS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
 - 2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 3. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Product substitutions or alternates utilized.

2. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 1. Field changes of dimension and detail.
 2. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

3.03 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 1. Description of unit or system, and component parts.
 2. Identify function, normal operating characteristics, and limiting conditions.
 3. Complete nomenclature and model number of replaceable parts.
- B. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- C. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- D. Provide servicing and lubrication schedule, and list of lubricants required.
- E. Include manufacturer's printed operation and maintenance instructions.
- F. Include sequence of operation by controls manufacturer.
- G. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- H. Additional Requirements: As specified in individual product specification sections.

3.04 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- E. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- F. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

- G. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

3.05 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.

END OF SECTION

**SECTION 01 7900
DEMONSTRATION AND TRAINING**

PART 1 GENERAL

1.01 SUMMARY

- A. Training of Owner personnel in operation and maintenance is required for:
 - 1. All software-operated systems.
 - 2. HVAC systems and equipment.
 - 3. Plumbing equipment.
 - 4. Electrical systems and equipment.
 - 5. Items specified in individual product Sections.
- B. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
 - 1. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

- A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.
- B. Other Specification Sections: Additional requirements for demonstration and training.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 TRAINING - GENERAL

- A. Conduct training on-site unless otherwise indicated.
- B. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
 - 1. The location of the O&M manuals and procedures for use and preservation; backup copies.
 - 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
- C. Product- and System-Specific Training:
 - 1. Review the applicable O&M manuals.
 - 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
 - 3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
 - 4. Provide hands-on training on all operational modes possible and preventive maintenance.
 - 5. Discuss common troubleshooting problems and solutions.
 - 6. Discuss any peculiarities of equipment installation or operation.
 - 7. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
 - 8. Review spare parts suppliers and sources and procurement procedures.

END OF SECTION



Construction Materials Testing • Special Inspections • Geotechnical Engineering

December 8, 2021

Evergreen Baptist Church
10301 East 111th Street South
Bixby, OK 74008
(918) 369-6400

Attn: Jerry Voris, Executive Pastor/Operations
jvoris@evergreenbc.com

Re: Geotechnical Engineering Report | Project No. 9831121
Evergreen Baptist Church – Phase 4
[10301 East 111th Street South, Bixby, OK 74008](#)

It has been a pleasure serving you on this project. AIMRIGHT is pleased to submit this Geotechnical Engineering Report for the proposed construction planned at the referenced site. This report presents the findings of the geotechnical exploration and presents recommendations for design for the project.

We look forward to serving as your geotechnical engineer and construction materials testing laboratory on the remainder of this and future projects. Please do not hesitate to contact us with any concerns or questions regarding this report.

Respectfully submitted,

AIMRIGHT Testing & Engineering, LLC
CA No. 5794 (exp. 6/30/22)
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1.0 PROJECT INFORMATION

1.1 Description

We understand that a new two-story pre-school structure with associated parking/drive areas will be constructed on the referenced site as part of the Phase 4 development plans. Additionally, a future two-story sanctuary (Phase 5) and gymnasium/youth (Phase 6) are being considered for future development and shall be included in this Phase 4 scope.

The site is currently developed with existing structures, pavements, playgrounds, courtyards, sidewalks, and above/below grade infrastructure and is mainly grass covered within the planned construction footprint.

The site is generally level with minimal elevation differences across the site. Cut/fill depths have not been finalized; and we estimate that cut/fill of approximately 6 to 12 inches will be required to reach the final site elevations.

The structures are anticipated to be steel framed and supported by a concrete shallow foundation system and slab-on-ground. Information regarding estimated structural loading conditions was not provided; however, we utilized maximum column loads of 50 to 150 kip and wall loads of 1 to 2 kip per linear foot in our engineering analyses.

The new parking/drive areas will more than likely be constructed with an asphalt and/or concrete surface and aggregate base course overlying a properly prepared subgrade. Information was not provided; however, we utilized an estimated traffic volume to be equal to 25,000 (standard) and 75,000 (heavy duty) equivalent 18-kip single-axle loads (ESALs).

1.2 Scope of Services

The primary purpose of this report is to provide geotechnical engineering recommendations for the proposed site development. Our Scope of Services consisted of the following:

- Drilling fourteen (14) soil test borings (borings) to depths of approximately 20 feet.
- Performing laboratory testing of selected soil samples obtained from the borings.
- Providing engineering analysis and preparation of this report discussing, in general, project description, our scope, exploration, testing, analysis, and recommendations.

The Boring Location Plans, Boring Logs, and other supporting data are presented in the Appendices to this report. Our Scope of Services did not include a survey of boring locations and elevations, rock coring, quantity estimates, preparation of plans or specifications, slope stability analysis, or the identification and evaluation of environmental aspects of the project site.

1.3 Field Exploration

AIMRIGHT located the borings in the field by making measurements from known existing site features. No claim is made as to the accuracy of the locations shown on the Boring Location Plans, and they should be considered approximate.

The borings were advanced using an ATV-mounted drill rig equipped with an automatic hammer and 6-inch diameter augers. Representative soil samples were obtained using a standard 2-inch outside diameter split-barrel sampler in general compliance with the Standard Penetration Testing (SPT) method of the American Society of Testing and Materials (ASTM) D1586 standard to evaluate the consistency and general engineering properties of the subsurface soils.

The number of blows required to drive the split-barrel sampler three (3) consecutive 6-inch increments is recorded, and the blows of the last two 6-inch increments are added to obtain the SPT N-value in blows per foot (bpf) representing the penetration resistance of the soil. At regular intervals within the borings, split-spoon samples were visually classified based on texture and plasticity.

During the drilling process, all encounters with groundwater, if any, were recorded. Upon completion of drilling, all borings were backfilled per OWRB requirements.

1.4 Laboratory Testing

The samples obtained from the geotechnical exploration were transported to the AIMRIGHT laboratory where representative samples were selected for testing. Testing consisted of Atterberg limits, sieve analysis, and determination of moisture content in general accordance with the ASTM testing procedures.

2.0 FIELD EXPLORATION FINDINGS

2.1 Subsurface

The subsurface conditions illustrated in the table below represent an estimate of the subsurface conditions based on interpretation of the boring data using normally accepted geotechnical engineering judgments. The transitions between soil strata are usually less distinct than shown on the Boring Logs.

Stratum	General Depth Interval	General Description of Conditions
Surface	2 to 4 inches	organic laden soils (topsoil) sampled as silty sand/sandy silt with organics and root matter
Native Soils	0.1 to 20 feet	medium stiff to very stiff, lean clay with varying amounts of silt, clay, sand

2.2 Groundwater

Groundwater was not encountered during or at the completion of drilling in any of the borings. Water traveling through soil and rock is often unpredictable and may be present at shallow depths. Due to the seasonal changes in groundwater and the unpredictable nature of groundwater paths, groundwater levels will fluctuate. As such, groundwater levels at other times of the year may be different than those described in this report.

Generally, the highest groundwater levels occur in late winter and early spring and the lowest levels in late summer and fall. Therefore, it is necessary during construction to be observant for groundwater seepage in excavations to assess the situation and make necessary changes. Where applicable, the contractor should determine the actual groundwater levels at the time of construction.

3.0 LABORATORY TESTING RESULTS

Laboratory tests were conducted on selected samples in general accordance with ASTM standards. The laboratory testing performed for this project consisted of Atterberg Limits (ASTM D4318), Moisture Content (ASTM D2216) and Sieve Analysis – No. 200 Sieve Wash Method (ASTM D1140) testing. The test results are presented on the Boring Logs and are summarized in the table below.

Boring No.	Sample Depth ¹ Interval (ft)	In-place Moisture Content (%)	Finer than No. 200 Sieve (%)	Atterberg Limits		
				Liquid Limit (%)	Plastic Limit (%)	Plasticity Index
B-1	1.5 to 3	13.7	79.9	35	18	17
B-2	3.5 to 5	15.0	89.2	27	18	9
B-3	0 to 1.5	14.7	83.9	30	19	11
	3.5 to 5	18.4	88.1	31	19	12
	13.5 to 15	13.3	94.1			
B-4	6 to 7.5	18.1	90.3	36	17	19
B-5	8.5 to 10	18.8	91.1	43	17	26
B-6	0 to 1.5	20.4	89.3	28	18	10
B-7	0 to 1.5	17.9	90.3	31	18	13
B-8	1.5 to 3	16.3	93.0	30	19	11
B-9	3.5 to 5	16.8	85.1	37	17	20
	13.5 to 15	18.8	91.4			
B-11	3.5 to 5	17.6	87.9	28	17	11
B-12	3.5 to 5	13.1	87.6	30	17	13
	18.5 to 20	18.6	70.0			

1. Sample depth is the measured depth from the existing surface grades.

4.0 ANALYSIS & CONCLUSIONS

The following recommendations are based on our observations at the site, interpretation and analysis of the field and laboratory data obtained during this exploration, assumed loads, and our experience with previous exploration and testing with similar projects. Soil penetration data have been used to estimate an allowable bearing pressure and associated settlement using established correlations. Subsurface conditions in unexplored locations may vary from those encountered.

If structure location, loadings, or elevations are changed, we request that we be advised so that we may re-evaluate our recommendations. In the event changes are made in the proposed design/construction plans, the recommendations presented in this report shall not be considered valid unless reviewed by AIMRIGHT and modified or verified in writing.

Determination of an appropriate foundation system for a given structure is dependent on the proposed structural loads, soil conditions, and construction constraints such as proximity to other structures, etc. The subsurface exploration aids the geotechnical engineer in determining the soil stratum appropriate for structural support. This determination includes considerations regarding both allowable bearing pressure and compressibility of the soil strata. In addition, since the method of construction greatly affects the soils intended for structural support, consideration must be given to the implementation of suitable methods of site preparation, fill compaction, and other aspects of construction.

In conclusion, provided the recommendations outlined in this report are followed throughout the design and construction phases of this project, it is our opinion that the site is suitable for the planned construction. A concrete slab-on-ground and shallow foundation design may be utilized to support the structures as notably outlined below.

To reduce excessive differential settlement risk and provide strengthened and more uniform bearing support conditions, AIMRIGHT recommends that the proposed structure foundations be supported by one of the options outlined below:

OPTION 1	Shallow Foundation Support with Existing Native Soils	properly compacted/approved existing native soils utilizing a net allowable bearing pressure of 900 psf
OPTION 2	Shallow Foundation Support with Aggregate Base	a minimum of eighteen (18) inches of properly compacted ODOT Type A aggregate base utilizing a net allowable bearing pressure 1,250 psf

5.0 RECOMMENDATIONS

5.1 Site Preparation and Earthwork

Before proceeding with construction, AIMRIGHT recommends conducting a pre-grading meeting to discuss recommendations as outlined in this report.

Existing utility lines beneath the existing or proposed structure, where applicable, should be located and properly abandoned; or, should be removed and backfilled with properly compacted engineered fill as outlined in this report.

All existing structures, pavements, topsoil/vegetation, moderately to highly plastic soils, wet, soft, or loose soils and any other deleterious non-soil materials should be removed to a minimum distance of 2 and 5 feet beyond the parking/drive area and structure footprints, respectively.

Proof-rolling of the subgrade with a 20 to 30-ton loaded truck or other pneumatic-tired vehicle of similar size and weight should then be performed. Proof-rolling should be performed during a time of good weather and not while the site is wet, frozen, or severely desiccated. The proof-rolling observation is an opportunity for the geotechnical engineer to locate inconsistencies intermediate of our boring locations in the existing subgrade.

All unsuitable materials observed during the evaluation and proof-rolling operations should be over-excavated and replaced with compacted fill or stabilized in place. The possible need for, and extent of over-excavation and/or in-place stabilization required can best be determined by the geotechnical engineer at that time.

The upper 8 inches of the existing subgrade in construction areas shall then be scarified, moisture-conditioned and re-compacted to at least ninety-five percent (95%) of the maximum dry density and within ± 2 percentage points of the optimum moisture content as determined by a Standard Proctor (ASTM D698). The moisture content and compaction shall be maintained prior to beginning any fill or aggregate placement and/or construction.

At the time of the investigation, the site soils were generally moist. If dry weather conditions exist prior to and during construction, the near surface soils may need moisture-conditioning to sufficiently enable adequate scarifying and compaction. However, if wet conditions exist at the time of construction, then care shall be taken to assure proper surface water drainage. If these soils do get wet, they must be dried or treated prior to further compaction efforts.

5.2 Site Drainage

An important aspect to consider during development of this site is surface water control. During the initiation of grading operations, we recommend that the grading contractor take those steps necessary to enhance surface flow and promote rapid clearing of rainfall and runoff water following rain events. It should be incumbent on the contractor to maintain favorable site drainage during construction to minimize deterioration of otherwise stable subgrades.

Permanent positive drainage should be provided around the perimeter of the structures to minimize moisture infiltration into the foundation and/or subgrade soils. We recommend landscaped areas adjacent to the structures be provided with a fall of at least 6 inches for the first 10 feet outward from the structure areas.

All grades must provide effective drainage away from the structures during and after construction. Water permitted to pond next to the structures can result in unacceptable differential floor slab movements and cracked slabs and/or walls.

After construction and landscaping, AIMRIGHT recommends verifying final grades to document that effective drainage has been achieved. Grades around the structures should also be periodically inspected and adjusted as necessary, as part of the structure's maintenance program.

Roof runoff should be collected in drains or gutters. Roof drains and downspouts should be discharged onto pavements which slope away from the structures or downspouts should be extended a minimum of 10 feet away from the structures.

Sub-drains are typically utilized where water may enter the structure footprint from below or above the final site elevations. Based on the results of the borings, we do not anticipate that sub-drains are required for this site. However, potential site drainage problems not encountered during the exploration may be revealed during construction that requires sub-drains.

5.3 Excavations Adjacent to Existing Structures

Caution should be exercised when excavating immediately adjacent to existing structure foundations and the following should be considered.

The contractor should consider conducting excavations along the building structure perimeter footings in shorter segments (i.e., ≤ 10 feet in length parallel to existing foundation) and backfilling with properly compacted engineered fill with hand-held or smaller-sized equipment having a maximum pre-compacted thickness of 4 to 6 inches prior to moving to the next section.

Excavations shall not impose on area extending outward at a 1:1 slope from the bottom of any footings of existing structures.

When determined applicable, appropriate shoring techniques for existing structures and/or foundations should be utilized, and the contractor shall have the necessary project approval and experience in executing such activities.

Similarly, due to the proximity of the existing adjacent structures, larger compaction equipment vibrations may disturb, crack or damage existing structural elements. The existing conditions of the structures should be documented before beginning earthwork operations.

5.4 Fill Material

A sample of each material type should be submitted to the geotechnical engineer for evaluation. Frozen material should not be used, and fill should not be placed on a frozen subgrade.

All fill material in structural areas (including utility backfill) should be placed in continuous, horizontal lifts having a maximum pre-compacted thickness of 9 inches. Aggregate base should have a maximum pre-compacted thickness of 6 inches; and fill compacted with hand-held or smaller-sized equipment having a maximum pre-compacted thickness of 4 to 6 inches.

Each lift should be compacted to at least ninety-five percent (95%) of the maximum dry density and within ± 2 percentage points of the optimum moisture content as determined by a Standard Proctor (ASTM D698), unless noted otherwise. The moisture content and density shall be maintained throughout construction activities.

A minimum of two (2) field tests to determine in-place density and moisture content should be performed per lift for each 2,000 and 5,000 sf within structure and parking/drive area footprints, respectively.

Engineered fill should consist of approved materials that are free of organic matter and debris, exhibit a maximum plasticity index (PI) of 18, maximum liquid limit (LL) of 40, and a maximum rock size of 3.0 inches.

Native soils could be used as fill; whereby, upon re-use, the soils meet the requirements for engineered fill as stated in this report. AIMRIGHT recommends conducting additional soil sampling and laboratory testing of any cut native soils during completion of grading activities to determine characteristics prior to placement in structural areas.

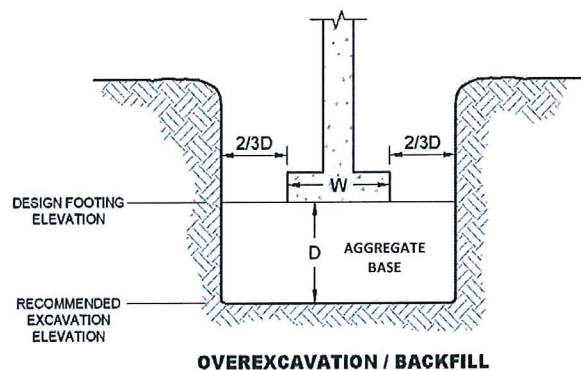
Aggregate base shall meet the requirements for ODOT Type A and may be used as engineered fill.

5.5 Shallow Foundation Design

The project structural engineer should determine the final foundation sizes based on the actual design loads, building code requirements, and other structural considerations. Structure foundations may be designed utilizing the following parameters:

	OPTION 1	OPTION 2 ⁵
Approved Bearing Material	<i>Native Soils</i>	<i>Aggregate Base</i>
Net Allowable Bearing Pressure ¹ (FS ≥ 3.0)	900 psf	1,250 psf
Total Unit Weight ² , γ	100 to 110 pcf	130 pcf
Angle of Friction ² , ϕ	5°	38°
Coefficient of Sliding Friction ² , μ	0.25 to 0.35	0.45
Rankine Passive Earth Pressure Coefficient ² , K_p	1.19	
Maximum Structural Loads	1 to 2 kip/ft (wall); 50 to 150 kip (column)	
Estimated Maximum Settlement	≤ 1 inch (total); ≤ ½ inch (differential)	
Minimum Footing Embedment ³	24 inches	
Minimum Footing Width	18 inches (wall); 30 inches (column)	
Earthquake Loads Site Class ⁴	D	

1. The value is the pressure more than the minimum surrounding overburden pressure at the footing base.
2. Range of values provided for soil types encountered at the site and/or imported approved material that are prepared in accordance with this report. Exclude total passive pressure resistance within 2 feet of the adjacent lowest final site elevation.
3. Minimum depth applies to both perimeter footings and foundations in unheated areas.
4. 2015 International Building Code (IBC) Section 16
5. **OPTION 2** - AIMRIGHT recommends a minimum of eighteen (18) inches of properly compacted ODOT Type A aggregate base be provided below all foundation bearing elevations. All foundation subgrades should be over-excavated to a minimum depth, D, of 18 inches and the width of the excavation shall extend a minimum of ⅔ D (12 inches) beyond the entire footing footprint as illustrated below.



OPTION 2

Note: Excavations shall be conducted with appropriate safety requirements.

5.6 Shallow Foundation Construction

Due to the limited quantity and wide spacing of our borings, AIMRIGHT recommend carefully evaluating all foundation excavations prior to reinforcing steel and concrete placement and implementing an intensive bearing grade observation and testing protocol to identify any unsuitable material within reasonable accessibility.

All exposed bearing subgrades should be re-compacted, evaluated, and verified for the design soil bearing pressure by the geotechnical engineer after excavation and prior to engineered fill or aggregate base placement. This evaluation should include, as a minimum, Dynamic Cone Penetrometer (DCP) testing at the planned bearing elevations at intervals of no less than 35 feet and extending to depths of at least 3 feet below the bearing elevations.

If unsuitable material is encountered during foundation bearing grade testing and inspections (DCP Testing), foundations should be over-excavated and replaced with compacted engineered fill (or approved native soils) or stabilized in place. The possible need for, and extent of over-excavation and/or in-place stabilization required can best be determined by the geotechnical engineer at the time of construction.

Foundation excavations must be maintained in a drained/de-watered condition throughout the foundation construction process and water should not be allowed to pond in any excavation. Excavations for footings should be made in such a way as to provide bearing surfaces that are firm and free of loose, soft, wet, or otherwise disturbed soils. Foundations should be concreted as soon as practical after they are excavated, and concrete should also not be placed on frozen or saturated subgrades.

If the foundation excavations must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, it is recommended that a 2 to 4-inch-thick "mud mat" of lean concrete with a minimum compressive strength of 1,500 pounds per square inches (psi) be placed on the bearing soils before placing the reinforcing steel to minimize damage to the bearing surface from weather or construction activities.

5.7 Slab-on-ground Design

The structure subgrades should be prepared as described in this report. Four (4) inches or more of granular base should be placed over the final soil subgrade and shall meet the requirements outlined in the table below. The modulus of subgrade reaction, k , value illustrated in the table below is based on 30-inch diameter plate load test.

Minimum Percent Finer than 1 ½-inch Sieve	Maximum Percent Finer than No. 200 Sieve	Maximum Plasticity Index	k w/ 4 inches of Granular Base (psi/in)	k w/ 8 inches of Granular Base (psi/in)
100	15	6	125	150

At the time of concrete placement, the granular base should be moist, but free of any self-draining water. If floor coverings are susceptible to moisture damage by moist floor conditions (capillary moisture), a vapor retarder should be placed below the slab-on-ground in accordance with the most recent addendum to ACI 302.1R-04 / 302.2R-06 and other current industry recommendations for use and placement of vapor retarders.

5.8 Pavement Design

These recommendations are based on our discussions with you, interpretation of the field and laboratory data, assumed traffic loading conditions, review of the provided documents, our experience with similar projects and utilization of the 1993 AASHTO Pavement Design Guidelines. AIMRIGHT recommends that governing authorities (i.e., city, county, or other recognized officials) be contacted to discuss appropriate pavement section requirements with respect to this project. The project architect or engineer of record should design the final pavement section. We utilized the design parameters as illustrated below.

Maximum Estimated Traffic, ESALs	Standard	25,000	Overall Standard Deviation	Asphalt	0.40
	Heavy Duty	75,000		Concrete	0.35
Subgrade Resilient Modulus (M_r), psi		3,000	Serviceability	Initial (Asphalt)	4.2
Modulus of Subgrade Reaction (K), psi/in		100		Initial (Concrete)	4.5
Concrete Modulus of Rupture (R), psi		650		Terminal	2.0
Load Transfer Coefficient		3.2	Layer Coefficients	Asphalt Wearing	0.44
Drainage Coefficient		1.0		Asphalt Base	0.40
Reliability, %		85		Aggregate Base	0.14

It is our opinion the following minimum sections overlying a properly prepared subgrade as outlined in this report may be utilized for construction:

Pavement Type	Section	Standard (inches)	Heavy Duty (inches)
Concrete ^{1, 2}	Concrete ($\geq 4,000$ psi, air-entrained)	5.0	6.0
	ODOT Type A Aggregate Base	4.0	
	Properly Prepared Subgrade ³	As Required	
Asphalt ¹	ODOT Type B (S4) or C (S5)	2.0	
	ODOT Type A (S3)	2.0	4.0
	ODOT Type A Aggregate Base	8.0	
	Properly Prepared Subgrade ³	As Required	

1. Constructed in accordance with Oklahoma Department of Transportation (ODOT) and city or county governing specifications and applicable American Concrete Institute (ACI) guidelines.
2. A minimum thickness of 7 inches of concrete and 6 inches of aggregate base should be provided in front of and beneath dumpster areas or any other areas subjected to continuous concentrated truck wheel loading.
3. Per Section 5.1, 5.4, and 5.9.

5.9 Pavement Construction

The parking/drive areas generally consist of near surface conditions that are generally suitable for support of the anticipated loads. However, soft, wet surface, or other unsuitable conditions may be encountered within some areas of the footprint. Remediation of these soils shall be required during site preparation and earthwork while following the recommendations outlined in this report.

AIMRIGHT recommends conducting additional soil sampling and laboratory testing of the final soil subgrades during completion of grading activities to determine characteristics and stabilization requirements prior to beginning pavement construction.

- Where soils with PI greater than 18 are encountered, to provide the roadway areas with a more stable subgrade, at minimum, the upper 8 inches of the final soil subgrade plus an additional 2 feet beyond the footprint be constructed with properly compacted engineered fill or native soils stabilized with a lime or fly ash additive.
- The actual amounts of lime or fly ash should be determined in the field and the modification/stabilization procedure shall be performed and monitored in general accordance with 2009 ODOT Standard Specifications for Highway Construction Section 307 Subgrade Treatment.

In general, long-term pavement performance requires good drainage, performance of periodic maintenance activities, and attention to subgrade preparation. We emphasize that good base course drainage is essential for successful pavement performance and should always be maintained in a drained condition. Consideration for proper drainage design should be carefully evaluated where unequal minimum pavement sections meet (i.e., light, or standard to heavy duty). Depending on drainage flow design, it may be necessary to deepen the aggregate base course for the thinner section requirement.

Water build-up in the base course could result in premature pavement failures. Sub-drains are typically utilized beneath a pavement where water may enter the pavement from below or above. Based on the results of the borings, we do not anticipate that sub-drains are required for this site. However, site drainage problems may be revealed during construction that requires sub-drains.

Proper drainage may be aided by grading the site such that surface water is directed away from pavements and by construction of swales adjacent to the pavements. All pavements should be graded such that surface water is directed towards the outer limits of the paved areas or to catch basins located such that surface water does not remain on the pavement.

6.0 CONSTRUCTION MONITORING

We recommend that all earthwork construction be monitored by an experienced engineering technician of AIMRIGHT. Monitoring should include site preparation, subgrade earthwork, engineered fill earthwork, structure foundation systems, conventional and/or structural slabs.

Monitoring will allow AIMRIGHT to confirm the soil conditions on site and evaluate the recommendations presented within this report. If at the time of construction, our recommendations are inappropriate for the project, monitoring will allow us to remediate the recommendations at that time to better serve the project.

Monitoring during construction will also allow for the testing of all construction materials for the project. This includes but is not limited to:

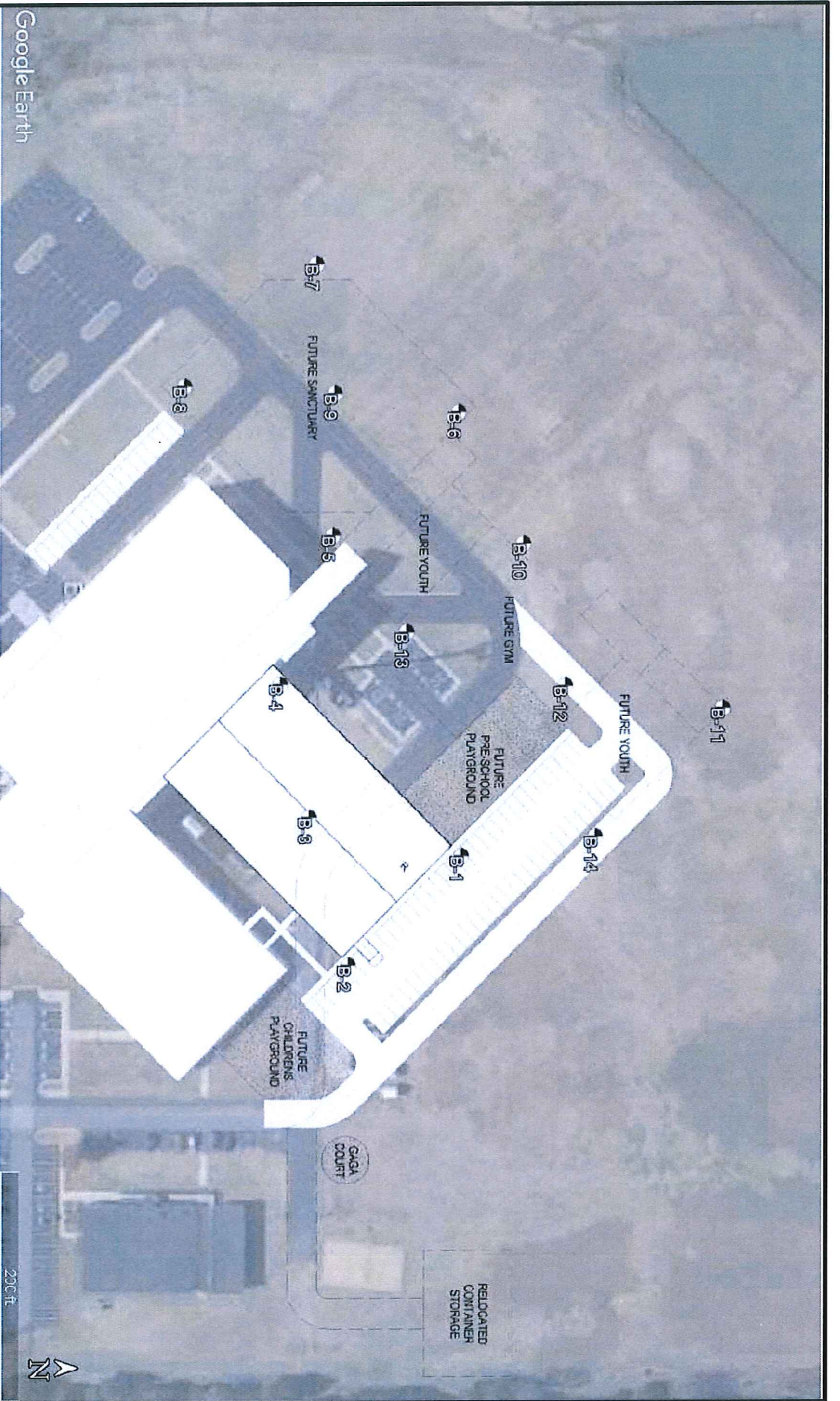
- ✓ subgrade inspection and density testing,
- ✓ structural area fill placement density testing,
- ✓ foundation bearing grade observations and testing,
- ✓ structural and reinforcing steel inspection,
- ✓ concrete testing, and
- ✓ asphaltic concrete testing, as applicable.

We recommend that AIMRIGHT be retained to provide these services based upon our current familiarity with the project subsurface conditions, and the provided intent of the geotechnical recommendations pertaining to the proposed development.

7.0 LIMITATIONS

The recommendations provided are based in part on project information provided to us and they only apply to the specific project and site discussed in this report. If our statements or assumptions concerning the location and design of this project contain incorrect information, or if additional information is available, you should convey the correct or additional information to us and retain us to review our recommendations. We can then modify our recommendations if they are inappropriate for the proposed project.

Regardless of the thoroughness of the geotechnical exploration, there is always a possibility that subsurface conditions will be different from those at a specific boring location and that conditions will not be as anticipated by the designers or contractors. In addition, the construction process may itself alter soil conditions. Therefore, experienced geotechnical personnel should observe and document the construction procedures used and the conditions encountered. Unanticipated conditions and inadequate procedures should be reported to the design team along with timely recommendations to solve the problems created. The conclusions and recommendations presented in this report were derived in accordance with standard geotechnical engineering practices and no other warranty is expressed or implied.



APPROXIMATE BORING LOCATIONS

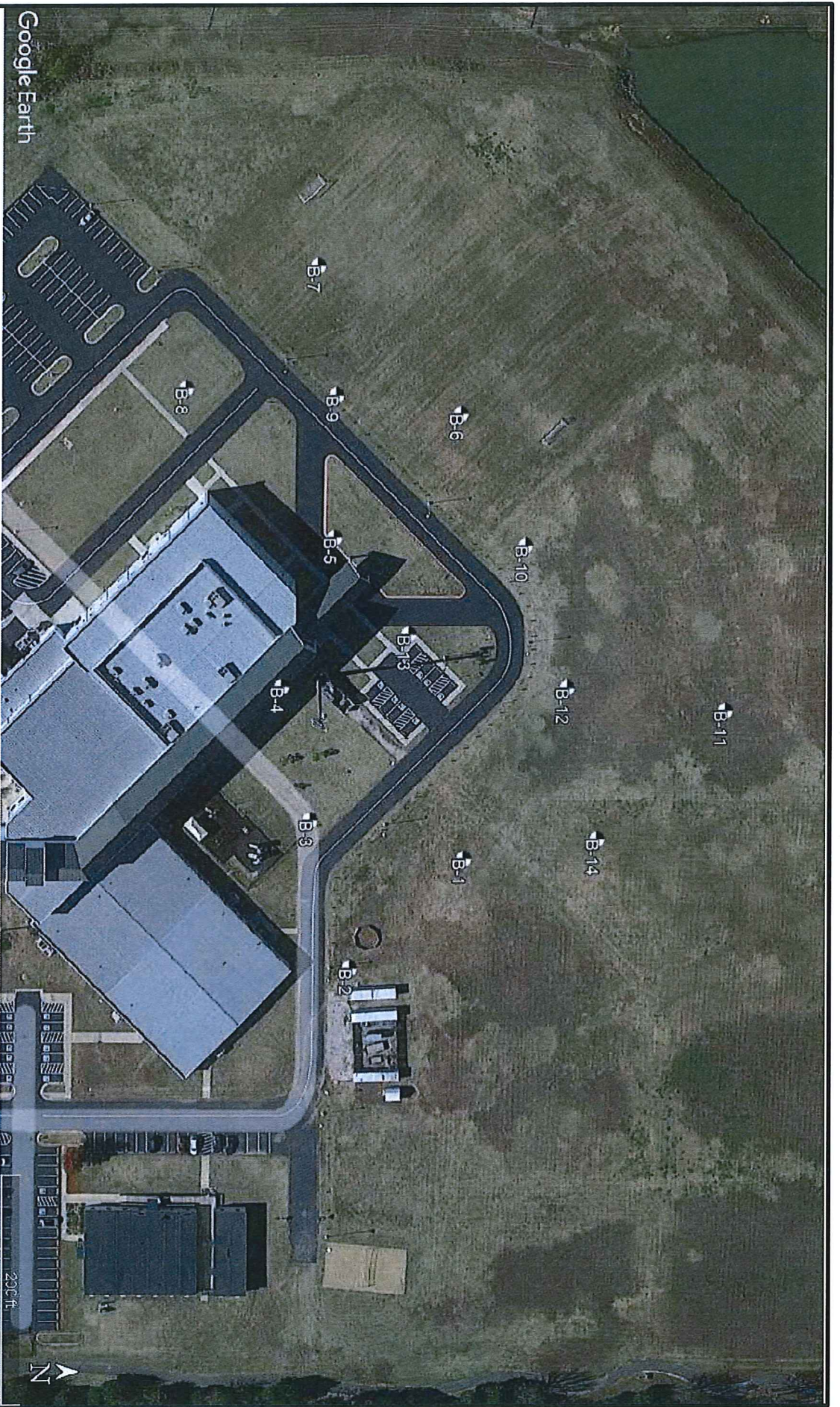
BORING LOCATION PLAN

PROJECT NO.: 9831121

SOURCE: Aerial Imagery/Provided Plan

PROJECT: Evergreen Baptist Church – Phase 4

CLIENT: Evergreen Baptist Church



APPROXIMATE BORING LOCATIONS

BORING LOCATION PLAN

PROJECT NO.: 9831121
SOURCE: Aerial Imagery

PROJECT: Evergreen Baptist Church – Phase 4
CLIENT: Evergreen Baptist Church

CAVING> C None

This information pertains only to this boring and should not be interpreted as being indicative of the site.

CAVING> C None

This information pertains only to this boring and should not be interpreted as being indicative of the site.



DEPTH TO WATER> INITIAL: Dry AT COMPLETION: Dry CAVING> C None

This information pertains only to this boring and should not be interpreted as being indicative of the site.



DEPTH TO WATER> INITIAL: Dry AT COMPLETION: Dry CAVING> C None

[illegible]

This information pertains only to this boring and should not be interpreted as being indicative of the site.

CAVING> C None[illegible]

This information pertains only to this boring and should not be interpreted as being indicative of the site.

LOG OF BORING B-6

PROJECT: Evergreen Baptist Church - Phase 4

CLIENT: Evergreen Baptist Church

PROJECT NO.: 9831121

PROJECT LOCATION: 10301 East 111th Street South, Bixby, OK 74008

LOCATION: see Boring Location Plan

ELEVATION: N/A

DRILLER: H. Wilson **LOGGED BY:** P. Scarborough **DRILLING RIG:** CME-550 ATV-Mounted

DRILLING METHOD: Rotary Continuous Flight Augers

DATE: 11/23/21

DEPTH TO WATER> INITIAL: Dry AT COMPLETION: Dry CAVING> C None

[illegible]

CAVING> C None

This information pertains only to this boring and should not be interpreted as being indicative of the site.

CAVING> C None

This information pertains only to this boring and should not be interpreted as being indicative of the site.



CAVING> C None

This information pertains only to this boring and should not be interpreted as being indicative of the site.



AT COMPLETION: Dry **CAVING**> C None

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DEPTH TO WATER> INITIAL: Dry AT COMPLETION: Dry CAVING> C None



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DEPTH TO WATER> INITIAL: Dry AT COMPLETION: Dry CAVING> C None

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DEPTH TO WATER> INITIAL:  Dry AT COMPLETION:  Dry CAVING> C None

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DEPTH TO WATER> INITIAL: Dry AT COMPLETION: Dry CAVING> C None

This information pertains only to this boring and should not be interpreted as being indicative of the site.

KEY TO SYMBOLS

Symbol Description

Strata Symbols



Topsoil



Low Plasticity Clay

Soil Samplers



Standard Penetration Test

SECTION 02 4100 DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selective demolition of built site elements.
- B. Selective demolition of building elements for alteration purposes.
- C. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

- A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 1000 - Summary: Sequencing and staging requirements.
- C. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- D. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- E. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- F. Section 31 1000 - Site Clearing: Vegetation and existing debris removal.
- G. Section 31 2200 - Grading: Topsoil removal.
- H. Section 31 2200 - Grading: Fill material for filling holes, pits, and excavations generated as a result of removal operations.
- I. Section 31 2323 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Site Plan: Showing:
 - 1. Areas for temporary construction and field offices.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 3 EXECUTION

2.01 SCOPE

- A. Remove portions of existing building as described on Demolition Plan.
- B. Remove paving and curbs as required to accomplish new work.
- C. Remove other items indicated, for disposal in accordance with current regulations..
- D. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 2200.

2.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Use of explosives is not permitted.
 - 4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 5. Provide, erect, and maintain temporary barriers and security devices.
 - 6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - 7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 8. Do not close or obstruct roadways or sidewalks without permit.
 - 9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 - 10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Protect existing structures and other elements that are not to be removed.
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.
- D. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- E. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
- F. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

2.03 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

2.04 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings.
- C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - 3. Verify that abandoned services serve only abandoned facilities before removal.
 - 4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- D. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
 - 4. Patch as specified for patching new work.

2.05 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

**SECTION 03 3000
CAST-IN-PLACE CONCRETE**

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2019.
- B. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2023, with Editorial Revision.
- C. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2024.
- D. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2020.
- E. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers; 2020.

1.02 SUMMARY

- A. Section includes cast-in-place concrete and supplementary items necessary to complete work required for their installation.
- B. Related Sections:
 - 1. Division 03 Section "Concrete Forming".
 - 2. Division 03 Section "Concrete Accessories" for items including but not limited to inserts, waterstops, expansion anchors, and adhesive anchors.
 - 3. Division 03 Section "Concrete Reinforcement".
 - 4. Division 03 Section "Concrete Finishing" for items including but not limited to tolerances, curing, protection, and surface repairs.
 - 5. Division 07 Section "Below Slab Vapor Retarder".
 - 6. Division 32 Sections for concrete paving and walks.

1.03 SUBMITTALS

- A. Laboratory Test Reports for Concrete Materials and Mix Designs: As specified herein and in accordance with Division 01 Sections "Quality Assurance" and "Quality Control".
- B. Material Certificates: As specified herein when required. Certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturer that chloride content complies with specification requirements, and admixture is compatible with other required or proposed admixtures.
- C. Sleeve Locations: Submit plan showing proposed sleeve dimensioned locations and sizes for review by Architect and Engineer prior to concrete placement.

1.04 QUALITY ASSURANCE

- A. Codes and Standards: Comply with following codes, specifications, and standards, except where more stringent requirements are shown or specified:
 - 1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete".
 - 2. ACI 318, "Building Code Requirements for Structural Concrete".
 - 3. ACI 306.1, "Std. Specification for Cold Weather Concreting".
 - 4. ACI 117, "Std. Specifications for Tolerances for Concrete Construction and Materials".
 - 5. Concrete Reinforcing Steel Institute (CRSI), "Manual of Std. Practice".
 - 6. ASTM E1155, "Std. Test Method for Determining Floor Flatness and Levelness Using F-Number System".

7. ACI 503.1, "Std. Specification for Bonding Hardened Concrete, Steel, Wood, Brick, and Other Materials to Hardened Concrete with Multi-Component Epoxy Adhesive".
8. ACI 503.2, "Standard Specification for Bonding Plastic Concrete to Hardened Concrete with Multi-Component Epoxy Adhesive".
 - a. Paragraph 2.3.7.1 of above code is hereby replaced in its entirety with following:
 - 1) Independent Testing Laboratory approved by Architect/Engineer shall evaluate bonding of fresh concrete to existing concrete after fresh concrete has cured for not less than 28 days. Written report prepared by Independent Testing Laboratory shall be submitted to Architect/Engineer for review.
- B. Document Conflict and Priority: In case of concrete work conflict between documents, including drawings and specifications, notify Architect prior to submitting proposal. Most stringent criteria shall govern and be given priority, unless otherwise indicated by Architect in writing.
- C. Compatibility of Concrete Admixtures and Surface Treatments: Contractor shall be responsible for selection of admixtures and surface treatments compatible with one another and with specified requirements of concrete work including final surface treatments. Contractor shall be responsible for following product manufacturer's instructions for use, limitations, and precautions.
- D. Concrete Plant Certification and Qualifications: Certified in accordance with National Ready Mixed Concrete Association (NRMCA) Plant Certification Checklist. Minimum of 5 years successful experience in manufacturing ready-mixed concrete complying with ASTM C94 requirements for facilities and equipment.
- E. Concrete Contractor Qualifications: Minimum of 5 years successful experience with installation and finishing of concrete similar in materials, system, and project scope to that indicated for this Project.
- F. Concrete Testing Service: Engage testing service acceptable to Architect to perform material evaluation tests and to design concrete mixes.
- G. Testing/Retesting of Materials and Installed Work: May be required at any time during progress of Work as directed by Architect. Such tests/retests, not indicated to be performed at Owner's expense, will be at Contractor's expense.
- H. Concrete Pre-construction Conference:
 1. At least 15 days prior to start of concrete construction, Contractor shall hold meeting to review detailed requirements of concrete mix designs and to determine procedures for producing proper concrete construction. Additionally, review requirements for submittals, Status of Coordinating Work, availability of materials and procedures for materials inspection, testing, certifications, and floor flatness/levelness. At minimum, discuss following items as pertains to project.
 - a. Requirements for submittals.
 - b. Status of Coordinating Work.
 - c. Availability of materials and procedures for materials inspection.
 - d. Testing.
 - e. Certifications.
 - f. Floor flatness/levelness.
 - g. Curing and finishing of floor surfaces.
 - h. Control of concrete moisture/wetness and the affects of moisture vapor transmission (MVT) on finish flooring materials.
 2. Contractor shall require responsible representatives of every party who is concerned with concrete work to attend conference, including but not limited to following:
 - a. Contractor's superintendent.
 - b. Contractor's Laboratory responsible for concrete mix design(s).

- c. Owner's Laboratory responsible for field quality control.
 - d. Concrete subcontractor.
 - e. Ready-mix concrete producer.
 - f. Admixture manufacturer.
 - g. Concrete pumping subcontractor.
 - h. Owner's and Architect's/Engineer's representative.
 - i. Floor Consultant and Floor Flatness Inspector.
 - j. Finish flooring subcontractor(s).
3. Minutes of meeting shall be recorded, typed and printed by Contractor and distributed by him to parties concerned within 5 days of meeting. One copy of minutes shall also be transmitted to following for information purposes.
- a. Owner's representative.
 - b. Architect.
 - c. Engineer of record.
 - d. Floor Consultant.
 - e. Owner's Laboratory responsible for field quality control.
4. Engineer will be present at conference. Contractor shall notify Engineer at least 7 days prior to scheduled date of conference.

1.05 TOLERANCES

- A. Tolerances for Concrete Construction and Materials shall conform to requirements of ACI 117, Standard Specifications for Tolerances for Concrete Construction and Materials, except as modified by requirements of these Contract Documents.
- B. Floor finish tolerances for surfaces designated to receive troweled finish shall be measured in accordance with ACI 117, Section 4.5.6, except as modified by these Contract Documents. Refer to Division 03 Section "Concrete Finishing" for Flatness and Levelness Inspection and finished surface F-number requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS AND PRODUCTS

- A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Engineer, provide product by one of manufacturers listed. If not listed, submit as substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

2.02 MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type III.
- B. Portland Cement at Concrete Exposed to Sulfates:
 - 1. Moderate Sulfate Exposure: ASTM C 150, Type II.
 - 2. Severe Sulfate Exposure: ASTM C 150, Type V.
- C. Supplementary Cementitious Materials
 - 1. Fly Ash: ASTM C618, Class C or F.
 - 2. Ground Granulated Blast-Furnace Slag (GGBFS): ASTM C 989, Grade 100 or 120.
 - 3. Silica Fume: ASTM C1240, Amorphous Silica.
- D. Blended Hydraulic Cements: ASTM C 595, Type "IP", or Type "IS".
- E. Fine Aggregate: ASTM C 33, natural sand, manufactured sand, or combination thereof, washed and screened, consisting of hard, durable, uncoated particles free of deleterious matter, and shall be so graded from coarse to fine as to produce minimum percentage of voids.
- F. Coarse Aggregate:

1. Normal Weight Aggregate: ASTM C 33, gravel or crushed stone suitably washed and screened, and shall consist of hard, durable particles without adherent coatings.
 2. Lightweight Aggregate: ASTM C 330, suitably processed, washed and screened, and shall consist of durable particles without adherent coatings.
- G. Water: ASTM C 94, paragraph 4.1.3.
1. Free of foreign matter that may be harmful to concrete, reinforcement, or concrete accessories, including but not limited to oils, acids, alkalies, salts, and organic materials.
 2. Free of deleterious amounts of chloride ions.
- H. Admixtures:
1. General: Calcium chloride, thiocyanates, or admixtures with more than 0.05 percent chloride ions are not permitted.
 2. Specific admixtures, or manufacturer listed under each item below is "acceptable" only if manufacturer can evidence product compatibility with other products comprising concrete mix.
 3. Air-Entraining Admixture: ASTM C 260
 - a. Provide air entraining agent in sufficient quantity to assure controlled entrainment within specified percentage limits required herein.
 - b. Manufacturers and Products:
 - 1) BASF; MB-VR Standard or Micro Air
 - 2) Euclid Chemical Company; Air-Mix or AEA 92
 - 3) Grace Construction Products; Darex AEA or Daravair
 - 4) Sika Corporation; AER
 4. Water-Reducing Admixture: ASTM C 494, Type A.
 - a. Certified by manufacturer as Lignin-Free.
 - b. Manufacturers and Products:
 - 1) BASF; Pozzolith 200N or Pozzolith 322N
 - 2) Euclid Chemical Company; Eucon WR-75 or WR91
 - 3) Grace Construction Products; WRDA or Daracem
 - 4) Sika Corporation; Plastocrete 161
 5. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F or G.
 - a. Manufacturers and Products:
 - 1) BASF; Rheobuild 1000
 - 2) Euclid Chemical Company; Eucon 37
 - 3) Grace Construction Products; Daracem 100
 - 4) Sika Corporation; Sikament 300
 6. Water-Reducing Accelerating Admixture: ASTM C 494, Type E.
 - a. Non-corrosive, non-chloride.
 - b. Manufacturers and Products:
 - 1) BASF; Pozzutec 20
 - 2) Euclid Chemical Company; Accelguard 80
 - 3) Sika Corporation; Plastocrete 161FL
 7. Water-Reducing Retarding Admixture: ASTM C 494, Type D.
 - a. Manufacturers and Products:
 - 1) Euclid Chemical Company; Eucon Retarder-75
 - 2) Grace Construction Products; Daratard-17
 - 3) BASF; Pozzolith R
 - 4) Sika Corporation; Plastocrete 161MR or Plastiment
 8. Shrinkage-Reducing Admixture: Admixture which reduces concrete drying shrinkage by reduction of capillary tension of pore water.

- a. Non-corrosive, non-chloride.
 - b. Consult with admixture manufacturers when used with air-entrained concrete mixes.
 - c. Manufacturers and Products:
 - 1) BASF; Tetraguard AS20 (at non-air-entrained concrete only)
 - 2) Grace Construction Products ; Eclipse (at non-air-entrained concrete only)
 - 3) Grace Construction Products; Eclipse Plus (at air-entrained concrete only)
- I. Chloride Ion Content:
- 1. Limit water soluble chloride ion concentrations in hardened concrete, at ages from 28 to 42 days, from ingredients including water, aggregates, cementitious materials, and admixtures as indicated by Table 4.4.1, ACI 318.
 - 2. Consider concrete placed on metal deck to be within same category as prestressed concrete in Table 4.4.1, ACI 318, regarding maximum chloride ion concentrations in hardened concrete.
 - 3. Provide certification for each mix design that chloride ion content does not exceed specified limits when tested in accordance with ASTM C 1218.

2.03 RELATED MATERIALS

- A. Bonding Compounds: Use in strict conformance with manufacturer's written recommended application limitations, precautions, and directions for use, including, but not limited to, surface preparation, mixing, placing, curing, and compatibility with substrate conditions.
- 1. Latex Bonding Agents, Admixtures, and Adhesives: ASTM C 1059, Type II.
 - a. Acceptable at non-structural and structural bonding applications, interior or exterior, unless noted otherwise in Contract Documents.
 - b. Use only acrylic or styrene butadiene latex based adhesives.
 - c. Manufacturers and Products:
 - 1) Euclid Chemical Company; SBR Latex
 - 2) L & M Construction Chemicals; Everbond
 - 3) W.R. Meadows, Inc.; ACRY-LOK
 - 2. Polyvinyl Acetate Bonding Agents: ASTM C 1059, Type I
 - a. Acceptable at non-structural and structural bonding applications, interior surfaces not subject to water exposure or high humidity during construction or in-service.
 - b. Manufacturers and Products:
 - 1) Euclid Chemical Company; Euco Weld
 - 2) L & M Construction Chemicals; Everweld
 - 3) W.R. Meadows, Inc.; Intralok
 - 3. Epoxy-Resin Bonding Adhesives: ASTM C 881, Types I, II, IV, and V.
 - a. Types I and II: Acceptable at non-structural bonding applications.
 - b. Types IV and V: Acceptable at structural load-bearing bonding applications.
 - c. Suitable for use on dry or damp surfaces.
 - d. Epoxy Adhesive for Bonding Plastic Concrete to Hardened Concrete: Conform to requirements of ACI 503.2-92 (R97), unless modified herein.
 - e. Epoxy Adhesive for Bonding Hardened Concrete, Steel, Wood, Brick, and other Materials to Hardened Concrete: Conform to requirements of ACI 503.1-92 (R97), unless modified herein.
 - f. Manufacturers (Consult with supplier for specific product and compatibility with substrate conditions. Subject to Engineer's review and approval):
 - 1) BASF
 - 2) Euclid Chemical Company
 - 3) Sika Corporation
 - 4) W.R. Meadows

- B. Overlay and Repair Mortar: Use of overlay and repair mortar shall be in accordance with manufacturer's application limitations, precautions, and directions for use, including but not limited to surface preparation, mixing, placing, curing, and compatibility with substrate conditions.
1. Epoxy Mortar: ASTM C 881, Types I, and IV.
 - a. Acceptable at interior applications only, unless otherwise directed by Engineer.
 - b. Appropriate applications include locations susceptible to high wear or high corrosion.
 - c. Type I: Acceptable at non-structural applications.
 - d. Type IV: Acceptable at structural applications.
 - e. Manufacturers (Consult with supplier for specific product and compatibility with substrate conditions. Subject to Engineer's review and approval):
 - 1) BASF
 - 2) Euclid Chemical Company
 - 3) Sika Corporation
 2. Polymer Modified Cementitious Mortar: ASTM C 1059, Type II:
 - a. Acceptable at structural and non-structural applications, interior or exterior.
 - b. Manufacturers (Consult with supplier for specific product and compatibility with substrate conditions. Subject to Engineer's review and approval):
 - 1) BASF
 - 2) Euclid Chemical Company
 - 3) Sika Corporation
- C. Self-Leveling Underlayment Compound: Specified in Division 03 Section "Concrete Finishing".

2.04 PROPORTIONING AND DESIGNING MIXES

- A. Types of concrete, minimum 28-day compressive strength (f'_c), and maximum nominal coarse aggregate sizes are shown in drawings.
- B. Prepare design mixes for each type and strength of concrete by either field experience methods or by laboratory trial batch methods. Mix design testing shall be furnished by Contractor. Selection of concrete proportions for each mix shall be certified by an Independent Testing Laboratory hired by Contractor.
- C. Field Experience Method: Provide prior established mix designs proportioned in accordance with ACI 211, accompanied by test data indicating acceptable strength history in accordance with ACI 318, part 5.3, unless otherwise modified herein. Data shall be certified by Independent Testing Laboratory.
1. Temperature of concrete in test data shall be within 5 degrees Fahrenheit. of maximum temperature specified for this project.
 2. Strength of concrete used in supporting test data shall vary no more than plus 1000 psi or minus 500 psi from that specified for this project.
 3. Shrinkage limits for each mix proposed for walls and horizontal surfaces shall be as specified by D.5.d. below. Proof of meeting shrinkage limits shall accompany mix designs.
- D. Laboratory Trial Batch Method: Establish proportions in accordance with ACI 211, and ACI 318 paragraph 5.3.3.2, unless otherwise modified herein.
1. Test cylinders at seven days and at twenty-eight days in accordance with ASTM C 39.
 2. Where required design strength is 6,000 psi or greater, test additional set of cylinders at fifty-six days.
 3. Temperature of concrete used in trial batches shall be maximum temperature specified herein.
 4. Cement content and mix proportions used shall be such that this water-cement ratio is not exceeded when slump is maximum permitted. Control in field shall be based upon

maintenance of proper cement content, water-cement ratio, slump, and air content.

- E. Mix Design Information: Include following as part of mix design submittals:
1. Project identification name.
 2. Specific location, member, etc....for mix usage. Affix code, mix design number, or other specific identification symbol to each mix design.
 3. Type of concrete, i.e....normal weight, lightweight, etc....
 4. Dry unit weight, (pcf).
 5. Aggregate type, gradation, and source.
 6. Admixture types, product identification, and supplier. Include manufacturer's literature for each admixture.
 7. Cement type and brand, including fly ash and micro silica fume when applicable.
 8. Placement method intended.
 9. Other characteristics including, but not limited to, 28-day compressive strength, slump, W/C ratio, and proportions of each material in mix.
 10. 28-day shrinkage data for concrete at walls and horizontal surfaces.
- F. Water-to-Cement Ratio (W/C):
1. Water content and W/C ratio shall be lowest possible value consistent with maximum consolidation, workability, and density.
 2. Intent of this specification is to achieve low porosity concrete, minimize shrinkage, and to minimize cracking, thus minimizing harmful moisture or ion penetrations, and thereby protecting reinforcement.
 3. Maximum W/C ratios for following normal weight concrete classes are as follows, unless otherwise noted herein:
 - a. f'_c at 28-days Concrete Type
 - 1) (psi) Air-entrained Non-Air-entrained
 - 2) 3,000 0.50 0.55
 - 3) 3,500 0.45 0.45
 - (a) 4,000 & above 0.40 0.45
 4. Maximum W/C ratio for building retaining walls with habitable space below grade (basement walls) shall conform to note F.3. above, but in no case greater than 0.48.
 5. Severe Exposure: Maximum W/C ratio at concrete subject to "severe exposure" shall be 0.40. Following locations are hereby classified as "severe exposure" conditions:
 - a. Garage Topping Slabs and Topping Slabs.
 - b. Truck Dock Slab.
 - c. Basin Walls, Slabs, and Pit Walls at Cooling Tower.
- G. Supplementary Cementitious Materials:
1. Use supplementary cementitious materials described below to improve consistency, placement, finishing, and economics. Use is at Contractor's option, unless otherwise indicated.
 2. Mixes with higher percentage than specified below for supplementary cementitious materials may be proposed by Contractor, but are subject to Engineer's approval and limitations herein. If proposed, include following as minimum for consideration:
 - a. Total cost savings to be realized.
 - b. Previous experience of satisfactory performance, using materials from identical sources as proposed for this project.
 - c. Affect, if any, on concrete finishing.
 - d. Affect, if any, on air-entrainment.
 - e. Affect, if any, on concrete shrinkage properties.
 - f. Amount of water content change.

- g. Any other comments based on Contractor's and concrete supplier's experience supportive of proposed percentage increase.
 - 3. Do not exceed specified percentage limits for concrete subject to exposure to de-icing chemicals.
 - 4. When supplementary cementitious materials are used in mixes, it shall be understood that time required for setting and strength gain may be longer than required for similar mix with Portland Cement only, therefore precautions to avoid premature finishing shall be considered and undertaken.
 - 5. Limits below represent percentage of total cementitious material in mix, by weight.
 - 6. Fly Ash: 25 percent.
 - 7. Ground Granulated Blast-Furnace Slag (GGBFS): 50 percent, except as follows. If used in hydraulic blend with other supplementary cementitious materials, reduce GGBFS percentage such that sum of supplementary cementitious materials does not exceed 50 percent of total cementitious materials, by weight.
 - 8. Silica Fume: 10 percent.
- H. Slump Limits: Proportion and design mixes to limit concrete slump at point of deposit as follows:
- 1. Concrete, unless noted otherwise 5" max., 2" min.
 - 2. Basement Walls, Footings 4" max., 1" min.
 - 3. Elevated Slabs, Slabs-on-grade,
 - a. Slabs-on-metal deck 4" max., 1" min.
 - 4. Pier Concrete Flowable Conc. req'd. (see below)
 - 5. Lightweight Concrete 4" max., 1" min.
 - 6. Flowable Concrete 8" max. after add'n of superplasticizer.
 - 7. (Concrete with Superplasticizer) 3" max. slump prior to addition.
- I. Admixtures:
- 1. Use approved WATER-REDUCING ADMIXTURE conforming to ASTM C 494, Type A, D, E, F, or G in concrete, unless otherwise noted herein.
 - 2. Use approved SUPERPLASTICIZER where Flowable Concrete is specifically indicated and as required to improve placement and workability; to lower W/C ratio; or for shrinkage or permeability reduction.
 - 3. Use high-range, water reducing admixture in concrete with a water/cement ratio of 0.42 and less.
 - 4. Use approved AIR-ENTRAINING ADMIXTURE as follows:
 - a. Normalweight concrete exposed to weather. Air content percent per ACI 318, Table 4.2.1, (exposure as follows) unless noted otherwise herein. Reduce air content percent indicated by 1 percent where concrete 28-day f'c is greater than 5,000 psi.
 - b. Lightweight Concrete Mixes: Air content percent as recommended by concrete supplier, but, not less than 4 percent.
 - c. Provide air content percent in accordance with ACI 318, Table 4.2.1, (exposure as follows) unless noted otherwise herein.
 - d. Reduce air content percent for normalweight concrete at unformed surfaces scheduled to receive troweled finish or dry shake hardeners to 3 percent.
 - 5. Use admixtures in compliance with manufacturer's directions. Control dosage rates. Do not overdose mixes.
- J. Cement Content:
- 1. Minimum cement content of concrete mixes to be placed where severe exposure conditions exist or exposure to deicing chemicals will occur shall be 520 lbs. per cu. yd. meeting ASTM C 150 or C 595.
 - 2. Parking Garage Structure: Provide minimum cement content in parking garage slab and beam mixes.

- K. Non-Shrink Grout: Material shall be ready-to-use non-metallic or metallic aggregate product requiring only addition of water at jobsite and shall produce flowable cementitious grouting material having no drying shrinkage at any age. Material shall conform to requirements of ASTM C 1107.
1. Use non-metallic grout for exposed conditions, unless indicated otherwise.
 2. Compressive strength at 7 days: 6,000 psi minimum.
 3. Compressive strength at 28 days: 8,000 psi minimum.
 4. Subject to compliance with requirements, acceptable non-shrink grouts are as follows:
 - a. BASF; Masterflow 928 Grout
 - b. Euclid Chemical Company; Euco N-S
 - c. W.R. Meadows, Inc.; 588 Precision Grout

PART 3 EXECUTION

3.01 GENERAL

- A. Coordination with Other Products/Trades:
1. Give various trades and subcontractors ample notification and opportunity to furnish anchors, nailers, pipes, conduits, boxes, inserts, thimbles, sleeves, frames, vents, wires, supports, or other items required to be built into concrete by provisions of Drawings or of Specifications governing work of those trades and subcontractors, or as may be necessary for proper execution of their work.
 2. Obtain suitable templates or instructions for installation of those items which are required to be placed in forms.
- B. Concrete Characteristics:
1. Slump: Concrete shall not be placed when its plasticity, as measured by slump tests, is outside limits specified.
 2. Classes: Concrete of several classes required shall have characteristics shown on Drawings or as specified herein.
- C. Mixing: Batch, mix, and transport ready-mixed concrete in accordance with the requirements of ASTM C 94. Concrete shall not be transported or used after period in excess of 90 minutes has elapsed after introduction of water into mixer. When concrete temperature exceeds 86 degrees Fahrenheit, time shall be reduced to 45 minutes. Agency supplying ready-mixed concrete shall have plant of sufficient capacity, and adequate transportation facilities, to assure continuous delivery at rate required. Plant equipment and facilities shall conform to "Certification of Ready Mixed Concrete Production Facilities (Checklist with Instructions)" of National Ready Mixed Concrete Association. Frequency of deliveries to site of work must be so as to provide for placing concrete continuously throughout one (1) pour.
- D. Conveying Concrete: Convey concrete from mixer to place of final deposit by methods which will prevent separation or loss of ingredients. Concrete to be conveyed by pumping will require approval of Architect for each class of concrete specified before being used.
1. Equipment for chuting, pumping, and pneumatically conveying concrete shall be of size and design as to assure practically continuous flow of concrete at delivery end without separation of materials.
 2. Use of gravity flow or aluminum chutes or conveyors for transporting concrete horizontally is not permitted.
- E. Control of Water: Control water at all times during mixing, placing, finishing, curing, and after completion of curing phase. Excess water during mixing and placing phases effects properties of concrete, including but not limited to strength, shrinkage/cracking, set time, and long-term durability. Excess water after curing phase effects drying of hardened concrete with direct affect on application of finish materials applied with adhesives sensitive to moisture and/or water

vapor. Control of water includes water at place of mixing, truck water, water at jobsite, and moisture due to rain, ice, or snow. Contractor is responsible for control of water and effects on concrete and material(s) to be applied to hardened concrete.

3.02 JOINTS

- A. General: Locate joints as indicated on Drawings or, if not shown, at locations approved by Architect/Engineer. Intent of this Specification is to locate joints so as not to adversely affect either structural integrity or appearance of structure, and to control cracking.
- B. Construction Joints: Place construction joints perpendicular to main reinforcement. Locate joints within middle third of span and continue reinforcement across construction joint unless otherwise indicated by Drawings. Provide dowels across construction joints as indicated by Drawings. Dowels shall be supported during concreting operations so as to remain parallel with slab or wall surface and perpendicular to joint. Additional criteria is as follows:
 - 1. Keyways: 1-1/2" deep x d/3 x continuous in walls, slabs, and between walls and footings, where "d" denotes specified wall or slab thickness, unless otherwise indicated by Drawings.
 - 2. Waterstops: Refer to Division 03 Section "Concrete Accessories".
 - 3. Walls: Space construction joints as follows:
 - a. Horizontal Spacing = 60 feet maximum.
 - b. Vertical Spacing = as shown on Drawings.
 - 4. Structural Slabs, Beams, and Girders: Horizontal unit of placement shall not exceed 90 feet in each direction. Girder construction joints shall not occur at face, inner or outer, of intersecting beam. Offset girder joint dimension equal to twice beam width from beam face. This requirement is not applicable to slabs-on-grade.
 - 5. Slabs-on-Metal-Deck: Horizontal unit of placement shall not exceed 90 feet in each direction.
 - 6. Avoid construction joints at areas specified to receive either thin-set tile or resilient floor finish materials. If unavoidable, Contractor shall make reasonable effort to minimize such occurrences. Slab grinding, chipping, filling at such occurrences to achieve specified floor tolerances will be at Contractor's expense.
 - 7. Contact surfaces of construction joints shall be cleaned and intentionally roughened. by removing the entire surface and exposing clean aggregate solidly embedded in mortar matrix. The contact surface must be thoroughly cleaned by chipping or sand-blasting the entire surface not earlier than five (5) days after initial pour or by an event that contact surface becomes coated with earth or sawdust, after being cleaned, entire surface so coated shall be recleaned.
 - 8. Do not make additional construction joints without Architect's written approval.
- C. Crack Control Joints in Slabs-on-Grade: Crack control shall be provided by construction joints at perimeter of LARGE BLOCK PLACEMENTS with checkerboarded interior control joints thereby defining "slab panels". As option, use LANE PATTERN PLACEMENT having longitudinal construction joints with transverse control joints, thereby defining "slab panels". Use following additional criteria:
 - 1. Construction Joints in slabs-on-grade shall be vertically formed, keyed, and doweled as indicated by Drawings. Finish with edging tool having radius of 1/8".
 - 2. Control Joints in slabs-on-grade shall be either sawcut or formed with continuous inserts at Contractor's option, as follows:
 - a. Sawcut Option: Initial sawcuts shall be performed no later than 3 hours after final surface finishing of slab with equipment specifically suited and designed for early concrete sawcutting (dry cut saw) without dislodging aggregate. Perform Final Sawcuts as soon as possible where required to achieve specified joint size. Additional criteria is as follows:

- 1) Initial Sawcuts: 1/8" min. width x 1" min. depth.
 - 2) Final Sawcuts: 1/8" min. width x t/4 min. depth where "t" denotes specified slab thickness.
 - 3) Final joint width of joints to receive sealant or grout shall be 1/4".
 - 4) If Initial Sawcuts can be installed to achieve final required control joint size, this is allowed.
3. Locate crack control joints at column centerlines and at intermediate intervals to restrict "slab panel" size to following limits:
 - a. 145 sq feet at 4" slabs-on-grade.
 4. "Slab panels" shall be approximately square, with no side longer than following:
 - a. 12 feet at 4" slabs-on-grade.
 5. If LARGE BLOCK PLACEMENT is used, maximum permitted placement size shall be 10,000 sf. Plan geometry shall be approximately rectangular where possible, with no edge longer than 1.5 times shortest edge. LARGE BLOCK PLACEMENT criteria shall not operate to relieve Contractor of time limit for initial sawcutting crack control joints, where sawcut option is used. Reduce placement size as required to conform with initial sawcutting time limit.
 6. If LANE PATTERN PLACEMENT is used, lanes shall be one "slab panel" in width. Length may be full width of slab in direction of lane placement, however, this shall not operate to relieve Contractor of time allotted for initial sawcutting crack control joints, where sawcut option is used. Reduce placement lane length as required to conform with initial sawcutting time limit.
- D. Expansion Joints and Isolation Joints: Construct as specifically shown by Drawings, typically without dowels, unless otherwise indicated.

3.03 CONCRETE PLACEMENT

- A. General:
1. Concrete shall not be placed until forms and reinforcement have been inspected and preparations for placement have been completed.
 2. Deposit concrete in forms as nearly in its final position as is possible to avoid rehandling.
 3. Place concrete in reasonably uniform layers, approximately horizontal, and no deeper than 18 inches except that slabs shall be placed in single layer. Placement shall be in manner to avoid vertical or inclined construction joints or other planes of weakness.
 4. Do not pile up concrete in forms in manner that will cause separation or loss of its ingredients.
 5. Place concrete at rate that concrete is plastic at all times and flows readily into spaces between reinforcement.
 6. Do not place concrete that has partially hardened or has been contaminated by foreign materials.
 7. Do not retemper concrete or remix after initial set.
 8. Do not place concrete on previously deposited concrete which has partially set or hardened sufficiently to cause formation of seams or planes of weakness. If section cannot be placed continuously, provide appropriate construction joint as specified herein.
 9. Remove debris and hardened or partially hardened concrete which has accumulated on forms or reinforcement before work proceeds.
 10. Do not permit concrete to drop freely greater than 6 feet. Use suitable equipment such as chute, tremie, or other approved conveyance where longer drops are necessary.
 11. Do not pour directly into excavations where water is standing, unless specific procedures and mix design specifically planned in advance and suited for underwater concrete placement have been made.
 12. Maintain reinforcement in proper position during concreting operations.

- B. Vibration: Thoroughly consolidate each layer of concrete as soon as it is deposited with mechanical vibrators and suitable hand tools, to work mixture well into parts and corners of forms, and entirely around reinforcement and embedded items. Equipment and procedures for consolidation shall conform to ACI 309, unless modified herein.
1. Do not overvibrate or use vibrators to transport concrete within forms.
 2. Insert and withdraw vibrators in vertical manner at sufficient points no farther apart than visible effectiveness of vibrator. Vibrator shall penetrate rapidly to bottom of placed layer and at least 6 inches into preceding layer if there is such. Duration of vibration at each point shall be sufficient to consolidate concrete but not excessive so as to cause segregation.
 3. Do not insert vibrator into lower layers that have begun to set.
 4. Maintain spare vibrator on job site during concrete operations.
- C. Bonding:
1. Prepare for bonding of fresh concrete to previously deposited concrete where contact surface is specifically noted on Drawings to be "Intentionally Roughened", as follows:
 - a. Before depositing new concrete on or against previously deposited concrete which has partially or entirely set, roughen surface of concrete in manner which will expose aggregate uniformly and leave contact surface clean, free of laitance, dust, loosened particles of aggregate or otherwise damaged aggregate concrete, or other bond-inhibiting material. Intentionally roughen surface to achieve amplitude of approximately 1/4 inch.
 - b. Prepared surface of previously deposited concrete shall be dampened (but not saturated) immediately prior to placing fresh concrete.
 2. Hardened concrete of horizontal joints in exposed work; horizontal construction joints in beams, girders, joists, and slabs; and horizontal construction joints in work designed to contain liquids shall be prepared same as described above for "Intentionally Roughened" surfaces. Additional requirements are as follows:
 - a. Apply approved Bonding Compound to roughened and cleaned surface of set concrete.
 - b. Mix and apply Bonding Compound in accordance with written instructions of manufacturer.
 - c. Apply fresh concrete to prepared surface within time limit recommended by Bonding Compound manufacturer.
- D. Hot Weather Concreting:
1. Definition: Conditions requiring hot weather concrete practices are defined as any combination of high ambient temperature, high concrete temperature, low relative humidity, wind speed, and solar radiation that tend to impair quality of freshly mixed or hardened concrete by accelerating rate of moisture loss and rate of cement hydration, or otherwise causing abnormal or detrimental results.
 - a. Maximum acceptable concrete temperature at truck discharge point is 95 degrees Fahrenheit, unless otherwise specified.
 - b. When conditions occur which cause rate of evaporation of 0.2 lb./sq.ft./hr. or higher, as determined by ACI 305, Figure 2.1.5, precautions to avoid plastic shrinkage cracking shall be taken.
 2. Records: Maintain records of outside air temperature, concrete temperature per ASTM C 1064, wind speed, relative humidity, and other general weather conditions that might impair concrete quality or strength during hot weather conditions as defined.
 3. When hot weather conditions exist, as defined, following items, all or in part as required, shall be undertaken by Contractor to maintain acceptable concrete temperature and to minimize possibility of plastic shrinkage cracking:

- a. Design concrete mixes specifically for hot weather conditions, utilizing fly ash, ground granulated blast-furnace slag, or both as partial replacements for Portland Cement.
 - b. Schedule concrete placement for early morning, late afternoon, or night, unless not permitted by Owner or other governing authority.
 - c. Cool ingredients before mixing to maintain concrete temperature at truck discharge point to below 95 degrees Fahrenheit. Mixing water may be chilled or use chopped ice to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.
 - d. Cover reinforcing steel with water-soaked burlap such that steel temperature will not exceed ambient air temperature sufficiently in advance of embedding in concrete.
 - e. Fog spray forms, reinforcing steel, and subgrade just prior to placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
 - f. Use water-reducing retarding admixture when required by conditions.
 - g. Minimize time between mixing and placement of concrete.
 - h. Do not add water to ready-mixed concrete at job site unless it is part of amount initially required for proportioned mix design maximum W/C ratio and specified slump. Addition of water in excess of proportioned maximum water-cementitious material ratio to compensate for loss of workability is prohibited.
 - i. Plan concrete placements so that reinforcement has been placed and inspected, and forms, equipment and workers are ready to receive and handle concrete.
 - j. Keep equipment cool by spraying with water, including chutes, conveyors, pump lines, tremies, and buggies, however do not permit cooling water to effect water content and properties of fresh concrete.
 - k. Protect slab concrete during stages of placing and finishing against moisture loss due to rapid evaporation by applying fog mist spray above surface and applying monomolecular film, evaporation retarding agent.
 - l. Provide continuous curing, preferably moist curing during first 72 hours using absorptive blankets kept continuously wet, or, at appropriate pre-planned locations by applying curing compound complying with ASTM C309, with moisture loss not exceeding 0.39 kg. per sq. meter in 72 hr. period. Use of curing compounds at floors to receive adhered floor coverings shall be in accordance with Div. 3 Section "Concrete Finishing" and shall be evaluated by Contractor prior to use for implications on concrete drying and satisfactory floor covering installation. Continue curing for minimum of 7 days. Do not change curing methods until concrete is at least 3 days old.
 - m. Loosen forms as soon as possible and run curing water down inside. When forms are removed, provide wet blanket curing cover to newly exposed surfaces for minimum of 7 days curing period. After curing period, covering should stay in place without wetting for additional 4 days.
4. Mass Concrete Requirements: Special batching, curing, and protection measures shall be used for concrete identified as "mass concrete". Batch mass concrete in accordance with paragraph above, "Mass Concrete Batching", and deliver to forms at temperature not less than 50 degrees Fahrenheit, but sufficient to control maximum temperature of 85 degrees Fahrenheit. Curing time and procedure is dependent on ambient conditions anticipated at time of placement, and therefore shall be developed by Contractor with consideration to applicable criteria of ACI 207.1R. Utilize fly ash, ground granulated blast-furnace slag, or both as partial replacements for Portland Cement. Subject to Engineer's approval.
- E. Cold Weather Concreting:
- 1. Definition:
 - a. Do not place concrete when outside air temperature is 40 degrees Fahrenheit. or less unless cold weather concreting practices are followed as specified below. Use cold

weather concreting practices whenever following conditions exist for more than 3 consecutive days:

- 1) Average daily air temperature is less than 40 degrees Fahrenheit., where average daily air temperature is average of highest and lowest temperatures occurring during period from midnight to midnight.
 - 2) Air temperature is not greater than 50 degrees Fahrenheit. for more than one half of any 24 hour period.
 - b. Concrete temperature at time that concrete is mixed and delivered to jobsite shall conform to following temperature ranges:
 - (a) Air Temperature Minimum Concrete Temperature
 - (1) Above 30 degrees Fahrenheit. 60 F.
 - (b) 0 to 30 degrees Fahrenheit. 65 F.
 - (c) Below 0 degrees Fahrenheit. 70 F.
 - c. Minimum temperature of concrete during placement and curing shall be 55 degrees Fahrenheit.
 - d. Maximum temperature of concrete at point of placement when heated by artificial means shall not exceed 90 degrees Fahrenheit.
 - e. Maximum allowable temperature drop of concrete surfaces during first 24 hours after end of protection period shall not exceed following requirements:
 - (a) Section Size Maximum Allowable
 - (1) Minimum Dimension Temperature Drop
 - (b) Less than 12" 50 degrees Fahrenheit.
 - (1) 12" to 36" 40 degrees Fahrenheit.
 - (2) 36" to 72" 30 degrees Fahrenheit.
2. Specification: Cold weather concreting practices required to maintain concrete temperatures as specified above shall be followed according to ACI 306.1.
 3. Records:
 - a. Maintain records of date, time, outside air temperature, temperature of concrete as placed and general weather conditions during cold weather conditions.
 - b. Record air temperature and concrete temperature at regular intervals, but not less than 4 times per 24 hour period. Record concrete temperature at several locations on surface, corners, and edges of concrete to monitor effectiveness of protection provided. Use lowest reading to represent temperature of section at that time.
 - c. Record maximum and minimum temperature readings for each 24 hour period.
 4. Following items are considered minimum steps that shall be undertaken by Contractor during cold weather conditions to maintain acceptable concrete temperature. Other actions and procedures to satisfactorily protect concrete during cold weather conditions may be necessary and are responsibility of Contractor.
 - a. Design concrete mixes specifically for cold weather conditions. Use air entrainment (where acceptable), limit W/C ratio to 0.45, and obtain high early strength by using higher cement content, high early strength Portland Cement (Type III) or non-chloride, non-corrosive accelerator as specified.
 - b. Heat mixing water and adjust mixing water temperature by blending hot and cold water to obtain concrete temperature within specified acceptable range.
 - c. Uniformly heat aggregates to eliminate ice, snow, and frozen lumps of aggregate and to prevent moisture variation in stockpile.
 - d. Cover thawed or heated stockpiles with tarpaulins to retain heat.
 - e. Add air-entraining admixture to batch after water temperature has been reduced by contact with cooler solid materials.
 - f. Submit detailed procedures for production, transportation, placement, protection, curing, and temperature monitoring of concrete during cold weather.

- g. Frozen subgrade shall be thawed prior to concrete placement.
- h. Remove snow, ice, and frost such that it does not occupy space intended to be filled with concrete.
- i. Cover metal embeds and wrap protruding reinforcing bars with insulation to avoid heat drain from fresh concrete and prevent localized freezing of concrete.

3.04 SCREEDING CONCRETE (AT ELEVATED FLOOR SURFACES)

- A. Act of striking off surface of concrete to predetermined grade conforming to elevations shown on Drawings shall be accomplished with use of rigid screed guides. Use of wet screed guides is to be avoided on elevated surfaces. Additional requirements and suggestions are as follows:
- B. Concrete on Metal Deck and Steel Beam Framing System:
 - 1. Grade for strike off shall be set at predetermined distance above top surface of steel floor members. Metal deck continues to deflect for short period after strike off; subsequent restraighening of surface often moves concrete paste from over beams into resulting depressions. It is suggested that Contractor plan for initial slab thickness over beams of design depth plus 1/8 inch. This should provide sufficient material to restraighen surface and still maintain adequate concrete cover over beams.
 - 2. It is anticipated that occasional areas will be identified where actual deflection of steel beams during concreting operations differs from that anticipated by Engineer. At such locations, modify procedures by one or combination of following:
 - a. Residual camber after concrete placement: Modify fabricated camber in shop where possible. Where this is not possible, maintain initial thickness at midspan and increase slab thickness at each end of beam by 1/2 of amount of residual camber. In case of beam with 1/2 inch of residual camber, slab thickness at ends of this beam only might be increased by 1/4 inch.
 - b. Over-deflection of beam during concrete placement: Modify fabricated camber where possible. Where this is not possible, two options are suggested. Option one is to attach shore to underside of this beam only at midspan. Leave initial gap below shore equal to beam camber. As beam deflects during concrete placement, shore will stop deflection at desired point. Option two is to maintain initial concrete slab thickness at each end of this beam only, and to increase slab thickness at midspan by amount of over deflection experienced.
 - 3. Bench mark shall be provided on each column for use by finishers as guide when they are completing finishing in these areas. It is suggested that mark be placed at predetermined distance above design grade (trowels are 16 inches long) for use by finishers in the removal of excess material as needed.
 - 4. Contractor shall include in his bid any additional concrete required to achieve specified slab surface finish tolerance. Finish floor tolerances shall be as specified in Division 03 Section "Concrete Finishing".
- C. Cast-in-Place Concrete Framing System:
 - 1. Grade for strike off shall be set at predetermined distance above top surface of formwork. Minimum slab thickness, as specified on Drawings, shall be maintained throughout slab surface. Formwork continues to deflect for short period after strike off; subsequent restraighening of surface often moves concrete paste from over beams into resulting depressions. It is suggested that Contractor plan for initial slab thickness of design depth plus 1/8 inch. This should provide sufficient material to restraighen surface and still maintain adequate concrete cover over reinforcing steel.
 - 2. It is anticipated that occasional local areas will be identified where actual deflection of formwork during concreting operations differs from that anticipated by Contractor. In these isolated areas only, adjustments in concrete thickness may be indicated or necessary. Minimum slab thickness, as specified on Drawings, shall be maintained throughout slab

surface. Modify formwork camber where possible. Where over deflection of formwork occurs, maintain concrete slab design thickness at each end of affected beams and increase slab thickness at mid-span by amount of over deflection experienced.

3. Contractor shall include in his bid any additional concrete required to achieve specified slab surface finish tolerance. Finish floor tolerances shall be as specified in Division 03 Section "Concrete Finishing".

3.05 MISCELLANEOUS CONCRETE ITEMS

- A. Floor Toppings: Place bonded and unbonded topping slabs indicated by Contract Documents conforming to following guidelines:
 1. Bonded Toppings: Topping slabs less than 3 inches thick shall be considered to be bonded toppings unless specifically indicated otherwise. Topping slabs 3 inches thick and greater that are considered as bonded toppings are specifically noted as such in Drawings. Satisfactorily pre-plan and prepare for placement of bonded topping slabs as follows:
 - a. Finish surface of base concrete shall consist of "scratch finish" obtained when base course is partially set by brushing with coarse wire broom. No troweling permitted.
 - b. If base course has not been prepared with noted "scratch finish", then roughening of base slab surface by sandblasting or other approved mechanical methods to achieve satisfactory surface amplitude will be required. Surface amplitude shall not be less than 1/8" or as otherwise recommended by overlay installer and approved by Engineer.
 - c. Base slab roughening technique/equipment shall be a process selected by Contractor, however, certain high impact techniques, (including but not limited to scarifying, scabbling, and rotomilling), are known to result in "bruising" and/or "micro-cracking", thereby weakening tensile/bond strength of substrate to receive bonded overlay. Where high impact surface preparation techniques are used, follow with sandblasting or other approved method.
 - d. Remove deteriorated concrete, dirt, oil, grease, dust, and other bond-inhibiting materials from surface.
 - e. Dampen prepared surface with clean water . Surface should be at moisture condition of saturated surface dry with no standing or glistening water at time of topping placement.
 - f. Apply product "scrub-coat", bonding agent, or bonding adhesive as recommended by overlay product manufacturer's written instructions. Where manufacturer's instructions do not require pre-dampening of prepared surface, omission of this step may be considered, but only with approval of Engineer.
 - g. Use following concrete topping products:
 - (a) Topping Thickness Product
 - (b) 1/2" to 1" Polymer-Modified Cementitious Mortar. (Use of other pre-mixed cement based mortars specifically manufactured for thin overlay applications may be considered but only with approval of Engineer.)
 - (c) Greater than 1" but Polymer-Modified Cementitious Mortar extended
 - (d) less than 3". with 3/8" maximum aggregate. (Use of other pre-mixed cement based mortars with aggregate extension specifically suited for thin overlay applications may be considered but only with approval of Engineer.)
 - (e) 3" and greater Conventional Concrete as specified in Drawings with bonding compound applied to base concrete.
 - h. No topping shall be less than 1/2 inch in total thickness.
 2. Unbonded Toppings: Topping slabs 3" thick and greater shall be considered as unbonded toppings unless specifically indicated otherwise. Prepare for placement of unbonded topping slabs as follows:

- a. Broom and vacuum clean base surface to receive topping.
 - b. Apply appropriate bond breaker compound to base surface when indicated on Drawings.
 - c. Use conventional concrete as specified in Drawings.
- B. Filling in: Fill in holes and openings left in concrete work for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work.
- C. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to hard, dense finish with corners, intersections, and terminations slightly rounded.
- D. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.
- E. Column Base Plates, Equipment Bases, and Foundations: Grout column base plates, equipment bases and foundations as indicated using specified non-shrink grout. Use non-metallic grout for exposed conditions, unless noted otherwise.
- F. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in safety inserts and accessories as shown on Drawings. Screed, tamp, and finish as required by Division 03 Section "Concrete Finishing".

3.06 CURING, PROTECTING, AND FINISHING CONCRETE

- A. Refer to Division 03 Section "Concrete Finishing".
- B. Protect freshly placed concrete from washing by rain or flowing water.
- C. Do not allow concrete to dry out from time it is deposited in forms until expiration of curing period.
- D. Protect floor slabs, platforms, and steps whenever scaffolding, shoring, formwork, masonry, concrete, or other work is being done on or above finished concrete slabs.
- E. Satisfactorily replace imperfect or damaged work, or material damaged or determined to be defective, before final completion and acceptance of entire job, in conformity with requirements of Drawings and Specifications, at Contractor's expense.
- F. After curing phase, control water at areas to receive adhesives, coatings, or other finish material(s) sensitive to moisture or water vapor.

3.07 FLOOR FLATNESS/LEVELNESS MEASUREMENT AND TOLERANCES

- A. Refer to Division 03 Section "Concrete Finishing" for required floor flatness and levelness criteria and Quality Control.

3.08 CLEANING

- A. Remove forms, equipment, protective coverings and rubbish resulting there from premises upon completion of work.
- B. Leave finished concrete surfaces in clean and undamaged condition, free of mortar, concrete droppings, loose dirt and mud, and satisfactory to Owner.
- C. Promptly, effectively and satisfactorily repair damage to floors.

3.09 FIELD QUALITY CONTROL

- A. The Owner will employ and pay a qualified independent testing agency to perform the following testing for field quality control, including special inspections required by local building code.

Retesting of materials failing to meet specified requirements shall be done at Contractor's expense. Specific items and testing to be performed at Contractor's expense are noted as such.

1. Tests of Concrete required to determine compliance with this specification shall be made by a certified ACI Concrete Field Testing Technician, Grade I or equivalent.
 2. The technician performing the strength tests shall be certified as an ACI Concrete Laboratory Testing Technician, Grade I or II or by an equivalent written and performance test program.
 3. The laboratory performing the tests shall conform to the requirements of ASTM C1077.
- B. Structural Concrete Control and Testing:
1. Secure composite samples in accordance with ASTM C 172. Each sample shall be obtained from different batch of concrete on random basis, avoiding selection of test batch other than by number selected at random before commencement of concrete placement.
 2. Perform sampling at following locations:
 - a. Adjacent to concrete mixer as concrete is delivered from mixer to conveying vehicle, unless otherwise noted.
 - b. At end of discharge hose, when concrete is pumped. Location shall be in reasonable close proximity to placement area, so as to satisfactorily simulate conditions at end of hose.
 3. Concrete shall be tested as follows:
 - a. Mold and cure four specimens (one strength test) from each sample in accordance with ASTM C 31.
 - b. Two specimens shall be tested at seven days for information and two shall be tested at 28 days for acceptance. Acceptance test results shall be average of two specimens at 28 days.
 - c. Refer to Division 03 Section "Concrete Forming" for testing requirements for early formwork removal.
 4. Deviations from requirements of ASTM Specifications shall be recorded in test report. Test concrete specimens in accordance with ASTM C 39.
 5. Make at least one strength test for each 100 cu. yd. or fraction thereof or for each 5,000 sq feet of floor slab or wall area, of each mix design of concrete placed in one day. Determine slump of concrete sample for each strength test and whenever consistency of concrete appears to vary, in accordance with ASTM C 143.
 6. Make one additional strength test (four specimens) for each truck in which 2.5 gallons per cubic yard or more mixing water has been added to truck after concrete has been batched in Batch Plant. This additional strength test shall be at Contractor's expense.
 7. Verify water to cement ratio is not exceeded if water is added to concrete mix in truck or otherwise. Addition of water beyond limits given on approved mix design shall not be permitted.
 8. Inspect each batch of concrete, report adjustment to amounts of mixing water and reason(s) for adjustment, in accordance with approved mix design, to assure uniform consistency from truck to truck. Check mixing time of concrete in trucks.
 - a. Testing Laboratory will issue Report of Field Inspection of Concrete for each concrete pour. Report shall identify project name, client, concrete supplier, date of placement, and name and signature of inspector.
 - b. Report will be in tabular form and include following information for each truck of concrete:
 - 1) Concrete cylinder set numbers, if cylinders were taken from that truck.
 - 2) Number of cylinders molded, if applicable.
 - 3) Time truck was dispatched and time unloaded.
 - 4) Number of yards of concrete in truck.

- 5) Water-to-cement (W/C) ratio.
 - 6) Slump, air content, and admixtures.
 - 7) Concrete temperature.
 - 8) Specific location of placement. Use column grids whenever possible to describe location.
 - 9) Other remarks, i.e. amount of water added, if any, and reason(s).
9. Should strength of concrete fall below minimum, then additional tests may be required. These tests, if required, shall be made at Contractor's expense and shall be in accordance with ASTM C 42, and ACI 318. If core sample strength tests and/or load test results do not meet strength requirements, then structure, or part of structure shall be removed and replaced at Contractor's expense.
 10. Testing Laboratory will issue timely consecutively numbered Concrete Compressive Strength Reports with following information for each set of strength test specimens:
 - a. Project name, Client, and concrete supplier.
 - b. Date sampled.
 - c. Name of technician performing inspection with ACI certification number.
 - d. Truck number and ticket number.
 - e. Concrete batch weights and whether or not batch plant inspection was performed.
 - f. Time concrete was batched and time sampled.
 - g. Air temperature and concrete temperature at time of sampling.
 - h. Slump, air content, and water-to-cement ratio.
 - i. 28 day compressive strength requirement, f'c.
 - j. Concrete mix designation, number, or other identification.
 - k. Descriptive and graphic location of placement. Provide grid locations whenever possible to describe location.
 - l. Concrete cylinder set number.
 - m. Date tested, concrete age, and compressive strength results.
 - n. Remarks that may affect concrete quality, including water added at site, elapsed time between start of mixing to completion of placement, and variation in curing requirements.
 11. Report promptly to Architect details of non-conforming concrete. Give information concerning locations of concrete pours, quantities, date of pours and other pertinent facts concerning concrete represented by specimens.
- C. Early Formwork Removal Time Control and Testing:
1. If early formwork removal is desired by Contractor, additional cylinders and testing performed for this purpose are required and shall be at Contractor's expense.
 2. Testing requirements are specified in Division 03 Section "Concrete Forming".

END OF SECTION

**SECTION 03 3511
CONCRETE FLOOR FINISHES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Clear penetrating sealers.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.
- B. Section 03 3000 - Cast-in-Place Concrete: Curing compounds that also function as sealers.
- C. Section 09 9600 - High-Performance Coatings.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with concrete floor placement and concrete floor curing.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.
- C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.
- D. Warranty Documentation: Manufacturer warranty; ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 MOCK-UP

- A. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.
- B. Mock-Up Size: 10 feet square.
- C. Locate where directed.
- D. Mock-up may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.07 FIELD CONDITIONS

- A. Do not finish floors until interior heating system is operational.
- B. Maintain ambient temperature of 50 degrees F minimum.

1.08 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a two-year period commencing on the Date of Substantial Completion.

PART 2 PRODUCTS

2.01 COATINGS

- A. Penetrating Sealer: Transparent, nonyellowing, water- or solvent-based coating.
 - 1. Composition: Silane-siloxane mixture.
 - a. Products:
 - 1) Clemons Concrete Coatings:
 - 2) Concrete Sealers USA:

3) Hi-Tech Systems;

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that floor surfaces are acceptable to receive the work of this section.
- B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 GENERAL

- A. Apply materials in accordance with manufacturer's instructions.

3.03 COATING APPLICATION

- A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.
- B. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.
- C. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

END OF SECTION

**SECTION 04 2000
UNIT MASONRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete block.
- B. Mortar and grout.
- C. Reinforcement and anchorage.
- D. Flashings.
- E. Lintels.
- F. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 2000 - Concrete Reinforcing: Reinforcing steel for grouted masonry.
- B. Section 06 1000 - Rough Carpentry: Nailing strips built into masonry.
- C. Section 07 2100 - Thermal Insulation: Insulation for cavity spaces.
- D. Section 07 6200 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.
- E. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.
- C. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- E. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.
- F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.
- G. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2023.
- H. ASTM C91/C91M - Standard Specification for Masonry Cement; 2023.
- I. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2023.
- J. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2023a.
- K. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.
- L. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.
- M. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.
- N. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2023.
- O. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.

- P. ASTM C476 - Standard Specification for Grout for Masonry; 2023.
- Q. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.
- R. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.
- S. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

1.04 ADMINISTRATIVE REQUIREMENTS

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Samples: Submit four samples of decorative block units to illustrate color, texture, and extremes of color range.
- D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
- E. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.
- F. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.

1.06 QUALITY ASSURANCE

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depth of 8 inches or as noted on contract drawings.
 - 2. Load-Bearing Units: ASTM C90, normal weight.
 - a. Hollow block, as indicated.
 - 3. Units with Integral Water Repellent: Concrete block units as specified in this section with polymeric liquid admixture added to concrete masonry units at the time of manufacture.
 - a. Use only in combination with mortar that also has integral water repellent admixture.
 - b. Use water repellent admixtures for masonry units and mortar by a single manufacturer.
 - c. Manufacturers:
 - 1) Amerimix, an Oldcastle brand; CMU with Rainbloc GP:
 - 2) Substitutions: See Section 01 6000 - Product Requirements.

2.02 MORTAR AND GROUT MATERIALS

- A. Masonry Cement: ASTM C91/C91M, Type N. Type S or Type M as required.
- B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Mortar Aggregate: ASTM C144.

- E. Grout Aggregate: ASTM C404.
- F. Water: Clean and potable.

2.03 REINFORCEMENT AND ANCHORAGE

- A. Manufacturers:
 - 1. Hohmann & Barnard, Inc; X-Seal Anchor:
 - 2. WIRE-BOND
 - 3. Dur-O-Wal.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi), deformed billet bars; galvanized.
- C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- D. Strap Anchors: Bent steel shapes, 1-1/2 inch width, 0.105 inch thick, 24 inch length, with 1-1/2 inch long, 90 degree bend at each end to form a U or Z shape or with cross pins, stainless steel.

2.04 FLASHINGS

- A. EPDM Flashing: ASTM D4637/D4637M, Type I, 0.040 inch thick.
 - 1. Manufacturers:
 - a. Heckmann Building Products, Inc:
 - b. Hohmann & Barnard, Inc:
 - c. WIRE-BOND:
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Flashing Sealant/Adhesives: Silicone, polyurethane, or silyl-terminated polyether/polyurethane or other type required or recommended by flashing manufacturer; type capable of adhering to type of flashing used.
 - 1. Manufacturers, Synthetic Rubber Products:
 - a. Substitutions: See Section 01 6000 - Product Requirements.
- C. Termination Bars: Stainless steel; compatible with membrane and adhesives.
- D. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.
- E. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.05 ACCESSORIES

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
 - 1. Manufacturers:
 - a. Hohmann & Barnard, Inc:
 - b. WIRE-BOND
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.
 - 1. Manufacturers:
 - a. Hohmann & Barnard, Inc: www.h-b.com/sle.
 - b. WIRE-BOND
 - c. Substitutions: See Section 01 6000 - Product Requirements.

- C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.06 MORTAR AND GROUT MIXING

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
 - 1. Masonry below grade and in contact with earth: Type S.
 - 2. Exterior, loadbearing masonry: Type N.
 - 3. Exterior, non-loadbearing masonry: Type N.
 - 4. Interior, loadbearing masonry: Type N.
- B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
- C. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

- A. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

- A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.04 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches.
 - 3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar and mortar smears as work progresses.
- E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

3.06 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.
- E. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.

3.07 LINTELS

- A. Install loose steel lintels over openings.
- B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.

3.08 GROUTED COMPONENTS

- A. Lap splices minimum 24 bar diameters.
- B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- C. Place and consolidate grout fill without displacing reinforcing.
- D. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

3.09 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

3.10 BUILT-IN WORK

- A. As work progresses, install built-in metal door frames, anchor bolts, and plates and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout.

3.11 TOLERANCES

- A. Install masonry within the site tolerances found in TMS 402/602.

3.12 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
- B. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.
- C. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.13 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.

3.14 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

**SECTION 05 1200
STRUCTURAL STEEL FRAMING**

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2018.
- B. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
- C. ASTM A449 - Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use; 2014 (Reapproved 2020).
- D. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.
- E. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.
- F. SSPC-SP 2 - Hand Tool Cleaning; 2024.
- G. SSPC-SP 3 - Power Tool Cleaning; 2024.
- H. SSPC-SP 11 - Power-Tool Cleaning to Bare Metal; 2020.

1.02 SUMMARY

- A. Section includes structural steel and supplementary items necessary to complete work required for its installation.
- B. Structural steel is that work defined in AISC "Code of Standard Practice" and as otherwise shown on drawings.
- C. Miscellaneous metal fabrications, steel joists and metal deck are specified elsewhere in Division 5.

1.03 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Preliminary Connection Review with Steel Fabricator:
 - 1. Proposed variations in details shown on drawings will be considered and such variations must have preliminary approval prior to preparation of detailed shop drawings.
- C. Submit in advance of fabrication, complete shop drawings prepared under supervision of Registered Professional Engineer necessary for fabrication of each component part of structural steel framing including following:
 - 1. Member size, length and camber.
 - 2. Bill of materials.
 - 3. Material specifications.
 - 4. Bolt hole size, bolt size and bolt type.
 - 5. Details of cuts, copes and bevels.
 - 6. Piece marks for field assembly.
 - 7. Splices.
- D. Submit erection drawings ("E" Sheets) as part of shop drawings, showing complete information necessary for erection of each component part of structural steel framing, including following:
 - 1. Setting drawings, templates and directions for installation of anchor bolts and other anchorage devices embedded in concrete or masonry work.
 - 2. Dimensions for alignment and elevation of each member.
 - 3. Location of members and attachments by match-marking of piece members.
 - 4. Type and location of each field connection.
 - 5. Required number and location of shear connectors on each member.

6. Details of each field connection or typical connection.
 7. Piece marks for field assembly.
 8. Splices.
 9. Size, length and type of bolts required in each field connection.
- E. Shop drawings shall not be made by using reproductions of Contract Drawings.
- F. Shop drawing shall be submitted through General Contractor to Architect. Any fabrication of material before approval of drawings will be at risk of Contractor.
1. Fabricated material and connections shall fit within architectural constraints.
 2. Fabricator alone shall be responsible for errors of detailing and fabrication.
- G. Both shop and field welding and required non-destructive testing shall be indicated on shop drawings by welding symbols and nondestructive testing symbols as shown in latest edition of AWS SPEC. A2.4 SYMBOLS FOR WELDING AND NON-DESTRUCTIVE TESTING.
1. Special conditions shall be fully explained by added notes or details.
 2. Welding symbols for groove welds shall indicate groove depth required to obtain specified effective throat thickness for welding process and position of welding to be used.
 3. Details of groove welds, joints, and preparation of base material shall be referenced to pre-qualified joint specified in AWS Code Figs. 2.9 through 2.11 and shall clearly distinguish between complete joint penetration and partial joint penetration.
 4. Fillet weld symbols shall indicate required weld size to obtain required effective throat thickness and effective length.
- H. Welding Procedures:
1. Welding Procedure Specification (WPS) for both shop and field welds, which are deemed prequalified in accordance with AWS Code Section 5 shall be prepared as written procedures and shall be made available to testing agency and posted next to welding equipment in Fabricator's plant.
 2. Welding Procedures Specifications (WPS) and other procedures, along with tests required to qualify procedure in accordance with AWS Code Section 5.2, shall be submitted for approval prior to use.
- I. Submit manufacturer's certification and test data that following items furnished conform to following specifications:
1. High strength bolts, including nuts and washers, ASTM A 325 or ASTM A 490.
 2. Filler metal for welding - appropriate AWS Specification - refer to Paragraph 2.2/F.
 3. Shear connectors - ASTM A108 - stud base qualification requirements in accordance with AWS Code Appendix IX.
 4. Non-shrink grout
 5. Structural steel primer paint
 6. Inorganic or other protective coatings.
 7. Direct tension indicators.
 8. Tension control bolts.
- J. Fabricator/Erector shall submit to Testing Laboratory reports of non-destructive testing required of them. These reports shall be on AWS suggested forms or similar form containing same information.
- K. Contractor shall submit to the Engineer and the enforcing agency, for acceptance, a quality control or inspection plan that addresses all inspection issues, including in process and final inspection that are addressed in AWS D1.1.
- L. The qualification of the contractor's Inspectors and NDE personnel shall be submitted to the engineer and enforcement agency for acceptance.

1.04 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following, except as otherwise indicated:
 - 1. American Institute of Steel Construction (AISC) "Code of Standard Practice for Steel Buildings and Bridges" including "Commentary".
 - a. Paragraph 4.2.1 of the above code is hereby modified by deletion of the following sentence:
 - 1) "Where the fabricator must select or complete connection details, this approval constitutes acceptance by the owner's authorized representative of design responsibility for the structural adequacy of such connections. If a fabricator wishes to change a connection that is fully detailed in the contract documents, the fabricator shall submit the change for review by the owner's authorized representative in a manner that clearly indicates that a change is being requested. Approval of this submittal constitutes acceptance by the owner's authorized representative of design responsibility for the structural adequacy of the changed detail."
 - 2. AISC "Specification for Structural Steel Buildings."
 - 3. AISC "Specification for Structural Joints using ASTM A 325 or A 490 Bolts".
 - 4. American Welding Society (AWS) D1.1-94 "Structural Welding Code - Steel."
 - 5. ASTM A 6 "General Requirements for Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use."
 - 6. Steel Structures Painting Council - "Steel Structures Painting Manual", Volumes 1 and 2.
- B. Qualifications for Welding Work: Qualify welding procedures and welding operators in accordance with AWS "Qualification" requirements.
 - 1. Fabricator and Erector shall provide Architect and Testing Laboratory with names of welders to be employed on Work, together with certification that each of these welders has passed qualification tests using procedures covered in American Welding Society Standard D1.1, and/or D.1.3 as applicable to specific welding work to be performed.
 - a. Fabrication shop welders shall be certified by qualification tests and recertified per AWS requirements within the last year.
 - b. Field erection welders shall be certified by test within the last year or shown to be continuously employed by erector since initial qualification tests and recertified per AWS requirements within the last year.
 - 2. If recertification of welders is required to meet the above criteria, retesting will be Contractor's responsibility.
- C. Steel Erector shall have 10 years experience.
 - 1. Certified Welders - Refer to Paragraph "B" above.
- D. Members designated on drawings (if any) as "Architectural Exposed Structural Steel" (AESS) shall comply with AISC Code, Section 10. This section covers fabrication care, erection care and dimensional tolerances of AESS members and components.
 - 1. Match abutting cross-section configuration so that joints align.
 - 2. Grind smooth all weld joints to remove weld show-through.
- E. Material shall be properly identified in accordance with UBC, 1994 Edition, Section 2202.]

1.05 PROPOSED SUBSTITUTIONS

- A. Substitutions of sections or modifications of details, if proposed by Contractor, shall be submitted for approval in sketch form prior to submission of shop drawings, and such substitutions shall be made only when approved by Architect, and at no additional cost to Owner. Total amount of credit, if any, shall be stated in writing with submission.
- B. Corrections for inaccuracies that result in change from Structural Drawings or final approved shop drawing details shall be submitted in sketch form for approval. Such substitutions or

corrections shall be made only when approved by Architect.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site at such intervals to ensure uninterrupted progress of work.
- B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not delay work.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration. If bolts and nuts become dry or rusty, clean and relubricate before use.
 - 1. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.
 - 2. Store materials, other than fabricated steel, in weathertight containers until ready for use in work. Store containers in dry place.
 - 3. Store electrodes in rod ovens and heat in accordance with AWS Code section 4.5 prior to use in welding.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Specific product, material or manufacturer listed under each item below is "acceptable" only if manufacturer can evidence product compliance with requirements of Contract Documents.
- B. For manufacturers not listed, submit as substitution according to the Conditions of the Contract and Division 1 Specification Sections.

2.02 MATERIALS

- A. Metal Surfaces, General: For fabrication of work that will be exposed to view, use only materials that are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and applying surface finishes.
- B. Structural Steel: Shapes, bars, plates and structural pipe as indicated on Structural Drawings conforming to one of following ASTM Specifications are approved for use under this specification. Base plates and column materials are to be inspected and tested as specified in Paragraph 2.2.B.7.
 - 1. Structural Steel Shapes, Plates, and Bars - Carbon Steel, ASTM A 36, "Standard Specification for Structural Steel."
 - 2. Welded and Seamless Pipe - ASTM A 501, or ASTM A 53, Types "E" or "S", Grade B, 35,000 psi minimum yield strength.
 - 3. Structural Tubing - ASTM A 500, Grade B, 46,000 psi minimum yield strength.
 - 4. Structural Steel Shapes, Plates, and Bars - High Strength Steel, ASTM A 572, Grade 50, "Standard Specification for High Strength Low Alloy Columbium-Vanadium Steels of Structural Quality.
 - 5. Supply fine grain killed steel for Group 3, 4 and 5 rolled shapes, (W14 series W14 x 145 and larger and W12 series W12 x 120 larger).
 - 6. Steel in Group 3, 4 and 5 rolled shapes subjected to primary tensile stresses due to tension or flexure, or spliced with full penetration welds shall be supplied with Charpy V-Notch testing in accordance with ASTM A 6, Supplementary Requirement S5. Impact test shall meet minimum average value of 20 ft-lbs. absorbed energy at +70 deg. F. and shall be conducted in accordance with ASTM A 673 with following exceptions:
 - a. Center longitudinal axis of specimens shall be located as near as practical to midway between inner flange surface and center of flange thickness at intersection with web

mid-thickness.

7. For plates exceeding 2 inch thickness, steel shall be supplied with Charpy V-Notch testing in accordance with ASTM A 6, Supplementary Requirement S5. Impact test shall be conducted in accordance with ASTM A 673, Frequency P and shall meet a minimum average value of 20 feet-lbs. absorbed energy at +70 deg. F.
 8. Steel plates 1-1/2 inches and thicker shall be tested in mill in conformance with ASTM A 435, "Straight-Beam Ultrasonic Examinations of Steel Plates" using S1 Supplementary Requirements to assure delivery of steel plates free of gross internal discontinuities such as pipe, ruptures, and laminations.
- C. High Strength Bolts and Washers:
1. High strength bolts for structural joints, including suitable nuts and plain hardened washers - ASTM A 325 SC and ASTM A 325 N where noted.
 - a. Bolts and nuts for high strength bolts shall be heavy hex head conforming to ANSI Standards B18.2.1 and B18.2.2 respectively. Nuts shall conform to ASTM A 563, "Standard Specification for Carbon and Alloy Steel nuts".
 - b. Washers shall be circular, flat and smooth and shall conform to requirements of Type A washers in ANSI Standard B23.1. Washers for high strength bolts shall be hardened and conform to ASTM F 436, Specification for Hardened Steel Washers. Beveled washers for American Standard Beams and channels shall be square or rectangular, shall taper in thickness (16-2/3 percent slope) with average thickness of 5/16 inch. When an outer face of a bolted part has a slope greater than 1:20 with respect to a plane normal to bolt axis, a beveled washer shall be used.
 2. Quenched and tempered alloy steel bolts for structural steel joints - ASTM A 490.
 3. Direct Tension Indicator Tightening Devices and Alternate Design Fasteners shall conform to RCSC Specification for Structural Joints, except as modified below.
 - a. Direct Tension Indicator washers conforming to the requirements of ASTM F 959.
 - 1) J.M. Turner, Inc.
 - 2) Applied Bolting Technology
 - b. Tension Control Bolts Conforming to AISC RCSC, Section 2 d), using pre-assembled sets of nut, washer and bolt.
 - 1) Bristol Machine Company
 - 2) NSS Industries and Lohr Structural
 - 3) Le Jeune
 - c. Each diameter, grade, and production lot shall have pre-installation testing preformed by testing lab prior to the fasteners being installed in the structure.
 4. Bolts shall be new and shall not be reused.
 5. Bolts shall be well lubricated at time of installation. Dry, rusty bolts will not be allowed. Bolts shall be lubricated at time of installation per ASTM A 325/A 490 and AISC RCSC.
 6. Galvanized Bolts: Provide bolts, nuts and washers that are hot dip galvanized according to ASTM A 153, Class C when used to connect steel called for on drawings or in specifications as hot dip galvanized after fabrication.
- D. Automatic End Welded Studs Used as Shear Connectors or Headed Stud Anchors for Concrete Embeds:
1. Automatic end welded studs shall be Nelson Granular Flux-filled Shear Connector or Anchor Studs (or approved equal).
 2. Studs shall be manufacturer of cold-finished carbon steel which conforms to ASTM A108, Grade 1015 or 1020. Minimum tensile strength: 60,000 psi; Minimum elongation: 20 percent in two inches, AWS Table 7.1, Type B.
 3. Dimensional tolerances of shear connectors shall be in accordance with Fig. 7.1 of AWS Code. Size and length shall be as indicated on Structural Drawings.

4. Arc shield ferrule of heat-resistant ceramic material shall be furnished with each stud.
 5. Suitable deoxidizing and arc-stabilizing flux for welding shall be furnished with each stud of 5/16 inch diameter or larger. Studs less than 5/16 inch in diameter may be furnished with or without flux.
 6. Only studs with qualified stud bases in accordance with AWS Appendix IX shall be used. See Submittals.
 7. Ceramic ferrules used in stud welding process shall be completely removed by Fabricator/Erector from area where concrete is to be placed.
- E. Anchor Bolts: Carbon steel externally and internally threaded standard fasteners - ASTM A307, unless noted otherwise, or ASTM A449 where noted.
- F. Filler Metal for Welding: Provide filler metal having a notch toughness not less than 20 feet-lbs. at -20 degrees Fahrenheit. as measured by Standard Charpy V-Notch Test, ASTM E 23. The minimum required energy absorption is 20 ft-lb. average. One specimen may be less than the minimum average, but not less than 15 feet-lbs. All electrodes shall meet code quality.
1. Conform to following AWS Specifications for welding process used:
 - a. Shielded Metal Arc Welding (SMAW) - AWS A5.1.
 - b. Flux Core Arc Welding - Self shielded (FCAW-SS) - AWS A5.20 or A5.29.
 - c. Flux-Core Arc Welding - Gas shielded (FCAW-G) - AWS A 5.20.
 2. Maximum diameter of electrodes allowed for SMAW is per AWS D1.1, Section 4.6. Maximum diameter of electrodes allowed for FCAW is per AWS D1.1, Section 4.14 except that the maximum diameter for the flat and horizontal position should be limited to 7/64 inch. Welding materials must be used within the positions, thicknesses, temperatures and other parameters provided by the manufacturer.
 3. Maximum width and thickness of weld layers shall be per AWS D1.1, Section 4.6 for SMAW and Section 4.14 for FCAW except that at the maximum width of a layer in any position should not exceed 5/8 inch.
- G. Nonshrink Grout:
1. Material shall be ready-to-use metallic or nonmetallic aggregate product requiring only addition of water at jobsite and shall produce flowable grouting material having no drying shrinkage at any age. Compressive strength of grout shall be not less than 6,000 psi at 7 days and 8,000 psi at 28 days.
 2. Subject to compliance with requirements, acceptable nonshrink grout are as follows:
 - a. Cormix Construction Chemicals - "Supreme"
 - b. Euclid Chemical Co. - "Euco N-S"
 - c. Master Builders - "Master Flow 928 Grout"
- H. Structural Steel Primer Paint: Fast curing, lead and chromate free, modified Alkyd Rust-Inhibitive Primer exceeding performance requirements of Federal Specification TT-P-86d, Type I. TNEMEC Company, Inc., 10-99 TNEMEC Primer, red color; 10-1009 TNEMEC Primer, Gray Color for second coat, where specified.
1. 56 percent solids by volume.
 2. Maximum Volatile Organic Compounds, thinned: (VOC) of 3.25 lbs/gallon.
 3. Physical Test Result: ASTM B117 Salt Spray (Fog): No blistering, cracking, softening, or delamination of film. No rust creepage at scribe and no rusting at edges after 500 hours.
- I. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds and repair painting galvanized steel, with dry film containing not less than 93 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.
- J. Miscellaneous Materials and Accessories: As specified hereinafter under various items of work and/or as indicated on drawings or required for good construction practice.

- K. [Slide Bearings: Bearing pads, upper and lower units shall be CON-SLIDE Type CSA elements as manufactured by CON-SERV Inc., East Hanover, N.J.
1. Sliding Surfaces shall be nominal 3/32" glass-filled virgin TFE factory bonded with a tested epoxy to a steel back-up plate. The bonding shall be done in a heated bonding press under controlled pressure.
 2. The coefficient of friction shall average 0.06 under a compressive load of 2000 psi.
 3. The compressive creep shall be a maximum of 2% at 2000 psi at 70 degrees Fahrenheit.
 4. Elements shall be flat, clean, and prepared for installation in the structure. Slots and holes if required shall be fabricated in the bearing manufacturer's plant.

2.03 FABRICATION

- A. Work shall be shop-assembled insofar as possible and delivered to site complete and ready for erection. Material shall be properly marked and match-marked where field assembly is required. Sequence of shipments shall be such as to expedite erection and minimize handling of material. Fabricate structural steel in accordance with AISC SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS (Ninth Edition), AISC Load and Resistance Factor Design Specification for Structural Steel Buildings and AISC Code of Standard Practice (Ninth Edition).
1. Structural steel which is used for main components and which is required to have yield stress greater than 36 ksi shall in fabrication plant be marked by painting ASTM Specification designation on piece. This identification shall remain on piece throughout erection.
 2. Rolled material before being laid out and after being worked must be straight with tolerance allowed by ASTM Specification A.6, unless noted otherwise. If straightening is necessary, it may be done by mechanical means or by application of limited amount of localized heat. Temperature of heated areas shall not exceed 1,200 deg. F. for material specified herein.
 3. Beams, girders and trusses shall be cambered as indicated on Structural Drawings. Specified camber shall be within tolerance of minus zero to plus 1/2" for members 50 feet and less; and minus zero to plus 1/2" plus 1/8" for each 10 feet or fraction thereof in excess of 50 feet. Members without specified camber shall be fabricated so that after erection any minor camber due to rolling or fabrication shall be upward.
 - a. Cambering shall be performed so as to result in a parabolic profile.
 - b. Cold cambering may be performed where beam size is applicable. Where cold cambering will cause web or flange buckling, tearing or other damage to the beam, other means shall be employed (i.e. heat cambering).
- B. Finishing of member shall be in accordance with following:
1. Column Base Plates:
 - a. Rolled base plates 2 inches or less in thickness may be used without planing, provided a satisfactory contact bearing surface is obtained.
 - b. Rolled base plates over 2 inches and less than 4 inches in thickness may be straightened by pressing or by milling bearing surfaces to obtain a satisfactory contact bearing surface.
 - c. Bottom surface of column base plates which are grouted on foundations need not be planed.
 - d. Top surfaces of base plates with columns full-penetration welded need not be pressed or milled.
 - e. Anchor Bolt Holes in Baseplates shall be made oversize as follows:
 - 1) Bolt Size Hole Size
 - (a) 3/4" dia. to 1" dia. incl. Dia. + 5/16"
 - (1) Over 1" dia. to 2" dia. incl. Dia. + 1/2"
 - (b) Over 2" dia. Dia. + 3/4"

2. Column Ends:
 - a. Compression joints depending upon contact bearing shall have bearing surface prepared to common plane by milling or other approved means in accordance with AISC Standards.
 - b. Milled or machined surfaces shall be protected against corrosion by a rust inhibiting coating that can be easily removed prior to erection.
 - c. Members to be milled shall be completely assembled before milling.
 3. Beam and Girder Ends:
 - a. Oxygen cut ends shall, wherever practicable, be done by mechanically guided torch.
 - b. Oxygen cut edges which are subject to stresses shall be free from gouges. Occasional gouges greater than 3/16 inch that remain from cutting shall be removed by grinding.
 - c. Oxygen cut edges which are to have weld metal deposited on them shall be in accordance with AWS Code Sec. 3.2.
 - d. Corners shall be smooth and rounded to minimum 1/2 inch radius, but in no case less than AISC minimum dimensions
 4. Remove mill scale from columns in the area where the beam flanges will be welded to the column.
- C. Splices in Structural Steel: Splicing of structural steel members in shop or field is prohibited without prior approval of Engineer. Members having splice not shown and detailed on approved shop drawings will be rejected.
- D. Shop connections shall be high strength bolted (slip critical or bearing type) or welded, as indicated on Structural Drawings or approved shop drawings.
- E. High strength bolted construction assembly shall be in accordance with AISC Specification for Structural Joints using ASTM A 325 or A 490 bolts.
1. Bolted parts shall fit solidly together when assembled and shall not be separated by gaskets or any other interposed compressible material. Joint surfaces shall be free of burrs and other foreign materials. Hot-dip galvanized contact surfaces shall be scored by wire brushing or blasting prior to assembly.
 2. If thickness of material is not greater than normal diameter of bolt plus 1/8 inch, holes may be punched. If thickness of material is greater than normal diameter of bolt plus 1/8 inch, it shall be drilled full size or sub-punched 1/16 inch smaller than bolt diameter and reamed to full size.
 3. Bolt holes shall be normal diameter not more than 1/16 inch in excess of normal bolt diameter unless otherwise specified on Structural Drawings. Slotted or oversize bolt holes, if required, shall be as specified in AISC Specification for Structural Joints Sec. 3©.
 4. Beam to Beam and Beam to Column Connections: Standard shear connections shall utilize bearing-type bolts with threads allowed across the shear plane (Type N).
 5. Bearing-Type Bolt Tightening: Standard shear connections utilizing bearing-type bolts need only be tightened to the snug tight condition. This is the tightness that exists when all the plies in a joint are in firm contact, generally achieved by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench.
 6. Slip-Critical Connections: Connections indicated as slip-critical shall utilize friction type bolts (Type SC) with approved tightening method using Direct Tension Indicator washers installed with Tension Control Bolts or Direct Tension Indicators. Bolts used in moment connections and tension members shall be considered as slip-critical fasteners.
 7. A 325 or A 490 bolts, regardless of method of tightening, shall have hardened washer installed per RSCS paragraph 7.c, 1 through 8. A 490 bolts used to connect material having specified minimum yield point less than 40 ksi shall have washer installed under bolt head and one installed under nut.

8. When tightening is done by calibrated wrench method, nut or bolt rotation from snug tight shall not be greater than that permitted in Table 5 of AISC Specification for Structural Joints.
- F. Holes for Other Work:
1. Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members as shown on contract documents, and/or final shop drawings.
 2. Provide specialty items as indicated to receive other work.
 3. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.
- G. Welded construction shall be performed in accordance with AWS Structural Welding Code D1.1-94, Sections 2 thru 7, and Section 8, 9 or 10, whichever is applicable.
1. Only welded joints deemed as being prequalified in accordance with AWS D1.1-94 Sec. 5.1, which are selected from AWS Code Figs. 2.1 thru 2.5 are approved for use.
 2. A Welding Procedure Specification (WPS) with the information required by AWS D1.1, Section 5, shall be submitted to the Owner's Engineer and the enforcement agency for acceptance prior to the start of work.
 - a. The WPS shall be used in providing the required special inspection.
 - b. The WPS shall contain the actual values to be used for the welding parameters and variables so that instruction is provided to welders; as a minimum the WPS shall list the position, electrode type and size, travel speed, electrode stick-out, voltage and amperage with acceptable limits, bead size, weld sequence, stress relieving, and other pertinent data.
 - c. A copy of the filler metal manufacturer's technical data sheet should be submitted with each WPS.
 - d. For WPS's which require qualification, Procedure Qualification Records (PQRs) shall also be submitted for acceptance. Production welding heat input shall be limited based on the PQR.
 - e. The welding parameters are a function of each electrode. The written WPS should be developed by a competent welding engineer, and the individual welding parameters should be within the electrode manufacturer's range of operation.
 - f. Approved WPS's shall be posted at appropriate locations throughout the job site or fabricator's shop to be available to welders, supervisors and inspectors.
 3. WPS's for groove welds joining the beams flanges to the column shall meet or exceed the workmanship and technique requirements of AWS D1.1. WPS's for FCAW should be qualified by testing in accordance with AWS D1.1, Section 5. The tests should include Charpy V-Notch (CVN) tests of the weld metal and the heat affected zone (HAZ). The CVN test temperature should be at least 30 degrees Fahrenheit colder than the Lowest Service Metal Temperature (LSMT) and not warmer than zero degrees F. The minimum required energy absorption is 20 Ft-Lbs. average. One specimen may be less than the minimum average, but not less than 15 Ft-lbs. The tests should be conducted in accordance with AWS D1.1, Appendix III.
 4. For highly restrained joints, or where shrinkage is likely to cause problems, the Contractor shall submit a weld shrinkage and distortion control plan to the Engineer for review to determine compliance with design intent.
 5. Welders, welding operators and tackers to be employed under this specification, shall have been qualified by test and certified by Qualified Agency or person as prescribed in AWS Code Sec. 5, Parts C, D and E, within last year. These qualifications shall be made available to Owner's Testing Laboratory for examination.
 6. Welders that will make welds with restricted access, such as, but not limited to, the bottom flange to column welds through a cope hole or access hole in the beam web, or where

access to the bottom of a groove is restricted by the presence of a column flange, shall be qualified by the Contractor using the same welding procedure as will be used for production and a mock-up assembly that simulates the construction configuration.

7. Welding process shall be prequalified and limited to following processes:
 - a. Shielded Metal Arc Welding (SMAW)
 - b. Flux-Core Arc Welding - Self Shielded (FCAW-SS)
 - c. Flux-Core Arc Welding - Gas Shielded (FCAW - G)
 - d. Welding process not pre-qualified must be qualified by test.
8. Maximum diameter of electrodes allowed for SMAW is per AWS D1.1, Section 4.6. Maximum diameter of electrodes allowed for FCAW is per AWS D1.1, Section 4.14 except that the maximum diameter for the flat and horizontal position should be limited to 7/64 inch. Welding materials must be used within the positions, thicknesses, temperatures and other parameters provided by the manufacturer.
9. Maximum bead width and thickness of weld layers shall be per AWS D1.1, Section 4.6 for SMAW and Section 4.14 for FCAW except that the maximum width of a bead in any position should not exceed 5/8 inch. The maximum layer thickness of all passes, except cap passes, shall be limited to 1/4".
10. Requirements for workmanship and technique shall be as specified in AWS Code Sec. 3 and 4, including preheat and interpass temperatures, in accordance with Table 4.3 for process being used.
11. Preheat, if required by the following requirement, shall be used for all welds including tack welds. Preheat and interpass temperatures should be determined in accordance with AWS D1.1-94, Appendix XI, using the hydrogen controlled method, but shall not be less than the temperatures set forth in AWS D1.1-94 Table 4.3. Welds for section in ASTM A6 Shape Size Groups 4 and 5 and plates with a thickness greater than 2-1/2 inches should have a minimum preheat of 350 degrees Fahrenheit. To ensure that the work piece is properly heated, the temperature of the part shall be measured at a distance from the axis of the weld equal to twice the thickness of the thickest part being welded, but in no case less than 3 inches in all directions, including the through thickness dimension of the part being welded, for the full length of the weld joint. Preheat should be verified by the inspector before welding commences. The cooling rate of the weldment should be controlled with thermal insulation or other appropriate methods to a maximum of 250 degrees Fahrenheit /hr.
12. All welds shall be started and ended with a full cross-section weld for a minimum length of 1.5 times the joint thickness, but not less than one inch on weld tabs ("run off" tabs) except at access bores in beam/girder webs (see AWS D1.1, Section 3.12). All weld tabs should be removed, the affected area ground smooth and magnetic particle tested for defects.
13. If backing bars are used under the bottom beam flange to column flange CJP groove weld, the backing bar shall be removed, the removal area ground to sound, bright metal and the area magnetic particle tested for defects. A 5/16 inch fillet weld shall be placed in this location.
14. If a backing bar is used under the top beam flange to column CJP groove weld, and is not removed, the backing bar shall be attached to the column and beam flanges by either a fillet weld along the complete bar length on the under side of the bar, or by a partial penetration weld from the underside of the bar, for the full length of the bar. Other methods of welding the bar to the column and beam may be used subject to the Engineers approval.
15. Weld "dams" are not allowed. Weld "dams" are weld tabs not aligned in such a manner to provide an extension of the joint preparation per AWS D1.1, Section 3.12. Weld "dams" are typically perpendicular to proper weld tabs.
16. All tack welds shall be of the same quality as the final welds. This includes requirements for preheat. All tack welds not incorporated into the final welds shall be removed.

17. Groove welds shall be made with "stringer" passes only, no excessing weaving allowed. "Wash" passes will not be allowed. Lay passes in horizontal layers. Each pass shall be thoroughly de-slugged and cleaned. Individual weld beads shall be completed prior to applying portions of subsequent beads. Ends of interrupted passes in way of access holes shall be staggered.
18. Fillet welds terminating at ends or sides shall be returned continuously for distance at least twice normal size of weld (end returns).
19. Intermittent and continuous welding, and straightening of built-up sections shall be done in manner to minimize internal stresses.
20. Welds not specified shall be continuous fillet welds, sufficient to transmit required forces, using minimum fillet as specified by AWS D1.1, Table 2.2.
21. [In progress visual inspection per AWS D1.1-94 is required for all welding (fit-ups, cut-outs, clean-up, root passes, fill-in passes, etc.). Ultrasonic Testing (UT) is required for all (100%) complete joint penetration groove welds of beam-to-column welds, continuity plates welds and shear tabs.

2.04 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:
 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 2. Surfaces to be field welded.
 3. Surfaces to be high-strength bolted with slip-critical connections.
 4. Surfaces to receive sprayed-on fireproofing.
 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:
 1. SSPC-SP 2 "Hand Tool Cleaning."
 2. SSPC-SP 3 "Power Tool Cleaning."
 3. SSPC-SP 5 "White Metal Blast Cleaning."
 4. SSPC-SP 6 "Commercial Blast Cleaning."
 5. SSPC-SP 7 "Brush-Off Blast Cleaning."
 6. SSPC-SP 8 "Pickling."
 7. SSPC-SP 10 "Near-White Blast Cleaning."
 8. SSPC-SP 11 "Power Tool Cleaning to Bare Metal."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 2.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 2. Apply 2 coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

2.05 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel indicated for galvanizing according to ASTM A 123.

2.06 SOURCE QUALITY CONTROL

- A. Access to places where material for contract is being fabricated or produced shall be provided to Architect and/or testing laboratory for purpose of inspection.
- B. Architect may inspect structural steel at plant before shipment. However, Architect reserves right to reject any material, at any time before final acceptance, which does not conform to

requirements of Drawings and Specifications.

- C. Furnished by General Contractor, as specified in this Section, unless otherwise noted.
 - 1. Structural Steel Mill Manufacturer/Supplier.
 - 2. Structural Steel Fabricator.
 - 3. Structural Steel Erector.
 - 4. Manufacturer/Supplier of Structural products.
- D. Implement special inspection requirements in AWS D1.1-94, Sections 6.1 through 6.6. Contractor is required to furnish a fabrication/erection inspector. Owner will employ verification inspector. Visual inspection means that the inspectors visually inspect the welding for adherence to approved welding procedure specification starting with fit-up and proceeding through the welding process. Reliance only upon use of non-destructive examination (NDE) at end of the welding is not permitted. Use visual inspection in conjunction with NDE for sound weld.
- E. Inspection and testing by Owner's Agency is for verification and shall not relieve contractor of his responsibility to furnish materials and workmanship in accordance with Contract Documents.
- F. In cases of differences of opinion between owner's Inspector and the contractor's Inspector regarding conformance of a weld with the specifications, the issue should be brought to the owner's Engineer and the enforcement agency as part of the resolution process.

2.07 EXTENT OF QUALITY CONTROL

- A. Contractor alone shall be responsible for correct fitting of structural members and for elevation and alignment of finished steel structure. General Contractor shall be responsible for establishing, setting and maintaining control points and building lines to be used in plumbing structural steel frame in accordance with AISC Code of Standard Practice, Section 7.11 and shall verify following:
 - 1. Verify that anchor bolts are located as specified on Drawings and are in proper relation to control points and building lines, prior to setting of structural steel.
 - 2. Verify that structural steel members have been located, elevated, plumbed, and aligned in relation to control points and building lines, within tolerance permitted by AISC Code of Standard Practice, Sec. 7.11. Any adjustments necessary in steel frame because of fabrication, construction or erection discrepancies in elevations and alignment shall be responsibility of Contractor.
- B. Structural Steel Fabricator/Erector shall provide quality control procedures to extent that he deems necessary to assure that fabrication work being performed and material or products being furnished, conform to Contract Documents, and to following extent:
 - 1. Visually inspect column material.
 - 2. Materials and products being furnished by Fabricator/Erector shall be received and identified in fabrication plant in such a manner that materials or products can be identified as being represented by mill test reports or manufacturer's certificates. Identification marks of materials shall remain on structural steel members through fabrication and erection.
 - 3. Inspect materials for compliance to ASTM A 6, prior to fabrication.
 - 4. Inspect installation of slip-critical High Strength Bolts and proper bolt tension, as follows:
 - a. When direct tension indicator method is used, observe installation of bolts to determine that bolt manufacturer's procedure is properly used and determine that correct indication of tension has been achieved.
 - 5. Visually inspect to confirm that plies of connected elements have been brought into firm contact.
 - 6. Visually inspect welds as specified in AWS Code, Section 6.

- C. Product Manufacturer/Supplier of structural items shall inspect and test products as specified in designated ASTM Specifications; reference Submittals, this Section.
- D. Structural Steel Mill/Manufacturer shall inspect and test materials as specified in designated ASTM Specifications and perform ultrasonic testing of materials required of Steel Mill Supplier, as specified in this Section; Reference submittals, this Section.
- E. Structural Steel Fabricator/Erector shall provide quality control procedures during erection to extent that he deems necessary to assure that erection work being performed conforms to Contract Documents and to following extent:
 - 1. Visually inspect welds as specified in AWS D1.1, 6.1 through 6.6.
 - 2. Inspect installation of direct tension indicators at bolted slip-critical connections.
 - 3. Perform bend test on shear studs as specified in accordance with AWS Code Section 4.25.
- F. Adjustments necessary in steel frame because of fabrication, construction or erection discrepancies in elevations and alignment shall be responsibility of Contractor.
- G. Survey Work:
 - 1. Contractor shall employ at his expense registered professional engineer or surveyor to establish control points and layout work for Building Control Lines. Steel Contractor shall conduct layout work and elevations for erection of structural steel.
 - 2. Check elevations of concrete and masonry bearing surfaces and anchor bolt locations prior to erection and submit discrepancies to Architect/Engineer prior to start of erection. Corrections or adjustments to structural steel shall be made and submitted for approval prior to start of erection.
 - 3. Upon completion of erection of steel frame and before start of work by other trades that are supported, attached or applied to frame, General Contractor shall make a final survey of frame and submit report certifying compliance with specified tolerances.

PART 3 EXECUTION

3.01 PREPARATION

- A. Templates shall be securely in place to preclude misplacements of anchor bolts, and bolts shall be installed at locations and with projections established by approved structural steel shop drawings.
- B. General Contractor and Structural Erection Contractor shall separately check and agree on correct positioning before concrete is placed.
- C. Subsequent displacement of anchor bolts will be responsibility of General Contractor.

3.02 ERECTION

- A. General:
 - 1. Contractor shall completely outline proposed method and sequence of erection to Architect for approval before delivering material to jobsite.
 - 2. Outline shall be prepared to avoid delay of any damage to work of other trades.
 - 3. Contractor shall comply with state, local and Federal laws pertaining to safety requirements for steel erection.
 - 4. Erection of structural steel members shall be in accordance with AISC Specification and AISC Code of Standard Practice, and as follows.
- B. Column Base Plates and Bearing Plates:
 - 1. Columns with base plates attached and bearing plates for beams and similar structural members shall be set level to their proper alignment and elevation using shim packs unless noted otherwise.

2. Loose column bases are to be set level to their proper alignment and elevation by use of shim packs, leveling bolts or as indicated on Structural Drawings.
- C. Erection Tolerances:
1. Each individual member shall be erected, plumbed, leveled and aligned within tolerance defined in Sec. 7.11 and Commentary of AISC Code of Standard Practice, except as noted. Top surface of closure angles/plates at building perimeter and at openings shall be within 1/4 inch of their proper location prior to commencement of concreting operations. Where this condition is not satisfied, 18 gage plate shall be attached to angles/plates in manner sufficient to serve as guide for strikeoff of concrete floor surface.
 2. Building lines for use in plumbing exterior columns shall be established by General Contractor. As erection progresses, General Contractor shall be responsible for accuracy of building lines off-set, maintaining and referencing building lines required to verify plumbness of structural steel framing.
 3. Elevation tolerance at beams and girders at columns to be +3/16" to -5/16" per AISC.
- D. Field Erection:
1. Erect members according to most economical method and sequence available consistent with Plans and Specifications.
 - a. The structure is considered a "Non-Self Supporting Steel Frame" as defined by Section 7.9.3 inch the AISC Code of Standard Practice.
 2. As erection progresses, provide temporary guy lines to properly align steel framing.
 3. Align various members accurately to lines and elevations indicated within specified erection tolerances.
 4. Make adjustments to various members prior to making permanent connections.
 5. Temporary guying or bracing shall be introduced wherever necessary to take care of loads to which structure may be subjected. This bracing shall be left in place as required by erection procedures. Adequacy of temporary bracing shall be sole responsibility of Contractor.
 6. This work shall be permanently connected as required by Structural Drawings or final shop drawings in a sequence that will minimize lock-in stress.
 7. Drift pins shall not be used to enlarge unfair holes in main material. Burning and drifting may be used to align unfair holes in secondary bracing members only upon approval of Architect. Ream holes that must be enlarged to admit bolts.
 8. High strength bolted connections shall be in accordance with this Section, Part 2.
 9. Welded construction shall be in accordance with this Section, Part 2.
- E. Installation of Automatic End Welded Stud for Shear Connectors or Headed Stud Anchors for Concrete:
1. Areas to which studs are to be attached must be free of foreign material, such as rust, oil, grease, paint, etc. When mill scale is sufficiently thick to cause difficulty in obtaining proper welds, it must be removed by grinding or sandblasting.
 2. Studs shall be automatically end welded in accordance with manufacturer's recommendations in such manner as to provide complete fusion between end of stud and plate. There should be no porosity or evidence of lack of fusion between welded end of stud and plate. Stud shall decrease in length during welding approximately 1/8 inch for 5/8 inch and under, and 3/16 inch for over 5/8 inch diameter. Welding shall be done only by qualified welders approved by welding inspector. Length of studs shown on drawings is length after welding.
 3. Ceramic ferrules used in stud welding process shall be completely removed from area where concrete is to be placed.
- F. Grouting of Base Plates and Bearing Plates:

1. Plates shall be set and anchored to proper line and elevation. Metal wedges, shims, and/or setting nuts shall be used for leveling and plumbing structural members, including plumbing of columns. Concrete surfaces shall be rough, clean, free of oil, grease, and laitance, and shall be damp. Metal surfaces shall be clean and free of oil, grease, and rust. Addition of water, mixing and placing, shall be in conformance with material manufacturer's instructions. Grout shall be mixed by using a mortar mixer. Batches shall be of size to allow continuous placement of freshly mixed grout. Placing shall be quick and continuous. Exposed surfaces shall have smooth, dense finish.
 2. Base plates shall be grouted prior to placement of structural concrete slabs.
- G. Clean-Up:
1. Upon completion of erection, Contractor shall remove falsework used by him.

3.03 FIELD QUALITY CONTROL

- A. Owner will employ and pay a qualified independent testing agency to perform following testing for field quality control, including special inspections required by local building code. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
- B. Scope of Services:
1. Testing Laboratory will furnish qualified Inspectors as duly designated persons who act in behalf of Architect/Owner on inspection and quality matters within scope of AWS Code D1.1. to ascertain that fabrication and erection by welding is performed in accordance with requirements of AWS Code D1.1.
 2. Testing Laboratory will furnish qualified Inspectors for inspection of Fabricator/ Erector's quality control procedures, materials and workmanship required of Owner's/Purchaser's representatives, as specified in AISC Specification M5. Such inspections are to be made to fullest extent possible in Fabricator's plant.
 3. Testing Laboratory will furnish qualified Inspectors and technicians to perform inspections and tests as specified herein, interpret results and report deviations from Contract Documents.
- C. Qualification of Personnel:
1. Personnel performing non-destructive testing will be qualified in accordance with current edition of American Society for Non-Destructive Testing Recommended Practice No. SNT-TC 1A. Only individuals qualified for NDT Level I and working under NDT Level II, or individuals qualified for NDT Level II may perform non-destructive testing specified.
 2. Personnel performing inspections of welding work will be currently registered with American Welding Society as having successfully complied with requirements of Section 4 of A.W.S. Standards for Qualification and Certification of Welding Inspectors, QC1 may perform welding inspection specified.
- D. Reports of Inspection and Tests:
1. Fabrication and Erection reports shall be issued on a weekly basis, or as conditions warrant, and will include following information:
 - a. Progress of work
 - b. Location and progress of inspections.
 - c. Results of inspections, noting any deviations from Contract Documents.
 - d. Correction of deviations.
 2. Non-destructive testing reports will include following information:
 - a. Reports shall be issued on suggested AWS (Appendix E) or similar forms containing same information.
 - b. Interpret test results and state in test report whether or not test specimen conforms to Contract Documents.
 3. Submit certified copies of tests and inspections to following:

- a. Owner (2)
 - b. Architect (1)
 - c. Engineer (1)
 - d. Contractor (2)
 - e. Fabricator (1)
 - f. Erector (1)
- E. Shop Inspection and Testing of Materials:
- 1. Check Certified Mill Test Reports to verify structural steel being furnished conforms to appropriate ASTM Specification.
 - 2. Verify following products being furnished are represented by manufacturer's certifications and test data.
 - a. High Strength bolts.
 - b. Filler metal for welding.
 - c. Shear studs used as shear connectors.
 - d. Direct tension indicators.
 - e. Tension Control Bolts
- F. Shop Inspection of High-Strength Bolted Connections:
- 1. Inspection will be performed in accordance with AISC Specification for Structural Joints Section 9, to following extent:
 - a. Observe installation of bolts to verify bolts have been properly installed and tightened to selected procedure of AISC Specification for Structural Joints Section 8(c). or 8(d).
 - b. When direct tension indicator method is used, observe installation of bolts to determine that DTI manufacturer's procedure is properly used and determine that correct indication of tension has been achieved.
- G. Shop Inspection of Welding:
- 1. Testing laboratory will obtain from fabricator and erector names of welders to be employed on Work, together with certification that each of these welders has passed qualification tests within last year using procedures covered in American Welding Society Standard D1.1 and as specified in Paragraph 1.3.B.
 - 2. Inspection of welding work will be performed as specified in AWS Code Section 6, and to following extent:
 - a. Visual inspection of welds as specified in AWS Code, Sec. 6.5.
 - b. Inspection of welding procedures as specified in AWS Code, Sec. 6.3.
 - c. Inspection of welder's qualification as specified in AWS Code, Sec. 6.4.
 - 3. Perform ultrasonic testing of complete penetration groove welds for entire weld length, in each designated joint, in accordance with AWS Code, Sec. 6, Part C, and to following extent:
 - a. 100 percent of welds splicing beams, girders, columns and braces where shown on drawings.
 - b. 100 percent of column to base plate welds at rigid frame columns only.
 - c. 100 percent of frame columns from 6" above joint to 6" below joint before and after welding connections.
 - d. 100 percent of complete joint penetration groove welds of beam-to-column welds, continuity plate welds and shear tabs.
- H. Field Inspection of Alignment and Fit-Up:
- 1. Verify location and setting of anchor bolts by witness of Contractor's final check prior to setting of steel members.
 - 2. As erection progresses, check connection of members for proper fit-up and adjustment prior to making permanent connections.

3. Verify plumbness of columns is within allowable tolerance specified in AISC Code Sec. 7.11 and Commentary.
 4. Verify that bracing and guying/cables, if required to secure steel framing during erection, are installed in accordance with erection procedures.
 5. During erection, verify specified phases of construction and steel erection are complete in accordance with erection procedure before proceeding with additional erection of structural steel.
- I. Field Inspection of High-Strength Bolted Connections:
1. Bolts will be inspected as specified in Para. 3.3/F, Shop Inspection of High-Strength Bolted Connections to following extent:
 - a. Each bolt in each slip-critical connection shall be inspected as specified above.
 - b. Two bolts in each bearing type bolted connection between girders and columns shall be inspected as specified above.
 - c. 10 percent of remainder of bolts, but not less than 2 inch each connection, shall be inspected as specified above.
 2. Bolted connections that fail shall be retightened and remaining bolts in connection shall be retested. Cost of retests on connections that fail shall be borne by Contractor.
- J. Field Inspection of Welding Work:
1. Testing laboratory will obtain from fabricator and erector names of welders to be employed on Work, together with certification that each of these welders has passed qualification tests within last year using procedures covered in American Welding Society Standard D1.1 and as specified in Paragraph 1.3.B.
 2. Visual inspection and non-destructive examination of welding work will be performed as specified in Para 3.3/G., Shop Inspection of Welding.
 3. Visually inspect the welding for adherence to approved welding procedure specification starting with fit-up and proceeding through the welding process as the welding is being performed. Follow up visual inspection with non-destructive examination.
 4. Base metal thicker than 1-1/2 inches shall be ultrasonically inspected for discontinuities directly behind weld after joint completion. Any material discontinuities shall be accepted or rejected on basis of defect rating in accordance with (larger reflector) criteria of U.B.C. Standard No. 27-6.
 5. Ultrasonically test full-penetration, moment connection welds in accordance with AWS Code, Sec. 6, Part C, to following extent:
 - a. 25 percent of welds made by each individual welder shall be tested at random as specified above.
 - b. If an unacceptable weld is found, two additional welds made by same welder shall be tested at random. If either of these welds are found unacceptable, 100 percent of same welder's welds shall be tested as specified above and welder shall be recertified by Testing Laboratory, in accordance with qualification tests specified in AWS Code, Sec. 5, Part B, before being allowed to continue welding on this project.
 - c. Test each weld in moment connection as specified above.
 6. Extent of testing shall be entire weld length in each designated joint.
 7. All groove welds in the steel moment frame girder-to-column connection should be ultrasonically (UT) examined for the full length. Backing bar removal areas and fillet welds on continuity plates should be examined for the full length by the magnetic particle testing (MPT) method.
 8. Welds found unacceptable shall be repaired by methods permitted by AWS Code, Sec. 3.7, and reinspected by ultrasonic testing. Cost of initial test and further testing shall be borne by Contractor.
- K. Field Inspection of Shear Studs used as Shear Connectors:

1. Inspect number and locations of shear studs for conformity to Structural Drawings.
 2. Inspection of shear stud welding will be in accordance with AWS Code, Chapter 7 and as follows:
 - a. Visual inspection of shear studs shall indicate complete fusion and full 360 degrees flash weld. There will be no indication of lack of fusion.
 - b. If, after welding, visual inspection reveals that a sound weld or full 360 degree flash weld has not been obtained, each stud shall be bent by hammering stud to an angle of 15 degrees from its original axis. Direction of bending shall be opposite missing flash weld. Studs that crack in weld, base metal, or shank shall be replaced.
 - c. Minimum of two (2) studs shall be welded at start of each production period in order to determine proper generator, control unit and stud welder setting. These studs shall be capable of being bent 45 Deg. from vertical without weld failure. After above test, weld section shall not exhibit tearing out or cracking.
 - d. In addition to above, six members per floor per building quadrant shall be selected at random on which 5 studs shall be hammered 15 degrees toward center of member. NOT MORE THAN ONE STUD SHALL SHOW ANY SIGN OF FAILURE. If two or more studs fail, remaining studs on member shall be hammered. Studs showing any sign of failure shall be replaced. For each beam with any defective studs, additional beam shall be tested.
- L. Base Plate Grout:
1. For every ten (10) base plates grouted, grout strength will be tested with set of cubes as follows:
 - a. Set of cubes will consist of two cubes to be tested at 7 days, and two cubes to be tested at 28 days.
 - b. Test cubes will be made and tested in accordance with Corps of Engineers Specification for Non-Shrink Grout, CRD-C621, with exception that grout should be restrained from expansion by top plate.

3.04 CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
1. Apply by brush or spray to provide a minimum dry film thickness of 2.5 mils.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A 780.

END OF SECTION

**SECTION 05 3100
STEEL DECK**

PART 1 GENERAL

1.01 REFERENCE STANDARDS

- A. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2018.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2023.
- D. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
- E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2023.
- F. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.02 RELATED DOCUMENTS

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

1.03 SUMMARY

- A. This Section includes the following:
 - 1. Roof deck.
 - 2. Composite floor deck.
 - 3. Noncomposite form deck.
- B. Related Sections include the following:
 - 1. Division 3 Section "Cast-in-Place Concrete" for concrete fill and reinforcing steel.
 - 2. Division 5 Section "Structural Steel" for shop-welded shear connectors.
 - 3. Division 5 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
 - 4. Division 9 Section "Painting" for repair painting of painted deck.
 - 5. Division 9 Section "Special Coatings" for repair of deck special coatings.

1.04 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.
- C. Product Certificates: Signed by steel deck manufacturers certifying that products furnished comply with requirements.
- D. Welding Certificates: Copies of certificates for welding procedures and personnel.
- E. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:
 - 1. Mechanical fasteners.
 - 2. Acoustical roof deck.
- F. Research/Evaluation Reports: Evidence of steel deck's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E329 to conduct the testing indicated, as documented according to ASTM E 548.
- C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- D. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those steel deck units tested for fire resistance per ASTM E119 by a testing and inspection agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 - 2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.
- E. AISI Specifications: Calculate structural characteristics of steel deck according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members."
- F. FM Listing: Provide steel roof deck evaluated by FM and listed in FM's "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 PRODUCTS

2.01 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. Steel Deck:
 - a. BHP Steel Building Products USA Inc.
 - b. Consolidated Systems, Inc.
 - c. Epic Metals Corp.
 - d. Marlyn Steel Products, Inc.
 - e. Nucor Corp.; Vulcraft Div.
 - f. Roof Deck, Inc.
 - g. United Steel Deck, Inc.
 - h. Verco Manufacturing Co.
 - i. Wheeling Corrugating Co.; Div. of Wheeling-Pittsburgh Steel Corp.

2.02 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 29, and the following:

1. Prime-Painted Steel Sheet: ASTM A 611, Grade C minimum, shop primed with gray or white baked-on, lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.
2. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) G90 (Z275) zinc coating.
3. Galvanized and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's baked-on, lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.
4. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, Structural Steel (SS), Grade 33 (230) minimum, AZ50 (AZ150) aluminum-zinc alloy coating.
5. Deck Profile: Type WR, wide rib.
6. Profile Depth: 1-1/2 inches
7. Design Uncoated-Steel Thickness: 0.0295 inch.
8. Span Condition: As indicated.
9. Side Laps: Overlapped.

2.03 COMPOSITE FLOOR DECK

- A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 29, the minimum section properties indicated, and the following:
 1. Prime-Painted Steel Sheet: ASTM A 611, Grade C minimum, with top surface phosphatized and unpainted and bottom surface shop primed with gray or white baked-on, lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.
 2. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) G90 (Z275) zinc coating.
 3. Galvanized and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230), G60 (Z180) zinc coating; with unpainted top and bottom surface cleaned, pretreated, and primed with manufacturer's baked-on, lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.
 4. Profile Depth: 2 inches.
 5. Design Uncoated-Steel Thickness: 0.0358 inch.
 6. Span Condition: As indicated.

2.04 NONCOMPOSITE FORM DECK

- A. Noncomposite Steel Form Deck: Fabricate ribbed-steel sheet noncomposite form deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 29, the minimum section properties indicated, and the following:
 1. Uncoated Steel Sheet: ASTM A1008, Grade 33 ksi minimum.
 2. Prime-Painted Steel Sheet: ASTM A 611, Grade 33 ksi minimum, top and bottom surface shop primed with gray or white baked-on, lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.
 3. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230).
 4. Galvanized and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230) zinc coating; cleaned, pretreated, and primed with manufacturer's baked-on, lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.
 5. Profile Depth: 9/16 inch.
 6. Design Uncoated-Steel Thickness: 0.0149 inch.
 7. Span Condition: As indicated.

8. Side Laps: Interlocking seam.

2.05 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (0.19 inch) minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Steel Sheet Accessories: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- G. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 29 for overhang and slab depth.
- H. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- I. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- J. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch 0.0747 inch thick, with factory-punched hole of 3/8-inch (9.5-mm) minimum diameter.
- K. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and sloped recessed pans of 1-1/2- inch (38-mm) minimum depth. For drains, cut holes in the field.
- L. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- M. Shear Connectors: ASTM A108, Grades 1010 through 1020 headed stud type, cold-finished carbon steel, AWS D1.1, Type B, with arc shields.
- N. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight..
- O. Repair Paint: Lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 29, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate decking bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract

side-lap interlocks.

1. Align cellular deck panels for entire length of cell runs and align cells at ends of abutting panels.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to decking.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.03 ROOF DECK INSTALLATION

- A. Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 1. Weld Diameter: 5/8 inch, nominal.
 2. Weld Spacing: As indicated.
 3. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals as indicated.
 1. Mechanically fasten with self-drilling No. 10 (4.8-mm-) diameter or larger carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 1. End Joints: Butted
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof decking and weld flanges to top of deck. Space welds not more than 12 inches apart with at least 1 weld at each corner.
- E. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.04 FLOOR DECK INSTALLATION

- A. Fasten floor deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 1. Weld Diameter: 5/8 inch, nominal.
 2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches apart, but not more than 18 inches apart.
 3. Weld Spacing: Space and locate welds as indicated.
 4. Weld Washers: Install weld washers at each weld location.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 36 inches, and as follows:
 1. Mechanically fasten with self-drilling No. 10 (4.8-mm-) diameter or larger carbon-steel screws.

- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches with end joints as follows:
 - 1. End Joints: Butted.
- D. Shear Connectors: Weld shear connectors through deck to supporting frame according to AWS D1.1 and manufacturer's written instructions. Butt end joints of deck panels; do not overlap. Remove and discard arc shields after welding shear connectors.
- E. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.
- F. Floor Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of decking. Weld cover plates at changes in direction of floor deck panels, unless otherwise indicated.
- G. Install piercing hanger tabs not more than 14 inches apart in both directions, within 9 inches of walls at ends, and not more than 12 inches from walls at sides, unless otherwise indicated.

3.05 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing agency to perform field quality-control testing.
- B. Field welds will be subject to inspection.
- C. Shear connector stud welds will be inspected and tested according to AWS D1.1 for stud welding and as follows:
 - 1. Shear connector stud welds will be visually inspected.
 - 2. Bend tests will be performed if visual inspections reveal less than a full 360-degree flash or welding repairs to any shear connector stud.
 - 3. Tests will be conducted on additional shear connector studs if weld fracture occurs on shear connector studs already tested according to AWS D1.1.
- D. Testing agency will report test results promptly and in writing to Contractor and Architect.
- E. Remove and replace work that does not comply with specified requirements.
- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.06 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
 - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
 - 2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Division 9.
- C. Repair Painting: Wire brushing, cleaning and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Division 9.
- D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

**SECTION 05 4000
COLD-FORMED METAL FRAMING SR**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formed steel stud exterior wall framing.
- B. Exterior wall sheathing.
- C. Formed steel joist and purlin framing and bridging.
- D. Water-resistive barrier over sheathing.

1.02 RELATED REQUIREMENTS

- A. Section 05 3100 - Steel Decking.
- B. Section 06 1000 - Rough Carpentry: Wood blocking and miscellaneous framing.
- C. Section 07 2100 - Thermal Insulation: Insulation within framing members.
- D. Section 07 6200 - Sheet Metal Flashing and Trim: Head and sill flashings.
- E. Section 07 9200 - Joint Sealants.
- F. Section 09 2116 - Gypsum Board Assemblies: Lightweight, non-load bearing metal stud framing.
- G. Section 09 2116 - Gypsum Board Assemblies: Gypsum-based sheathing.
- H. Section 09 2216 - Non-Structural Metal Framing.
- I. Section 09 5100 - Acoustical Ceilings: Ceiling suspension system.

1.03 REFERENCE STANDARDS

- A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2012.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- D. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.
- E. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
- F. ASTM C955 - Standard Specification for Cold-Formed Steel Structural Framing Members; 2018, with Editorial Revision.
- G. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.
- H. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
- I. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- J. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).
- K. ICC-ES AC308 - Acceptance Criteria for Water-Resistive Barriers; 2016, with Editorial Revision (2021).

- L. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.
- C. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.
- D. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
1. Design data:
- a. Shop drawings signed and sealed by a professional structural engineer.
- E. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention , and _____.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design framing system under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

1.07 MOCK-UP

- A. Provide mock-up of exterior framed wall, including components specified elsewhere, such as insulation, sheathing, window frame, door frame, exterior wall finish, and interior wall finish.
- B. Mock-Up Size: As indicated on drawings.
- C. Location: As indicated on drawings.
- D. Mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Framing:
1. CEMCO; _____: www.cemcosteel.com/#sle.
 2. ClarkDietrich; _____: www.clarkdietrich.com/#sle.
 3. Jaimes Industries; ____: www.jaimesind.com/#sle.
 4. Marino; ____: www.marinoware.com/#sle.
 5. SCAFCO Corporation; _____: www.scafco.com/#sle.
 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Framing Connectors and Accessories:
1. Same manufacturer as metal framing.
 2. ClarkDietrich:
 3. Simpson Strong Tie:
 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FRAMING SYSTEM

- A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

- B. Design Requirements: Provide completed framing system having the following characteristics:
1. Design: Calculate structural characteristics of cold-formed steel framing members according to AISI S100-12.
 2. Structural Performance: Design, engineer, fabricate, and erect to withstand specified design loads for project conditions within required limits.
 3. Design Loads: In accordance with applicable codes.
 4. Live load deflection meeting the following, unless otherwise indicated:
 - a. Floors: Maximum vertical deflection under live load of 1/480 of span.
 - b. Roofs: Maximum vertical deflection under live load of 1/240 of span.
 - c. Exterior Walls: Maximum horizontal deflection under wind load of 1/180 of span.
 - d. Design non-axial loadbearing framing to accommodate not less than 1/2 in vertical deflection.
 5. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
 6. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.03 FRAMING MATERIALS

- A. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
1. Gage and Depth: As required to meet specified performance levels.
- B. Joists and Purlins: Fabricated from ASTM A653/A653M steel sheet, with G90/Z275 hot dipped galvanized coating.
1. Base Metal: As required to meet specified performance levels within maximum depths indicated.
 2. Gage and Depth: As required to meet specified performance levels.
- C. Framing Connectors: Factory-made, formed steel sheet.
1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with G90/Z275 hot dipped galvanized coating for base metal thickness less than 10 gage, 0.1345 inch, and factory punched holes and slots.
 2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
 3. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.
 4. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.
 - a. Products:
 - 1) Simpson Strong Tie:
 - 2) Substitutions: See Section 01 6000 - Product Requirements.
 5. Wall Stud Bridging Connections: Provide mechanical load-transferring devices that accommodate wind load torsion and weak axis buckling induced by axial compression loads. Provide bridging connections where indicated on the drawings.
 6. Products:
 - a. ClarkDietrich:
 - b. Simpson Strong Tie:
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- D. Factory Fabricated Shear Wall Panels:

1. Products:
 - a. CEMCO:
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 FASTENERS

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
- B. Anchorage Devices: Powder actuated.
- C. Welding: Comply with AWS D1.1/D1.1M.

2.05 WALL SHEATHING

- A. Gypsum Board Wall Sheathing: See Section 09 2116.

2.06 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
- B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.
- C. Water-Resistive Barrier: As specified in Section 07 2500.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION OF STUDS

- A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.

3.03 INSTALLATION OF JOISTS AND PURLINS

- A. Install framing components in accordance with manufacturer's instructions.
- B. Make provisions for erection stresses. Provide temporary alignment and bracing.

3.04 INSTALLATION OF WALL SHEATHING

- A. Install wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.
 1. Provide steel diagonal bracing at corners with foam insulation or gypsum board wall sheathing.
 2. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.

END OF SECTION

**SECTION 05 5000
METAL FABRICATIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Prefabricated aluminum ladders.

1.02 RELATED REQUIREMENTS

- A. Section 05 5100 - Metal Stairs.
- B. Section 09 9123 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- B. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008 (Reaffirmed 2018).
- C. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric); 2012.
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- F. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata (2020).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 MATERIALS - ALUMINUM

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Bolts, Nuts, and Washers: Stainless steel.
- C. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.02 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured. Make exposed joints butt tight, flush, and hairline from FF to 8'-0" AFF.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 PREFABRICATED LADDERS

- A. Prefabricated Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
 - 1. Manufacturers:

- B. Prefabricated Ship Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
 - 1. Components: Manufacturer's standard rails, rungs, treads, handrails, returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
 - 2. Materials: Aluminum; ASTM B221 (ASTM B221M), 6063 alloy, T52 temper.
 - 3. Incline: 60 degrees.
 - 4. Finish: Mill finish aluminum.
 - 5. Manufacturers:
 - a. O'Keeffe's Inc; Model 523:
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 FINISHES - ALUMINUM

- A. Interior Aluminum Surfaces: Class II natural anodized.
- B. Class II Natural Anodized Finish: AAMA 611 AA-M12C22A31 Clear anodic coating not less than 0.4 mils thick.
- C. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Obtain approval prior to site cutting or making adjustments not scheduled.
- D. Corrosion Protection: Protect dissimilar metals from galvanic corrosion by pressure tapes, coatings or isolators as acceptable to Architect or Engineer.

END OF SECTION

**SECTION 05 5100
METAL STAIRS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Stairs with concrete treads.
- B. Structural steel stair framing and supports.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete fill in stair pans.
- B. Section 03 3000 - Cast-in-Place Concrete: Placement of metal anchors in concrete.
- C. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.
- D. Section 05 5000 - Metal Fabrications.
- E. Section 05 10 00: Bearing plates for metal stairs, including anchorage.
- F. Section 05 5213 - Pipe and Tube Railings: Metal handrails for the stairs specified in this section.
- G. Section 09 9123 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.
- C. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2023.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
- F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- G. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- H. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
- I. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
- J. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.
- K. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- L. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates; 2015 (Reapproved 2021).
- M. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.
- N. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi

Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.

- O. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
- P. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- Q. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- R. NAAMM AMP 510 - Metal Stairs Manual; 1992.
- S. UL 1994 - Luminous Egress Path Marking Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
 - 2. Include the design engineer's seal and signature on each sheet of shop drawings.
- C. Welders' Certificates.
- D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is certified under AISC 201.

1.05 QUALITY ASSURANCE

- A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.
- B. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 METAL STAIRS - GENERAL

- A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
 - 1. Regulatory Requirements: Provide stairs and railings complying with the most stringent requirements of local, state, and federal regulations; where requirements of the contract documents exceed those of regulations, comply with the contract documents.
 - 2. Handrails: Comply with applicable accessibility requirements of ADA Standards.
 - 3. Structural Design: Provide complete stair and railing assemblies complying with the applicable local code.
 - 4. Dimensions: As indicated on drawings.
 - 5. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
 - 6. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
 - 7. Separate dissimilar metals using paint or permanent tape.
- B. Metal Jointing and Finish Quality Levels:
 - 1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
 - a. Welded Joints: Continuously welded and ground smooth and flush.
 - b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
 - c. Exposed Edges and Corners: Eased to small uniform radius.

- d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.
- C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.
- D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 METAL STAIRS WITH CONCRETE TREADS

- A. Jointing and Finish Quality Level: Architectural, as defined above.
- B. Risers: Closed.
- C. Treads: Metal pan with field-installed concrete fill.
 - 1. Concrete Depth: 1-1/2 inches, minimum.
 - 2. Tread Pan Material: Steel sheet.
 - 3. Tread Pan Thickness: As required by design; 14 gage, 0.075 inch minimum.
 - 4. Concrete Reinforcement: None.
 - 5. Concrete Finish: Steel troweled.
- D. Risers: Same material and thickness as tread pans.
 - 1. Nosing Depth: Not more than 1-1/2 inch overhang.
 - 2. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch wide.
- E. Stringers: Rolled steel channels or as detailed on drawings.
 - 1. Stringer Depth: As indicated on drawings.
 - 2. End Closure: Sheet steel of same thickness as risers welded across ends.
- F. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.
- G. Railings: Steel pipe railings.
- H. Finish: Shop- or factory-prime painted.
- I. Under Side of Stair: Exposed to view, to be finished same as specified for other exposed to view surfaces.

2.03 HANDRAILS AND GUARDS

- A. Wall-Mounted Rails: As specified in Section 05 5213.
- B. Guards: Pipe railings as specified in Section 05 5213.

2.04 MATERIALS

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.
- C. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
 - 1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
 - 2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).
- D. Checkered Plate: ASTM A786/A786M, rolled steel floor plate; manufacturer's standard pattern.

2.05 ACCESSORIES

- A. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.
- B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

- C. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.06 SHOP FINISHING

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Prime Painting: Use specified shop- and touch-up primer.
 - 1. Preparation of Steel: In accordance with SSPC-SP 2 Hand Tool Cleaning.
 - 2. Number of Coats: One.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. When field welding is required, clean and strip primed steel items to bare metal.
- B. Supply items required to be cast into concrete and embedded in masonry with setting templates.

3.03 INSTALLATION

- A. Install components plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.
- D. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.
- E. Obtain approval prior to site cutting or creating adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

END OF SECTION

**SECTION 05 5133
METAL LADDERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop-fabricated metal ladders.
- B. Prefabricated ladders.
- C. Prefabricated ship ladders.

1.02 RELATED REQUIREMENTS

- A. Section 05 5100 - Metal Stairs.
- B. Section 05 5213 - Pipe and Tube Railings.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1910.23 - Ladders; Current Edition.
- B. 29 CFR 1910.28 - Duty to have Fall Protection and Falling Object Protection; Current Edition.
- C. 29 CFR 1910.29 - Fall Protection Systems and Falling Object Protection - Criteria and Practices; Current Edition.
- D. 29 CFR 1910.140 - Personal fall protection systems; Current Edition.
- E. 29 CFR 1926.1053 - Ladders; Current Edition.
- F. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- G. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- H. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008 (Reaffirmed 2018).
- I. ANSI/ASSP Z359.12 - Connecting Components for Personal Fall Arrest Systems; 2019.
- J. ANSI/ASSP Z359.15 - Safety Requirements for Single Anchor Lifelines and Fall Arresters for Personal Fall Arrest Systems; 2014.
- K. ANSI/ASSP Z359.16 - Safety Requirements for Climbing Ladder Fall Arrest Systems; 2016.
- L. ASTM B85/B85M - Standard Specification for Aluminum-Alloy Die Castings; 2018, with Editorial Revision.
- M. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- N. ASTM B210/B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2019a.
- O. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2019.
- P. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.
- Q. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
- R. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- S. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata (2020).

- T. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data sheets on each ladder safety system product to be used, including installation instructions.
- C. Shop Drawings:
 - 1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
- D. Certificate: Provide documentation that ladder safety system products of this section meet or exceed cited 29 CFR 1910.28, 29 CFR 1910.29, ANSI/ASSP Z359.16, and ANSI A14.3 requirements.

1.05 QUALITY ASSURANCE

- A. Design under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.
- B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M and dated no more than 12 months before start of scheduled welding work.
- C. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

PART 2 PRODUCTS

2.01 MATERIALS - ALUMINUM

- A. Extruded Aluminum: ASTM B211/B211M, 6063 alloy, T6 temper.
- B. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.
- C. Aluminum-Alloy Bars: ASTM B211/B211M, 6061 alloy, T6 temper.
- D. Bolts, Nuts, and Washers: Stainless steel.
- E. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.02 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED LADDERS

- A. Ladders: Aluminum; in compliance with ANSI A14.3; with mounting brackets and attachments; mill finish.
 - 1. Side Rails: 3/8 by 2 inches members spaced at 20 inches.
 - 2. Rungs: One inch diameter solid round bar spaced 12 inches on center.
 - 3. Space rungs 7 inches from wall surface.

2.04 PREFABRICATED LADDERS

- A. Prefabricated Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
 - 1. Components: Manufacturer's standard rails, rungs, treads, handrails, returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
 - 2. Finish: Manufacturer's standard clear anodized coating, comply with AAMA 611, Class 1.
 - 3. Manufacturers:
 - a. O'Keeffe's Inc; Model 500.
 - b. Precision Ladders, LLC; Fixed Aluminium Wall Ladder
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- B. Prefabricated Ship Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
 - 1. Components: Manufacturer's standard rails, rungs, treads, handrails, returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
 - 2. Materials: Aluminum; ASTM B211/B211M 6063 alloy, T52 temper.
 - 3. Incline: As shown on drawings,
 - 4. Finish: Manufacturer's standard clear anodized coating, comply with AAMA 611, Class 1.
 - 5. Manufacturers:
 - a. O'Keeffe's Inc; Model 520: www.okeeffes.com/#sle.
 - b. Precision Ladders, LLC: www.precisionladders.com/#sle.
 - c. Substitutions: See Section 01 6000 - Product Requirements.

2.05 FINISHES - ALUMINUM

- A. Exterior Aluminum Surfaces: Class I natural anodized.
- B. Interior Aluminum Surfaces: Class I natural anodized.
- C. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

2.06 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Confirm that the ladder structure to which the ladder safety system is installed is capable of withstanding the loads applied by the system in the event of a fall.

3.02 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Install ladder safety system in accordance with manufacturer's instructions.
- C. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Obtain approval prior to site cutting or making adjustments not scheduled.

END OF SECTION

**SECTION 05 5213
PIPE AND TUBE RAILINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall mounted handrails.
- B. Stair railings and guardrails.
- C. Free-standing railings at steps.
- D. Balcony railings and guardrails.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Placement of anchors in concrete.
- B. Section 05 5100 - Metal Stairs: Attachment plates for handrails specified in this section.
- C. Section 09 2116 - Gypsum Board Assemblies: Placement of backing plates in stud wall construction.
- D. Section 09 9113 - Exterior Painting: Paint finish.
- E. Section 09 9123 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
- E. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2021.
- F. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2024.
- G. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
- H. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Rail Infill: 6 gauge woven wire 2 x 2 or as shown on contract drawings. Shop primed. Field painted.
 - 1. The G-S Company: Woven wire
 - 2. The Western Group; Woven Wire:
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 RAILINGS - GENERAL REQUIREMENTS

- A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code.
- B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935
- C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935
- D. Allow for expansion and contraction of members and building movement without damage to connections or members.
- E. Dimensions: See drawings for configurations and heights.
- F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
 - 1. For anchorage to concrete, provide inserts to be cast into concrete, for bolting or welding anchors.
 - 2. For anchorage to masonry, provide brackets to be embedded in masonry, for bolting or welding anchors.
 - 3. For anchorage to stud walls, provide backing plates, for bolting or welding anchors.
- G. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.03 STEEL RAILING SYSTEM

- A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.
- B. Steel Pipe: ASTM A53/A53M Grade B Schedule 80, galvanized finish.
- C. Non-Weld Mechanical Fittings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.
- D. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.
- E. Exposed Fasteners: No exposed bolts or screws.
- F. Straight Splice Connectors: Steel concealed spigots.
- G. Galvanizing: In accordance with requirements of ASTM A123/A123M.
 - 1. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic.
- H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.04 FABRICATION

- A. Accurately form components to suit specific project conditions and for proper connection to building structure.
- B. Fit and shop assemble components in largest practical sizes for delivery to site.
- C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
- D. Welded Joints:

1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
2. Interior Components: Continuously seal joined pieces by continuous welds.
3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- C. Install railings in compliance with ADA Standards for accessible design at applicable locations.
- D. Anchor railings securely to structure.
- E. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

**SECTION 06 1000
ROUGH CARPENTRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof-mounted curbs.
- B. Roofing cant strips.
- C. Preservative treated wood materials.
- D. Fire retardant treated wood materials.
- E. Miscellaneous framing and sheathing.
- F. Communications and electrical room mounting boards.
- G. Concealed wood blocking, nailers, and supports.
- H. Miscellaneous wood nailers, furring, and grounds.

1.02 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- B. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2017).
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- D. AWPA U1 - Use Category System: User Specification for Treated Wood; 2024.
- E. PS 1 - Structural Plywood; 2023.
- F. PS 20 - American Softwood Lumber Standard; 2025.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. Species: Douglas Fir-Larch, unless otherwise indicated.
 - 2. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
- B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry or MC19.
- C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.04 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

2.05 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
- B. Fire Retardant Treatment:
 - 1. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Do not use treated wood in direct contact with the ground.
 - 2. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Treat rough carpentry items as indicated .
 - c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

- C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- D. Provide the following specific non-structural framing and blocking unless detailed otherwise.
 - 1. Cabinets and shelf supports.
 - 2. Wall brackets.
 - 3. Handrails.
 - 4. Grab bars.
 - 5. Towel and bath accessories.
 - 6. Wall-mounted door stops.
 - 7. Chalkboards and marker boards.
 - 8. Wall paneling and trim.
 - 9. Joints of rigid wall coverings that occur between studs.

3.03 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at all roof openings except where prefabricated curbs are specified and where specifically indicated otherwise.

3.04 INSTALLATION OF CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
 - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 - 3. Install adjacent boards without gaps.
 - 4. Size and Location: As indicated on drawings.

3.05 CLEANING

- A. Waste Disposal: Comply with the requirements of Section 01 7419 - Construction Waste Management and Disposal.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not burn scraps that have been pressure treated.
 - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

**SECTION 07 1713
BENTONITE PANEL WATERPROOFING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Bentonite clay waterproofing panels and accessories for installation at elevator pit.

1.02 RELATED REQUIREMENTS

- A. Section 07 2100 - Thermal Insulation: Rigid insulation board used as protection board.
- B. Section 31 2323 - Fill.
- C. Section 33 4100 - Subdrainage.

1.03 REFERENCE STANDARDS

- A. NRCA (WM) - The NRCA Waterproofing Manual; 2021.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product criteria, characteristics, accessories, jointing and seaming methods, and termination conditions.
- C. Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer's Installation Instructions: Indicate special preparation of substrate, panel attachment methods, and perimeter conditions requiring special attention.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Maintain bentonite products dry. Protect with waterproof cover.

1.06 FIELD CONDITIONS

- A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Bentonite Panel Waterproofing:
 - 1. CETCO, a division of Minerals Technologies Inc:
 - 2. Epro Waterproofing Systems:
 - 3. Tremco Commercial Sealants and Waterproofing:

2.02 MATERIALS

- A. Bentonite: Granulated pure, dry, bentonite clay comprised of 90 percent minimum sodium montmorillonite; 90 percent minimum passing No. 20 mesh sieve and 10 percent maximum passing No. 200 mesh sieve.
- B. Geotextile-Faced Panels: One layer of non-woven polypropylene geotextile fabric, center core filled with self healing, self expanding bentonite clay granules and one layer of woven polypropylene geotextile fabric; all layers needlepunched together with high-strength polypropylene yarn.

2.03 ACCESSORIES

- A. Fasteners: Galvanized nails.

- B. Adhesive: Manufacturer's recommended type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify substrate surfaces are smooth and durable; free of matter detrimental to application of waterproofing system.
- C. Verify that items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

- A. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.
- B. Remove concrete fins, projections, and form ties.
- C. Fill holes, cracks, honeycombs, and voids with bentonite gel seal, at least 1/8 inch thick, extending 3 inches, minimum, beyond defect.

3.03 INSTALLATION - GENERAL

- A. Install panels in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- B. Cut panels parallel to corrugations to prevent bentonite loss.
- C. Seal construction joints with joint seal.

3.04 INSTALLATION - VERTICAL SURFACES

- A. Install panels with masonry nails or adhesive, starting at base of foundation.
- B. Fold panels around corners with corrugations vertical, and install unfolded panels with corrugations horizontal.
- C. Lap adjoining panels 1-1/2 inches.

END OF SECTION

SECTION 07 2100 THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation and integral vapor retarder at exterior foundation and at CMU exterior walls.
- B. Batt insulation and vapor retarder in exterior wall, ceiling, and roof construction.
- C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.
- D. Sound Attenuation Batt insulation where noted on partition schedule.
- E. Expanding spray foam insulation.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Field-applied termiticide for concrete slabs and foundations.
- B. Section 06 1000 - Rough Carpentry: Supporting construction for batt insulation.
- C. Section 07 2500 - Weather Barriers: Separate air barrier and vapor retarder materials.
- D. Section 09 2116 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.
- E. Section 07 51 10 - Multi-Ply Cold Process Roof.

1.03 REFERENCE STANDARDS

- A. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.
- B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).
- C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.
- D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.
- E. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- G. FM DS 1-28 - Wind Design; 2015, with Editorial Revision (2024).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.05 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Thermal Insulation:
 - 1. Owens-Corning
 - 2. BASF
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

- B. Expanding Spray Foam Insulation
 - 1. Dow Great Stuff
 - 2. Lockite Tight Foam

2.02 APPLICATIONS

- A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.
- B. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.
- C. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.
- D. Insulation Above Lay-In Acoustical Ceilings: Batt insulation with no vapor retarder.
- E. Insulation Over Roof Deck: If required for noted application, Extruded polystyrene (XPS) board.

2.03 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
- B. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
 - 1. Classifications:
 - a. Type II:
 - 2. Board Size: 48 inch by 96 inch.
 - 3. Board Thickness: 2.0 inch.
 - 4. Manufacturers:
 - a. GAF; EnergyGuard Polyiso Insulation: www.gaf.com/#sle.
 - b. Carlisle.
 - c. DuPont
 - d. BASF
 - e. Substitutions: See Section 01 6000 - Product Requirements.

2.04 BATT INSULATION MATERIALS

- A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at Contractor's option.
- B. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 - 1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
- C. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
 - 3. Manufacturers:
 - a. Johns Manville; MinWool Sound Attenuation Fire Batts:
 - b. ROCKWOOL (ROXUL, Inc); COMFORTBATT: www.rockwool.com/#sle.
 - c. Thermafiber, Inc; SAFB:
 - d. Thermafiber, Inc; SAFB FF:
 - e. Substitutions: See Section 01 6000 - Product Requirements.

2.05 ACCESSORIES

- A. Sheet Vapor Retarder: Specified in Section 07 2500.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. Install boards horizontally on foundation perimeter.
 - 1. Place boards to maximize adhesive contact.
 - 2. Install in running bond pattern.

3.03 BOARD INSTALLATION AT EXTERIOR WALLS

- A. Adhere a 6 inch wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.
- B. Apply adhesive to back of boards:
- C. Install boards horizontally on walls.
 - 1. Place boards to maximize adhesive contact.
 - 2. Install in running bond pattern.
 - 3. Butt edges and ends tightly to adjacent boards and to protrusions.
- D. Extend boards over expansion joints, unbonded to wall on one side of joint.
- E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.04 BATT INSTALLATION

- A. Install insulation in accordance with manufacturer's instructions.
- B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

3.05 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.

3.06 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

**SECTION 07 7234
ROOF HATCHES**

PART 1 GENERAL

1.01 SUMMARY

- A. Metal roof hatches with integral curbs.

1.02 SYSTEM DESCRIPTION

- A. The roof hatches shall have a clear opening as shown on the drawings, and shall consist of an insulated cover and frame. Material shall be G-90 galvanized steel and have a factory applied coat of primer. Corners shall be fully welded and ground smooth. A gasket between cover and frame shall create a weather tight seal.

1.03 DELIVERY, STORAGE AND HANDLING

- A. A. Examine units upon arrival at jobsite. Notify the carrier and manufacturer of any damage immediately.
- B. B. Store units under roof, if possible until installation; or, if stored outside, store under a tarp or suitable cover.

1.04 WARRANTY

- A. The unit to carry a limited warranty of 5 years against defective material and workmanship, covering parts only, no labor or freight. Defective parts, if deemed so by the manufacturer, will be replaced at no charge, freight excluded, upon inspection at manufacturer's plant which warrants same.

1.05 MAINTENANCE

- A. A. Under normal usage, the hatches shall require no preventive maintenance.
- B. B. No "Spare Parts" shall be required.

PART 2 PRODUCTS

2.01 MANUFACTURER

- A. Acceptable Manufacturer: Bilco NB-20, or product approved by Pre-Engineered Metal Building Manufacturer.

2.02 MATERIALS

- A. A. PERFORMANCE CHARACTERISTICS
 1. 1. Cover shall be reinforced to support a minimum live load of 40 psf (195kg/m²) with a maximum deflection of .67% of the span and a 20 psf (97 kg/m²) wind uplift for galvanized steel (Model PH-G).
 2. 2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
 3. 3. Operation of the cover shall not be affected by temperature.
 4. 4. Entire hatch shall be weather tight with fully welded corner joints on cover and curb.
- B. B. CURB
 1. 1. Provided by Pre-engineered Building Manufacturer.
 2. 2. Sheathed with 1" of rigid fiber board insulation.
- C. C. COVER
 1. 1. Formed from 14 gauge galvanized steel of lockforming quality per ASTM A-525 with G90 coating (.090 Aluminum H-14 3003 on aluminum models).
 2. 2. Liner shall be 22 gauge galvanized steel with G90 coating (.040 Aluminum H-14 3003 on aluminum models).
 3. 3. Insulation between cover and liner to be 1" thick U.L. plain fiberglass 0.75# density.

- 4. 4. Lid shall be reinforced as required with 11 ga. steel channel (.090 Aluminum H-14 3003 on aluminum models).
- 5. 5. A one point cab lock is to be provided with a built-in inside handle.
- 6. 7. Outside handle shall be vinyl coated, steel handle.
 - a. 8. Automatic hold-open device shall be formed from 3/16" steel flat bar and 1/2" diameter steel round stock with a vinyl grip.
- 7. 9. Padlock provisions provided on exterior and interior of unit.
 - a. 10. Extruded rubber gasket shall be securely attached to the liner, thus providing a weather-tight seal.
- D. D. PRESSURE CONTROL
 - 1. Opening/closing assistance/resistance shall be provided with spring-loaded pressure intensifiers consisting of a telescoping tube; the top(outer) tube shall be 1 5/16", bottom (inner) tube shall be 1 1/2". Tubes shall be cadmium plated and chromate-sealed.
- E. E. HARDWARE
 - 1. Corrosion resistant hardware and fasteners.
- F. H. FABRICATION
 - 1. The hatch to be completely fabricated ready for installation before shipment to the site.
- G. I. FINISH
 - 1. Red oxide primer.
- H. J. SOURCE QUALITY CONTROL
 - 1. 1. All products tested in factory for proper operation before shipment.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine rough opening in roof for opening size and squareness.

3.02 INSTALLATION

- A. Install per the manufacturer's installation instructions.

END OF SECTION

SECTION 07 8400 FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping systems.
- B. Firestopping of joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

- A. Section 01 7000 - Execution and Closeout Requirements: Cutting and patching.
- B. Section 09 2116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.
- C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).
- D. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems; 2020a.
- E. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2020a.
- F. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2023b.
- G. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2023a.
- H. ITS (DIR) - Directory of Listed Products; Current Edition.
- I. FM 4991 - Approval Standard of Firestop Contractors; 2013.
- J. FM (AG) - FM Approval Guide; Current Edition.
- K. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).
- L. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.
- M. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.
- N. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

1.05 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.

1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

1.06 MOCK-UP

- A. Install one firestopping assembly representative of each fire rating design required on project.
 1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.
 2. Where firestopping is intended to fill a linear opening, install minimum of 1 linear ft.
- B. If accepted, mock-up will represent minimum standard for the Work.
- C. If accepted, mock-up may remain as part of the Work. Remove and replace mock-ups not accepted.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Firestopping Manufacturers:
 1. 3M Fire Protection Products:
 2. Hilti, Inc:
 3. Nelson FireStop Products:
 4. Tremco Commercial Sealants & Waterproofing:

2.02 MATERIALS

- A. Firestopping Materials: Any materials meeting requirements.
- B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.
- B. Head-of-Wall Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.
- C. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
- D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

2.04 FIRESTOPPING SYSTEMS

- A. Firestopping: Any material meeting requirements.
 1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

3.04 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174, and ASTM E2393.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

END OF SECTION

**SECTION 07 9100
PREFORMED JOINT SEALS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Precompressed foam seals.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Liquid and mastic joint sealants and their backing materials.

1.03 REFERENCE STANDARDS

- A. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber; 2020.
- B. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements; 1991 (Reapproved 2016).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's technical data sheets for each product, including chemical composition, movement capability, color availability, limitations on application, and installation instructions.
- C. Color Cards: For color selection.

1.05 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a two year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealers that fail to achieve watertight seal or exhibit loss of adhesion or cohesion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Precompressed Foam Seals:
 - 1. EMSEAL Joint Systems, Ltd:
 - 2. Nystrom, Inc:
 - 3. Tremco Commercial Sealants & Waterproofing:
 - 4. Watson Bowman Acme Corporation:
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Preformed Strip Seals:
 - 1. EMSEAL Joint Systems, Ltd
 - 2. Sika Corporation:
 - 3. Tremco Commercial Sealants & Waterproofing:
 - 4. Willseal LLC:
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESSORIES

- A. Adhesive: As recommended by seal manufacturer.
- B. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and strip seal.
- C. Substrate Cleaner: Non-corrosive, non-staining type recommended by seal manufacturer; compatible with joint forming materials.

- D. Primer: Type recommended by seal manufacturer to suit application; non-staining.
- E. Backing Tape: Self-adhesive polyethylene tape with surface that seal will not adhere to.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive this work.
- B. Measure joint dimensions and verify that seal products are of the correct size to properly seal the joints.

3.02 PREPARATION

- A. Properly prepare construction components adjacent to the work of this section to prevent damage and disfigurement due to this work.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's written instructions.

3.04 CLEANING

- A. Clean adjacent soiled surfaces.

3.05 PROTECTION

- A. Protect joints from damage until adhesives have properly cured.

END OF SECTION

SECTION 07 9200 JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 2500 - Weather Barriers: Sealants required in conjunction with air barriers and vapor retarders.
- B. Section 07 9513 - Expansion Joint Cover Assemblies: Sealants forming part of expansion joint cover assemblies.
- C. Section 08 7100 - Door Hardware: Setting exterior door thresholds in sealant.
- D. Section 08 8000 - Glazing: Glazing sealants and accessories.
- E. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- F. Section 09 2216 - Non-Structural Metal Framing: Sealing between framing and adjacent construction in acoustical and sound-rated walls and ceilings.
- G. Section 09 3000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.03 REFERENCE STANDARDS

- A. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).
- B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- C. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- E. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.
- F. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Certification by manufacturer indicating that product complies with specification requirements.
- C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of each referenced document covering installation requirements on site.

- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
 - 1. Bostik Inc:
 - 2. Dow Chemical Company:
 - 3. Hilti, Inc:
 - 4. Pecora Corporation:
 - 5. Sika Corporation; _____: www.usa-sika.com/#sle.
 - 6. Tremco Commercial Sealants & Waterproofing; _____: www.tremcosealants.com/#sle.
 - 7. W.R. Meadows, Inc:
 - 8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Openings below ledge angles in masonry.
 - e. Other joints indicated below.
 - 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. Other joints indicated below.
 - 3. Do not seal the following types of joints.
 - a. Intentional weepholes in masonry.
 - b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
 - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - d. Joints where installation of sealant is specified in another section.
 - e. Joints between suspended panel ceilings/grid and walls.
- B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
- C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
 - 1. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
- D. Interior Wet Areas: Bathrooms, restrooms, and food service areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

2.03 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.04 NONSAG JOINT SEALANTS

- A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 50 percent, minimum.
 - 2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
 - 3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
 - 4. Color: To be selected by Architect from manufacturer's standard range.
 - 5. Cure Type: Single-component, neutral moisture curing.
 - 6. Manufacturers:
 - a. Dow Chemical Company; 756 SMS Building Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
 - b. Pecora Corporation: www.pecora.com.
 - c. Sika Corporation; Sikasil WS-290: www.usa-sika.com/#sle.
 - d. Tremco Commercial Sealants & Waterproofing; Spectrem 1: www.tremcosealants.com/#sle.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- B. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Color: To be selected by Architect from manufacturer's standard range.
 - 3. Cure Type: Single-component, neutral moisture curing
 - 4. Service Temperature Range: Minus 65 to 180 degrees F.
 - 5. Manufacturers:
 - a. Dow Chemical Company; 758 Silicone Weather Barrier Sealant:
 - b. Pecora Corporation:
 - c. Sherwin-Williams Company; Silicone Rubber All Purpose Sealant:
 - d. Sika Corporation; Sikasil GP:
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- C. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
 - 1. Manufacturers:
 - a. Pecora Corporation: www.pecora.com.
 - b. Sika Corporation; Sikasil GP: www.usa-sika.com/#sle.
 - c. Substitutions: See Section 01 6000 - Product Requirements.
- D. Polymer Sealant: ASTM C920; single component, cured sealant is paintable and mold/mildew resistant, low odor and VOC, and ultraviolet (UV) resistant.
 - 1. Color: White.
 - 2. Manufacturers:
 - a. DAP Products Inc; DYNAFLEX 800 Sealant:
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- E. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Color: To be selected by Architect from manufacturer's standard range.

3. Service Temperature Range: Minus 40 to 180 degrees F.
4. Manufacturers:
 - a. Pecora Corporation:
 - b. The QUIKRETE Companies; QUIKRETE® Polyurethane Non-Sag Sealant:
 - c. Sherwin-Williams Company; Stampede 2NS Polyurethane Sealant:
 - d. Sika Corporation; Sikaflex-1a:
 - e. Tremco Commercial Sealants & Waterproofing; Dymonic 100:
 - f. W. R. Meadows, Inc; POURTHANE NS:
 - g. Substitutions: See Section 01 6000 - Product Requirements.

2.05 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
 1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
 2. Open Cell: 40 to 50 percent larger in diameter than joint width.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- D. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

3.02 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Install bond breaker backing tape where backer rod cannot be used.
- D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- E. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- F. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

END OF SECTION

**SECTION 07 9513
EXPANSION JOINT COVER ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Expansion joint cover assemblies for floor roof and wall surfaces as shown on contract drawings.

1.02 RELATED REQUIREMENTS

- A. Section 04 2000 - Unit Masonry: Placement of joint cover assembly frames in masonry.
- B. Section 05 5000 - Metal Fabrications: Custom fabricated metal expansion and control joint devices.
- C. Section 07 6200 - Sheet Metal Flashing and Trim: Roof expansion and control joint covers.
- D. Section 07 9200 - Joint Sealants: Sealing expansion and control joints using gunnable and pourable sealants.
- E. Section 09 2116 - Gypsum Board Assemblies: Gypsum board control joint trim.
- F. Section 09 5100 - Acoustical Ceilings: Expansion joint assemblies in suspended ceiling grids.

1.03 REFERENCE STANDARDS

- A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- C. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2020.
- D. ITS (DIR) - Directory of Listed Products; Current Edition.
- E. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices and available colors and finish.
- C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction and anchorage locations.
- D. Samples: Submit two samples 12 inch long, illustrating profile, dimension, color, and finish selected.
- E. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Expansion Joint Cover Assemblies:
 - 1. Construction Specialties, Inc:
 - 2. Inpro:
 - 3. Nystrom, Inc:
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 EXPANSION JOINT COVER ASSEMBLY APPLICATIONS

- A. Exterior Wall to Roof and Wall to Wall Joints Subject to Thermal Movement:
- B. Interior Wall/Ceiling Joints Subject to Thermal Movement:
- C. Interior Fire-Rated Wall/Ceiling/Floor Joints Subject to Thermal Movement:
- D. Exterior Wall Joints Subject to Thermal Movement:

2.03 EXPANSION JOINT COVER ASSEMBLIES

- A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
- B. Floor Joint Covers: Coordinate with indicated floor coverings.
- C. Resilient Seal Type Covers: Having flat exposed surface without crevices that could collect dirt; designed to withstand expected movement without extrusion of seal from joint assembly; for floors, provide style that is flush with top of floor covering; for exterior joints, weathertight.
- D. Covers In Fire Rated Assemblies: Provide cover assembly having fire rating equivalent to that of assembly into which it is installed.
 - 1. Acceptable Evaluation Agencies: UL (DIR) and ITS (DIR).

2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.
- B. Resilient Seals:
 - 1. For Ceilings: Any resilient material, flush, pleated, or hollow gasket.
- C. Anchors and Fasteners: As recommended by cover manufacturer.
- D. Ferrous Metal Anchors: Galvanized where embedded in concrete or in contact with cementitious materials.
- E. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphaltic type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.
- B. Verify that frames and anchors installed by others are in correct locations and suitable for installation of remainder of assembly.

3.02 INSTALLATION

- A. Install components and accessories in accordance with manufacturer's instructions.
- B. Align work plumb and level, flush with adjacent surfaces.
- C. Rigidly anchor to substrate to prevent misalignment.

END OF SECTION

**SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
1. Standard and custom hollow metal doors and frames.
 2. Steel sidelight, borrowed lite and transom frames.
 3. Louvers installed in hollow metal doors.
 4. Light frames and glazing installed in hollow metal doors.
- B. Related Sections:
1. Division 01 Section "General Conditions".
 2. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
 3. Division 08 Section "Flush Wood Doors".
 4. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
 5. Division 08 Section "Door Hardware".
 6. Division 08 Section "Access Control Hardware".
 7. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
 8. Division 28 Section "Access Control Hardware".
- C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
 2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
 3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
 4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
 5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
 6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
 10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
 11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
 12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
 13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.

14. FEMA P-361 2015 – Design and Construction Guidance for Community Safe Rooms.
15. ICC 500 - 2014 ICC/NSSA Standard for the Design and Construction of Storm Shelters.
16. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
17. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
18. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- C. Shop Drawings: Include the following:
 1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of anchorages, joints, field splices, and connections.
 6. Details of accessories.
 7. Details of moldings, removable stops, and glazing.
 8. Details of conduit and preparations for power, signal, and control systems.
- D. Samples for Verification:
 1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257.

Provide labeled glazing material.

- E. Energy Efficient Exterior Openings: Comply with minimum thermal ratings, based on ASTM C1363. Openings to be fabricated and tested as fully operable, thermal insulating door and frame assemblies.
 - 1. Thermal Performance (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM C1363 and meet or exceed the following requirements:
 - a. Door Assembly Operable U-Factor and R-Value Ratings: U-Factor 0.37, R-Value 2.7, including insulated door, thermal-break frame and threshold.
 - 2. Air Infiltration (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM E283 to meet or exceed the following requirements:
 - a. Rate of leakage of the door assembly shall not exceed 0.25 cfm per square foot of static differential air pressure of 1.567 psf (equivalent to 25 mph wind velocity).
- F. Severe Storm Shelter Openings: Provide complete door systems for hurricane or tornado storm shelters, and other areas of refuge, complying and tested according to FEMA P-361, Third Edition (2015), Design and Construction Guidance for Community Safe Rooms; and ICC 500 (2014), ICC/NSSA Standard for the Design and Construction of Storm Shelters.
 - 1. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- G. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.07 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

Evergreen Baptist Church
Phase 5
Broken Arrow, Oklahoma
March 3, 2025

HOLLOW METAL DOORS AND
FRAMES
08 1113
3
Construction Documents

Reed Architecture and Interiors
18 East Hobson Avenue
Sapulpa, Oklahoma

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
 - 1. CECO Door Products (C).
 - 2. Curries Company (CU).

2.02 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.03 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Exterior Doors (Energy Efficient): Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, ANSI/SDI A250.4 for physical performance level, and HMMA 867 for door construction.
 - 1. Design: Flush panel.
 - 2. Core Construction: Foamed in place polyurethane and steel stiffened laminated core with no stiffener face welds, in compliance with HMMA 867 "Laminated Core".
 - a. Provide 22 gauge steel stiffeners at 6 inches on-center internally welded at 5" on-center to integral core assembly, foamed in place polyurethane core chemically bonded to all interior surfaces. No stiffener face welding is permitted.
 - b. Thermal properties to rate at a fully operable minimum U-Factor 0.37 and R-Value 2.7, including insulated door, thermal-break frame and threshold.
 - c. Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.38 and R-Value 2.6, including insulated door, kerf type frame, and threshold.
 - 3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053 inch - 1.3-mm) thick steel, Model 2.
 - 4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 - 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 - 6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".

7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. Interior Doors (Energy Efficient): Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A366 or 620. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
 2. Core Construction: Steel stiffened laminated core with fiberglass filler with no stiffener face welds, in compliance with HMMA 867 "Laminated Core".
 - a. Provide 22 gauge steel-stiffeners at 6 inches on-center internally welded at 5" on-center to integral core assembly, No stiffener face welding is permitted.
 - b. Acoustical sound transmission rating shall be no less than STC 38 complying with ASTM E 90 and must be visible on factory applied labels.
 3. Level/Model: Level 2 and Physical Performance Level A (Heavy Duty), Minimum 18 gauge (0.042 inch - 1.1-mm) thick steel, Model 2.
 4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- D. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
 2. Core Construction: Manufacturer's standard vertical steel-stiffener core. Minimum 22 gauge steel-stiffeners at 6 inches on-center construction attached by spot welds spaced not more than 5" on centers. Spaces between stiffeners filled with fiberglass insulation (minimum density 0.8#/cubic ft.).
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
 4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
 5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
 6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Manufacturers Basis of Design:
1. Curries Company (CU) - Polystyrene Core - 707 Series.
 2. Curries Company (CU) - Energy Efficient - 777 Trio-E Series.

2.04 HOLLOW METAL DOORS FOR SEVERE STORM SHELTERS

- A. General: Provide complete tornado or hurricane resistant door and frame shelter assemblies constructed to resist the design wind pressures for components and cladding and missile impact loads as described in ICC 500 - 2014, ICC/NSSA Standard for the Design and Construction of Storm Shelters. Only single opening and paired opening doors and their frames constructed to resist calculated design wind pressures and laboratory tested missile impacts are acceptable.
 - 1. Door systems, both single doors and paired openings, tested and complying with ICC 500 - 2014 and FEMA P-361 (2015), Design and Construction Guidance for Community Safe Rooms and supported by third party test results.
 - 2. Sheets fabricated on exterior openings from commercial quality hot dipped zinc coated steel complying with ASTM A924 A60. Gauges to be in accordance with manufacturers tested assemblies.
 - 3. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 - 4. Top Edge: Reinforce top of doors with a continuous steel channel extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached and welded in place with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 - 5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
- B. Manufacturers Basis of Design:
 - 1. CECO Door Products (C) - StormPro Series.
 - 2. Curries Company (CU) - StormPro Series.

2.05 HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames. Tested for thermal performance in accordance with NFRC 102, and resistance to air infiltration in accordance with NFRC 400. Where indicated provide thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate with 1/16" positive thermal break and integral vinyl weatherstripping.
- C. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.
 - 1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 - 2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
 - 3. Manufacturers Basis of Design:
 - a. Curries Company (CU) – M Series.
- D. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
 - 1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 - 2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
 - 3. Manufacturers Basis of Design:
 - a. Curries Company (CU) - M Series.
- E. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

- F. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.06 FRAME ANCHORS

- A. Jamb Anchors:
1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
 3. FEMA 361 Storm Shelter Anchors: Masonry T-shaped, wire masonry type, or existing opening type anchors.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.07 LOUVERS

- A. Metal Louvers: Unless otherwise indicated provide louvers to meet the following requirements.
1. Blade Type: Vision proof inverted V or inverted Y.
 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.
- B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.
1. Manufacturers: Subject to compliance with requirements, provide louvers to meet rating indicated.
 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.08 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.09 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.10 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
 - 1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
 - 2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
 - 3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
- D. Hollow Metal Frames:
 - 1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
 - 3. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
 - 4. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
 - 5. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
 - 6. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 - 7. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

- 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
8. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
9. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.11 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
 - 1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 - 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.04 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION

**SECTION 08 1416
FLUSH WOOD DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush wood doors; flush configuration; fire-rated and non-rated.

1.02 RELATED REQUIREMENTS

- A. Section 06 2000 - Finish Carpentry: Wood door frames.
- B. Section 08 1113 - Hollow Metal Doors and Frames.
- C. Section 08 7100 - Door Hardware.
- D. Section 08 8000 - Glazing.
- E. Section 09 2116 - Gypsum Board Assemblies:
- F. Section 09 9123 - Interior Painting: Field finishing of doors.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).
- C. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- D. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.
- E. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.
- F. ASTM E413 - Classification for Rating Sound Insulation; 2022.
- G. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2023.
- H. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- I. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- J. FM (AG) - FM Approval Guide; Current Edition.
- K. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.
- M. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.
- N. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- O. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- P. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.
- Q. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2021, with Errata (2022).

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
 - 1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- D. Samples: Submit two samples of door veneer, 4 inch by 4 inch in size illustrating wood grain, stain color, and sheen.
- E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- F. Specimen warranty.
- G. Warranty, executed in Owner's name.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wood Veneer Faced Doors:
 - 1. Construction Specialties, Inc:
 - 2. Eggers Industries:
 - 3. Marshfield DoorSystems, Inc:
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS AND PANELS

- A. Doors: Refer to drawings for locations and additional requirements.
 - 1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
 - 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
 - 1. Provide solid core dutch door at location shown on drawings.No shelf. Provide upper and lower leaf latch to match door hardware..
 - 2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
 - 3. Wood veneer facing for field finish match existing..

2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core Doors: Type particleboard core (PC), plies and faces as indicated.
- B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: Species as specified above, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with plank match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.

2.05 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
 - 1. Provide solid blocks at lock edge for hardware reinforcement.
 - 2. Provide solid blocking for other throughbolted hardware and leaf latch.
- C. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- F. Provide edge clearances in accordance with the quality standard specified.

2.06 FACTORY FINISHING - WOOD VENEER DOORS

- A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
 - 1. Transparent:
 - a. System - 1, Lacquer, Nitrocellulose.
 - b. Stain: Natural transparent. Verify with architect sample.
 - c. Sheen: Satin.

2.07 ACCESSORIES

- A. Glazed Openings:
 - 1. Heat-Strengthened and Fully Tempered Glass: ASTM C1048.
- B. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
- C. Door Hardware: As specified in Section 08 7100.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install door in accordance with manufacturer's instructions and specified quality standard.
 - 1. Install fire-rated doors in accordance with NFPA 80 requirements.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.

3.03 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.

END OF SECTION

**SECTION 08 3100
ACCESS DOORS AND PANELS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall and ceiling access door and frame units.

1.02 RELATED REQUIREMENTS

- A. Section 09 9113 - Exterior Painting: Field paint finish.
- B. Section 09 9123 - Interior Painting: Field paint finish.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of each access door and/or panel unit.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

- A. Wall-Mounted Units:
 - 1. Location: As indicated on drawings.
 - 2. Size: 24 inch by 24 inch or as shown on contract drawings.
 - 3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 - 4. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
 - 5. Masonry Mounting Criteria: Provide surface-mounted frame with door surface flush with frame surface.
- B. Wall-Mounted Units in Wet Areas:
 - 1. Size: 24 inch by 24 inch.
 - 2. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 - 3. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
 - 4. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
- C. Ceiling-Mounted Units:
 - 1. Location: As indicated on drawings.
 - 2. Material: Steel.
 - 3. Size - Lay-In Grid Ceilings: To match module of ceiling grid.
 - 4. Size - Other Ceilings: 24 inch by 24 inch or as shown on contract drawings.
 - 5. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

2.02 WALL AND CEILING MOUNTED UNITS

- A. Manufacturers:
 - 1. Babcock-Davis:
 - 2. Milcor, Inc; _____:
 - 3. Nystrom, Inc:
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings are correctly sized and located.
- B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to proceeding with this work.
- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

**SECTION 08 4313
ALUMINUM-FRAMED STOREFRONTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Weatherstripping.

1.02 RELATED REQUIREMENTS

- A. Section 05 1200 - Structural Steel Framing: Steel attachment members.
- B. Section 05 5000 - Metal Fabrications: Steel attachment devices.
- C. Section 07 2500 - Weather Barriers: Sealing framing to weather barrier installed on adjacent construction.
- D. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.
- E. Section 08 5113 - Aluminum Windows: Operable sash within glazing system.
- F. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.
- G. Section 08 8000 - Glazing: Glass and glazing accessories.
- H. Section 12 2400 - Window Shades: Attachments to framing members.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.
- B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.
- C. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2014.
- D. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- E. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- F. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- I. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).
- J. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).
- K. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).
- L. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015 (Reapproved 2023).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
- D. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- E. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.
- F. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

- A. Center-Set Style, Thermally-Broken:
 - 1. Basis of Design: Kawneer Co., Inc. Tri-Fab VG-451T.
 - 2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
- B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 BASIS OF DESIGN -- FRAMING FOR MONOLITHIC GLAZING

- A. Center-Set Style:
 - 1. Basis of Design: Kawneer Co., Inc. Tri-Fab VG 450.
 - 2. Vertical Mullion Dimensions: 1-3/4 inches wide by 4 inches deep.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.03 BASIS OF DESIGN -- SWINGING DOORS

A. Wide Stile, Insulating Glazing, Thermally-Broken:

1. Basis of Design: Kawneer 500 wide stile with 61/2" bottom rail.
2. Thickness: 1-3/4 inches.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.04 STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.

1. Glazing Rabbet: For 1 inch insulating glazing.
2. Finish: Class I natural anodized. #14 Kawneer finish.
 - a. Factory finish all surfaces that will be exposed in completed assemblies.
 - b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
3. Finish Color: As selected by Architect from manufacturer's standard line.
4. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
7. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
8. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
9. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
10. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.

B. Performance Requirements:

1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - a. Design Wind Loads: Comply with requirements of applicable code.
 - b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
2. Wind-Borne-Debris Resistance: Identical full-size glazed assembly without auxiliary protection, having Florida Building Code FLA (PAD) approval for Large and Small Missile impact and pressure cycling at design wind pressure.
3. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 10 psf.
4. Air Leakage Laboratory Test: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 psf pressure differential across assembly.

2.05 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
 - 1. Glazing Stops: Flush.
- B. Glazing: As specified in Section 08 8000.
- C. Swing Doors: Glazed aluminum.
 - 1. Thickness: 1-3/4 inches.
 - 2. Glazing Stops: Square.
 - 3. Finish: Same as storefront.

2.06 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Fasteners: Stainless steel.
- C. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.07 FINISHES

- A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils thick.
- B. Color: As selected by Architect from manufacturer's standard range.
- C. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.08 HARDWARE

- A. For each door, include all hardware not otherwise supplied in Section 087100.
- B. Other Door Hardware: As specified in Section 08 7100.
- C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.
- D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

- I. Set thresholds in bed of sealant and secure.
- J. Install glass and infill panels in accordance with Section 08 8000, using glazing method required to achieve performance criteria.
- K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.
- B. Water-Spray Test: Provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.
 - 1. Perform a minimum of two tests in each designated area as indicated on drawings.
 - 2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
- C. Provide field testing of installed storefront system by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.
 - 1. Perform a minimum of two tests in each designated area as indicated on drawings.
 - 2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
 - 3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf.
 - a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.
- D. Repair or replace storefront components that have failed designated field testing, and retest to verify performance conforms to specified requirements.

3.04 ADJUSTING

- A. Adjust operating hardware and sash for smooth operation.

3.05 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.06 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

**SECTION 08 8000
GLAZING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Insulating glass units.
- B. Glazing units.
- C. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 2500 - Weather Barriers.
- B. Section 07 9200 - Joint Sealants: Sealants for other than glazing purposes.
- C. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- D. Section 08 4313 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.
- E. Section 08 8300 - Mirrors.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- E. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- H. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.
- I. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes; 2023.
- J. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.
- K. ASTM F1233 - Standard Test Method for Security Glazing Materials And Systems; 2021.
- L. GANA (GM) - GANA Glazing Manual; 2022.
- M. GANA (SM) - GANA Sealant Manual; 2008.
- N. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- O. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (Reaffirmed 2016).
- P. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2023.
- Q. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2023.

- R. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2023.
- S. UL 972 - Standard for Burglary Resisting Glazing Material; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Certificate: Certify that products of this section meet or exceed specified requirements.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.

1.07 MOCK-UPS

- A. Provide on-site glazing mock-up with the specified glazing components.
- B. Locate where directed.
- C. Mock-ups may remain as part of the Work.

1.08 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F.

1.09 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.
- C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Glass Fabricators:
 - 1. Viracon, Inc:
 - 2. PPG Industries.
 - 3. Pilkington North America
 - 4. Substitutions: Refer to Section 01 6000 - Product Requirements.
- B. Float Glass Manufacturers:

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1. Pilkington North America Inc
2. Viracon, Inc.
3. PPG Industries
4. Substitutions: Refer to Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
 1. Design Pressure: Calculated in accordance with ASCE 7.
 2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
 4. Glass thicknesses listed are minimum.
- B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
 1. In conjunction with vapor retarder and joint sealer materials described in other sections.
 - a. Refer to Section 07 2500.
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless noted otherwise.
 1. Type FG-1 Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality-Q3.
 2. Type FG-2 Fully Tempered Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria.
 3. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

2.04 INSULATING GLASS UNITS

- A. Manufacturers:
 1. Any of the manufacturers specified for float glass.
 2. Substitutions: Refer to Section 01 6000 - Product Requirements.
- B. Insulating Glass Units: Types as indicated.
 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 2. Warm-Edge Spacers: Low conductivity thermoplastic and stainless steel.
 - a. Spacer Width: 1/2 inch.
 3. Spacer Color: Black.
 4. Edge Seal:
 - a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
 5. Color: Black.

6. Purge interpane space with dry air, hermetically sealed.
- C. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.
 1. Applications: Exterior glazing unless otherwise indicated.
 2. Space between lites filled with air.
 3. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum by default or as defined on contract drawings.
 - a. Tint: Clear.
 - b. Coating: Low-E (passive type), on #2 surface.
 4. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum by default or as defined on contract drawings.
 - a. Tint: Clear.
 5. Total Thickness: 1 inch.

2.05 GLAZING UNITS

- A. Type G-1 - Monolithic Exterior Vision Glazing:
 1. Applications: Exterior glazing unless otherwise indicated.
 2. Glass Type: Annealed float glass. Tempered where shown on glazing elevations or as required by code.
 3. Tint: Clear.
 4. Thickness: 1/4 inch, nominal.
 5. Glazing Method: Dry glazing method, gasket glazing.
- B. Type G-2 - Monolithic Interior Vision Glazing:
 1. Applications: Interior glazing unless otherwise indicated.
 2. Glass Type: Fully tempered float glass.
 3. Tint: Clear.
 4. Thickness: 1/4 inch, nominal.
 5. Glazing Method: Dry glazing method, gasket glazing.

2.06 GLAZING COMPOUNDS

- A. Type GC-1 - Glazing Putty: Polymer modified latex recommended by manufacturer for outdoor use, knife grade consistency; gray color.
- B. Type GC-2 - Butyl Sealant: Single component; ASTM C920 Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

2.07 ACCESSORIES

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.
- B. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

- A. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

- A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - DRY GLAZING METHOD (TAPE AND GASKET SPLINE GLAZING)

- A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.
- B. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.
- C. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- D. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- E. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
- F. Carefully trim protruding tape with knife.

3.06 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Monitor and report installation procedures and unacceptable conditions.

3.07 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove non-permanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.08 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

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**SECTION 08 8300
MIRRORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Glass mirrors.
- B. Polycarbonate mirrors.

1.02 RELATED REQUIREMENTS

- A. Section 10 2800 - Toilet and Bath Accessories: Metal mirror frames and as shown on Specialties Schedule in Contract drawings.

1.03 REFERENCE STANDARDS

- A. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- B. GANA (TIPS) - Mirrors: Handle with Extreme Care (Tips for the Professional on the Care and Handling of Mirrors); 2011.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Manufacturer's Certificate: Certify that mirrors, meets or exceeds specified requirements.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

- A. Fabricate, store, transport, receive, install, and clean mirrors in accordance with recommendations of GANA (TIPS).

1.06 FIELD CONDITIONS

- A. Do not install mirrors when ambient temperature is less than 50 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Mirrors:
 - 1. Bradley 780 Series as shown on contract drawings. _____
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

- A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.

2.03 ACCESSORIES

- A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness.

- C. Glazing Tape: Preformed butyl compound; 10 to 15 Shore A durometer hardness; on release paper.
- D. Glazing Clips: Manufacturer's standard type.
- E. Mirror Attachment Accessories: Stainless steel clips.
- F. Mirror Adhesive: Silicone pre-polymer based, chemically compatible with mirror coating and wall substrate.
 - 1. Application Temperature: Minus 35 to 140 degrees F at contact surfaces.
- G. Channel Frame: One piece, channel frame, stainless steel, Type 430, satin finish, 1/2 inch by 1/2 inch by 3/8 inch deep with 90 degree mitered corners.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that openings for mirrored glazing are correctly sized and within tolerance.
- B. Verify that surfaces of mirror frames or recesses are clean, free of obstructions, and ready for installation of mirrors.

3.02 PREPARATION

- A. Prepare installation in accordance with ASTM C1193 for solvent release sealants, and install sealant in accordance with manufacturer's instructions.

3.03 INSTALLATION

- A. Install mirrors in accordance with GANA (TIPS) and manufacturers recommendations.
- B. Set mirrors plumb and level, and free of optical distortion.
- C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

3.04 CLEANING

- A. Remove labels after work is complete.
- B. Clean mirrors and adjacent surfaces.

END OF SECTION

**SECTION 09 2116
GYPSUM BOARD ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Acoustic insulation.
- E. Cementitious backing board.
- F. Gypsum wallboard.
- G. Joint treatment and accessories.
- H. Water-resistive barrier over exterior wall sheathing.

1.02 RELATED REQUIREMENTS

- A. Section 05 4000 - Cold-Formed Metal Framing SR : Structural steel stud framing.
- B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.
- C. Section 07 2100 - Thermal Insulation: Acoustic insulation.
- D. Section 07 2500 - Weather Barriers: Water-resistive barrier over sheathing.
- E. Section 07 9200 - Joint Sealants:
- F. Section 09 2216 - Non-Structural Metal Framing.

1.03 REFERENCE STANDARDS

- A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2012.
- B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.
- C. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2023.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- E. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
- F. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2018.
- G. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.
- H. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- I. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.
- J. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.
- K. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

- L. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.
- M. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
- N. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2018 (Reapproved 2023).
- O. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2022, with Editorial Revision (2023).
- P. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- Q. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2023.
- R. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2019, with Editorial Revision (2020).
- S. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- T. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.
- U. ASTM E413 - Classification for Rating Sound Insulation; 2022.
- V. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.
- W. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- X. ICC-ES AC308 - Acceptance Criteria for Water-Resistive Barriers; 2016, with Editorial Revision (2021).
- Y. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate special details. associated with fireproofing and acoustic seals.
- C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
- D. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches in size, illustrating finish color and texture.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- B. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
 - 1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
 - 2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Shaft Walls at Elevator Shafts: Provide completed assemblies with the following characteristics:
 - 1. Air Pressure Within Shaft: Intermittent loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.

2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- D. Manufacturers - Metal Framing, Connectors, and Accessories:
 1. Clark Dietrich Building Systems LLC:
 2. Marino:
 3. SCAFCO Corporation:
 4. Steel Construction Systems:
 5. Substitutions: See Section 01 6000 - Product Requirements.
 - E. Non-structural Steel Framing for Application of Gypsum Board: As specified in Section 09 2216.
 - F. Structural Steel Framing for Application of Gypsum Board: As specified in Section 05 4000.
 - G. Non-structural Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
 1. Studs: "C" shaped with flat or formed webs with knurled faces.
 2. Runners: U shaped, sized to match studs.
 3. Ceiling Channels: C-shaped.
 4. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch.
 5. Resilient Furring Channels: 1/2 inch depth or as detailed, for attachment to substrate.
 - a. Products:
 - 1) Same manufacturer as other framing materials.
 - H. Exterior Non-Loadbearing Studsand Furring for Application of Gypsum Board: As specified in Section 09 2216.
 - I. Loadbearing Studs for Application of Gypsum Board: As specified in Section 05 4000.
 - J. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
 - K. Area Separation Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with specified performance requirements.
 - L. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
 - M. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.

2.02 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 1. American Gypsum Company
 2. CertainTeed Corporation:
 3. Georgia-Pacific Gypsum:
 4. National Gypsum Company:
 5. USG Corporation:
 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 4. Thickness:

- a. Vertical Surfaces: 5/8 inch.
 - b. Ceilings: 1/2 inch.
- C. Abuse Resistant Wallboard:
 - 1. Application: High-traffic areas indicated on contract drawings.
 - 2. Soft Body Impact: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
 - 3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 4. Type: Fire resistance rated Type X, UL or WH listed.
 - 5. Thickness: 5/8 inch.
 - 6. Edges: Tapered.
- D. Backing Board For Wet Areas:
 - 1. Application: Surfaces behind tile in wet areas including .
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
 - a. Thickness: 5/8 inch.
 - b. Products:
 - 1) National Gypsum Company; PermaBase Cement Board:
 - 2) USG Corporation:
 - 3) Substitutions: See Section 01 6000 - Product Requirements.
- E. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
 - 1. Application: Vertical surfaces behind thinset tile, except in wet areas.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 3. Type: Regular and Type X, in locations indicated.
 - 4. Type X Thickness: 5/8 inch.
 - 5. Regular Board Thickness: 5/8 inch.
 - 6. Edges: Tapered.
 - 7. Products:
 - a. American Gypsum Company; M-Bloc.
 - b. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board.
 - c. Georgia-Pacific Gypsum; DensArmor Plus.
 - d. National Gypsum Company; Gold Bond XP Gypsum Board.
 - e. Substitutions: See Section 01 6000 - Product Requirements.
- F. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Ceilings, unless otherwise indicated.
 - 2. Thickness: 5/8 inch.
 - 3. Edges: Tapered.
- G. Exterior Soffit Board: Exterior gypsum soffit board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Ceilings and soffits in protected exterior areas, unless otherwise indicated.
 - 2. Type X Thickness: 5/8 inch.
 - 3. Regular Type Thickness: 5/8".
 - 4. Edges: Tapered.
 - 5. Products:
 - a. American Gypsum Company; Exterior Soffit Gypsum Wallboard Type X.
 - b. American Gypsum Company; Exterior Soffit Gypsum Wallboard Type C.

- c. Georgia-Pacific Gypsum; ToughRock Fireguard C Soffit Board.
 - d. Substitutions: See Section 01 6000 - Product Requirements.
- H. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
 - 1. Glass Mat Faced Type: Glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel as defined in ASTM C1658/C1658M.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 3. Products:
 - a. American Gypsum Company; M-Glass Shaft Liner.
 - b. Continental Building Products; Shaftliner Type X.
 - c. Georgia-Pacific Gypsum; DensGlass Shaftliner (mold-resistant).
 - d. National Gypsum Company; Gold Bond Brand eXP Shaftliner.

2.03 GYPSUM WALLBOARD ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. 5 1/2 inch
- B. Verify size as detailed on contract drawings.
- C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- D. Water-Resistive Barrier: As specified in Section 07 2500.
- E. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
 - 1. Types: As detailed or required for finished appearance.
 - 2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
 - 3. Products:
 - a. Same manufacturer as framing materials.
 - b. Substitutions: See Section 01 6000 - Product Requirements.
- F. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
- G. High Build Drywall Surfer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
- H. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.
- I. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 SHAFT WALL INSTALLATION

- A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
 - 1. Install studs at spacing required to meet performance requirements.
- B. Shaft Wall Liner: Cut panels to accurate dimension and install sequentially between special friction studs.

3.03 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.

1. Laterally brace entire suspension system.
2. Install bracing as required at exterior locations to resist wind uplift.
- C. Studs: Space studs at 16 inches on center.
 1. Extend partition framing to structure where indicated and to ceiling in other locations.
 2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
 3. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Blocking: Install wood blocking for support of:
 1. Framed openings.
 2. Wall mounted cabinets.
 3. Plumbing fixtures.
 4. Toilet partitions.
 5. Toilet accessories.
 6. Wall mounted door hardware.

3.04 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.05 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
 1. Seal joints, cut edges, and holes with water-resistant sealant.
 2. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.
- C. Exterior Soffits: Install exterior soffit board perpendicular to framing, with staggered end joints over framing members or other solid backing.
 1. Seal joints, cut edges, and holes with water resistant sealant.
- D. Cementitious Backing Board: Install over steel framing members where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- E. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 1. At exterior soffits, not more than 30 feet apart in both directions.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.07 JOINT TREATMENT

- A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 3. Level 3: Walls to receive textured wall finish.
 4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 5. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
1. Feather coats of joint compound so that camber is maximum 1/32 inch.
 2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
 3. Taping, filling and sanding is not required at base layer of double layer applications.
- C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

END OF SECTION

**SECTION 09 2216
NON-STRUCTURAL METAL FRAMING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal partition, ceiling, and soffit framing.
- B. Framing accessories.

1.02 RELATED REQUIREMENTS

- A. Section 05 2100 - Steel Joists: Execution requirements for anchors for attaching work of this section.
- B. Section 05 4000 - Cold-Formed Metal Framing SR : Structural load bearing metal stud framing and Exterior wall stud framing.
- C. Section 05 4000 - Cold-Formed Metal Framing SR : Execution requirements for anchors for attaching work of this section.
- D. Section 05 5000 - Metal Fabrications: Metal fabrications attached to stud framing.
- E. Section 05 5000 - Metal Fabrications: Execution requirements for anchors for attaching work of this section.
- F. Section 06 1000 - Rough Carpentry: Wood blocking within stud framing.
- G. Section 07 2100 - Thermal Insulation: Acoustic insulation.
- H. Section 07 2500 - Weather Barriers.
- I. Section 07 6200 - Sheet Metal Flashing and Trim: Head and sill flashings
- J. Section 07 8400 - Firestopping: Sealing top-of-wall assemblies at fire rated walls.
- K. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
- L. Section 08 5113 - Aluminum Windows: Product requirements for window anchors.
- M. Section 09 2116 - Gypsum Board Assemblies: Metal studs for gypsum board partition framing.

1.03 REFERENCE STANDARDS

- A. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2018.
- B. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- C. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.
- D. ASTM E413 - Classification for Rating Sound Insulation; 2022.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Indicate prefabricated work, component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories, and items of other related work.
 - 2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.
- C. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

1.05 MOCK-UP

- A. Provide mock-up of stud wall, ceiling, and soffit framing including insulation, sheathing, window frame, and door frame and finish specified in other sections. Coordinate with installation of associated work specified in other sections.
 - 1. Mock-up Size: Full height, minimum 12 feet long, including corner.
 - 2. Mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Framing, Connectors, and Accessories:
 - 1. ClarkDietrich Building Systems:
 - 2. Marino:
 - 3. SCAFCO Corporation:
 - 4. Steel Construction Systems:
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FRAMING MATERIALS

- A. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
 - 1. Studs: C shaped with flat or formed webs with knurled faces.
 - 2. Runners: U shaped, sized to match studs.
- B. Loadbearing Studs: As specified in Section 05 4000.
- C. Partition Head to Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and braced with continuous bridging on both sides.
- D. Acoustic Insulation: As specified in Section 07 2100.

2.03 FABRICATION

- A. Fabricate assemblies of framed sections to sizes and profiles required.
- B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.

3.02 INSTALLATION OF STUD FRAMING

- A. Comply with requirements of ASTM C754 and Product Technical Guide of the Steel Stud Manufacturer's Association current edition.
- B. Extend partition framing to structure where indicated and to ceiling in other locations.
- C. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
- D. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs as indicated.
- E. Align and secure top and bottom runners at 24 inches on center.
- F. At partitions indicated with an acoustic rating:
 - 1. Provide components and install as required to produce STC ratings as indicated, based on published tests by manufacturer conducted in accordance with ASTM E90 with STC rating calculated in accordance with ASTM E413.

- 2. Place one bead of acoustic sealant between studs and adjacent vertical surfaces.
- G. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- H. Align stud web openings horizontally.
- I. Secure studs to tracks using crimping method. Do not weld.
- J. Fabricate corners using a minimum of three studs.
- K. Double stud at wall openings, door and window jambs, not more than 2 inches from each side of openings.
- L. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.
- M. Blocking: Use wood blocking or metal studs as required to provide for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and opening frames.
- N. Sound Isolation Clips: Mechanically attach to framing or structure with fasteners recommended by clip manufacturer. Install at spacing indicated on drawings.
- O. Furring: Coordinate with sound isolation clip spacing and locations. Lap splices a minimum of 6 inches.

3.03 CEILING AND SOFFIT FRAMING

- A. Comply with requirements of ASTM C754 and Product Technical Guide of the Steel Stud Manufacturer's Association current edition.
- B. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.
- C. Install furring independent of walls, columns, and above-ceiling work.
- D. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.
- E. Space main carrying channels at maximum 72 inch on center, and not more than 6 inches from wall surfaces. Lap splice securely.
- F. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.
- G. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.
- H. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.
- I. Laterally brace suspension system.

3.04 TOLERANCES

- A. Maximum Variation From True Position: 1/8 inch in 10 feet.
- B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION

**SECTION 09 3000
TILING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Cementitious backer board as tile substrate.
- D. Coated glass mat backer board as tile substrate.
- E. Ceramic accessories.
- F. Ceramic trim.
- G. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- B. Section 09 2116 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

- A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2024.
- B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2023.
- C. ANSI A108.1b - Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar; 2023.
- D. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive; 2023.
- E. ANSI A108.5 - Setting of Ceramic Tile with Dry-Set Cement Mortar, Modified Dry-Set Cement Mortar, EGP (Exterior Glue Plywood) Modified Dry-Set Cement Mortar, or Improved Modified Dry-Set Cement Mortar; 2023.
- F. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy; 2023.
- G. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2024).
- H. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 2023.
- I. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2017 (Reaffirmed 2022).
- J. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.
- K. ANSI A108.12 - Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Modified Dry-Set Mortar; 2023.
- L. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2021).

- M. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2023.
- N. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2019.
- O. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2023.
- P. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2022.
- Q. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2018.
- R. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2024.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. Extra Tile: 10 square feet of each size, color, and surface finish combination.

1.05 MOCK-UPS

- A. See Section 01 4000 - Quality Requirements for general requirements for mock-up.
 - 1. Approved mock-up may remain as part of work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

- A. Manufacturers: As specified on contract drawings Finish Schedule.
 - 1. Substitutions: See Section 01 6000 - Product Requirements.
- B. Glazed Wall Tile: ANSI A137.1 standard grade. Refer to contract drawings.
 - 1. Color(s): As indicated on drawings.
 - 2. Products: As specified on contract drawings Finish Schedule.
 - a. Substitutions: See Section 01 6000 - Product Requirements.

2.02 TRIM AND ACCESSORIES

- A. Ceramic Accessories: Glazed finish, same color and finish as adjacent field tile; same manufacturer as tile.
- B. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
 - 1. Manufacturers: Same as for tile.

- C. Non-Ceramic Trim: Brushed stainless steel, style and dimensions to suit application, for setting using tile mortar or adhesive.
 - 1. Manufacturers:
 - a. Schluter-Systems: www.schluter.com/#sle.
 - b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 SETTING MATERIALS

- A. Manufacturers:
 - 1. ARDEX Engineered Cements:
 - 2. Bostik Inc:
 - 3. Custom Building Products: .
 - 4. LATICRETE International, Inc:
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
 - 1. Products:
 - a.
 - 1) ARDEX Engineered Cements; ARDEX N 23 MICROTEC:
www.ardexamericas.com/#sle.
 - 2) Custom Building Products; ProLite Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer:
www.custombuildingproducts.com/#sle.
 - 3) Merkrete, by Parex USA, Inc; Merkrete 735 Premium Flex:
www.merkrete.com/#sle.
 - 4) Pro-fix Multiflex.

2.04 GROUTS

- A. Manufacturers:
 - 1. ARDEX Engineered Cements:
 - 2. Bostik Inc:
 - 3. Custom Building Products:
 - 4. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout:
 - 5. Hydroment.
 - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
 - 1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
 - 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
 - 3. Color(s): As selected by Architect from manufacturer's full line.
 - 4. Products:
 - a. Bostik Hydroment 425 unsanded.

2.05 ACCESSORY MATERIALS

- A. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 7/16 inch thick; 2 inch wide coated glass fiber tape for joints and corners.
- B. Backer Board: Coated glass mat type complying with ASTM C1178/C1178M; inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder.
 - 1. Standard Type: Thickness 1/2 inch.
 - 2. Fire Resistant Type: Type X core, thickness 5/8 inch.
- C. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- B. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

3.03 INSTALLATION - GENERAL

- A. Install tile and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install ceramic accessories rigidly in prepared openings.
- G. Install non-ceramic trim in accordance with manufacturer's instructions.
- H. Install thresholds where indicated.
- I. Sound tile after setting. Replace hollow sounding units.
- J. Keep control and expansion joints free of mortar, grout, and adhesive.
- K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- L. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- M. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
 - 1. Use uncoupling membrane under all tile unless other underlayment is indicated.
 - 2. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

3.05 INSTALLATION - WALL TILE

- A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.
- B. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.

3.06 CLEANING

- A. Clean tile and grout surfaces.

3.07 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

**SECTION 09 5100
ACOUSTICAL CEILINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.02 RELATED REQUIREMENTS

- A. Section 05 3100 - Steel Decking: Placement of special anchors or inserts for suspension system.
- B. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler heads in ceiling system.
- C. Section 23 3700 - Air Outlets and Inlets: Air diffusion devices in ceiling.
- D. Section 26 5100 - Interior Lighting: Light fixtures in ceiling system.
- E. Section 27 5116 - Public Address Systems: Speakers in ceiling system.
- F. Section 28 4600 - Fire Detection and Alarm: Fire alarm components in ceiling system.

1.03 REFERENCE STANDARDS

- A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023.
- B. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
- C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning.
- C. Product Data: Provide data on suspension system components.

1.05 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc:
 - 2. CertainTeed Corporation:
 - 3. Hunter Douglas Architectural.
 - 4. USG:
 - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Suspension Systems:
 - 1. Same as for acoustical units.

2.02 ACOUSTICAL UNITS

- A. Acoustical Units/Decorative Ceiling Panels - General: ASTM E1264, Class A. **As scheduled on contract drawings Finish Schedule.**

2.03 SUSPENSION SYSTEM(S)

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
- B. Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; heavy-duty.
 - 1. Profile: Tee; 15/16 inch wide face.
 - 2. Construction: Double web.
 - 3. Finish: As indicated on drawings.

2.04 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

- A. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- B. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- C. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- E. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- F. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- G. Do not eccentrically load system or induce rotation of runners.

3.03 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install units after above-ceiling work is complete.
- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. Cutting Acoustical Units:
 - 1. Make field cut edges of same profile as factory edges.

END OF SECTION

**SECTION 09 6519
RESILIENT TILE FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient tile flooring.
- B. Installation accessories:
 - 1. Adhesives.
 - 2. Finishes and cleaners.

1.02 RELATED REQUIREMENTS

- A. Section 07 9200 - Joint Sealants.
- B. Section 07 9513 - Expansion Joint Cover Assemblies.

1.03 REFERENCE STANDARDS

- A. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine; 2017.
- B. ASTM F137 - Standard Test Method for Flexibility of Resilient Flooring Materials with Cylindrical Mandrel Apparatus; 2008 (Reapproved 2013).
- C. ASTM F386 - Standard Test Method for Thickness of Resilient Flooring Materials Having Flat Surfaces; 2017 (Reapproved 2022).
- D. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- E. ASTM F925 - Standard Test Method for Resistance to Chemicals of Resilient Flooring; 2013 (Reapproved 2020).
- F. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2020.
- G. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.
- H. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- C. Verification Samples: Submit two samples, 4 by 4 inch in size illustrating color and pattern for each resilient flooring product specified.

1.05 FIELD CONDITIONS

- A. Acclimate material at jobsite between 65 to 85 degrees F and 35 percent to 85 percent relative humidity for 48 hours prior to installation. Temperature and relative humidity should also be maintained at the same levels during installation, and after installation.
- B. Close areas to traffic during installation of flooring and accessories.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 RESILIENT TILE FLOORING: PRODUCTS AS NOTED ON CONTRACT DRAWINGS FINISH SCHEDULE.

2.02 ACCESSORIES

- A. Moldings, Transition and Edge Strips: Same material as flooring.

PART 3 EXECUTION

3.01 EXAMINATION - SEE ALSO SECTION 01 7000.

- A. Install flooring and accessories after other operations (including painting) have been completed.
- B. Acceptance of Conditions: Carefully examine all installation areas with installer/applicator present, for compliance with requirements affecting work performance.
 - 1. Verify that field measurements, product, adhesives, substrates, surfaces, structural support, tolerances, levelness, temperature, humidity, moisture content level, pH, cleanliness and other conditions are as required by the manufacturer, and ready to receive work.
- C. Verify that substrate is contaminant-free, including old adhesives and abatement chemicals.
- D. Test substrates as required by manufacturer to verify proper conditions exist.
 - 1. Concrete:
 - a. Check for concrete additives such as fly ash, curing compounds, hardeners, or other surface treatments that may prevent proper bonding of floor coverings.
 - b. Moisture testing: Perform either the In-Situ Relative Humidity (RH) test (ASTM F2170) or Moisture Vapor Emission Rate (MVER) test (ASTM F1869). Refer to the Manufacturer's Installation Guide/Manual for the maximum allowable substrate moisture content. Substrates above the maximum allowable moisture content will require a moisture mitigation system.
 - c. Perform alkalinity testing per ASTM F710 to verify pH level is between 7 to 10.
 - d. Check substrate for absorbency per manufacturer's recommendations.
 - e. Perform bond testing per ASTM F710 to determine compatibility of adhesive to concrete substrate.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Flooring installation should not begin until all site conditions have been assessed, testing has been completed and subfloor conditions have been approved.
- B. Prepare per manufacturer's written instructions, Section 01 7000, and as follows:
 - 1. Prepare substrates to ensure proper adhesion of Luxury Vinyl Plank & Tile.

3.03 INSTALLATION

- A. Installation per manufacturer's written instructions, Section 01 7000, and as follows:
 - 1. Layout shall be specified by Architect, Designer or End User.
 - 2. Follow layout and ensure installation reference lines are square.
 - 3. Check cartons for and do not mix dye lots.
 - 4. Expansion Joints: Locate expansion, isolation, and other moving joints prior to installation.
 - a. Do not fill expansion, isolation, and other moving joints with patching compound nor cover with resilient flooring.
 - b. Install movement joint systems per manufacturer's instructions and per Section 07 9200 and Section 07 9513.

5. Adhesives: Adhere flooring to substrate using the full spread method resulting in a completed installation without gaps, voids, raised edges, bubbles or any other surface imperfections.
 - a. Select appropriate adhesive, trowel and follow manufacturer's instructions.
 - b. Periodically spot-check transfer of adhesive to back of tile during installation.
 - c. Roll floor with a 100 pound roller to ensure proper transfer of adhesive and bonding.
 - d. Protect floor from traffic per manufacturer's instructions.
 - e. Do not wet mop floor until the adhesive has properly set per written instructions.

3.04 PROTECTION

- A. Protect materials from construction operations until Date of Substantial Completion or Owner occupancy, whichever occurs first.
 1. Protect finished floor from abuse and damage by using heavy non-staining kraft paper, drop cloths or equivalent. Use additional, non-damaging protective materials as needed.
 2. Light foot traffic on a newly installed floor can be permitted after 24 hours.
 3. Keep heavy traffic and rolling loads off the newly installed LVT flooring for 48 hours.
 4. Protect the floor from rolling loads by covering with protective boards.

END OF SECTION

**SECTION 09 6813
TILE CARPETING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.

1.03 REFERENCE STANDARDS

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- B. CRI 104 - Standard for Installation of Commercial Carpet; 2015.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- D. Concrete Sub-floor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Tile Carpeting:
 - 1. Refer to contract drawings.:

2.02 MATERIALS

- A. Tile Carpeting: Tufted, manufactured in one color dye lot for each different selection.

2.03 ACCESSORIES

- A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Edge Strips: Embossed aluminum, color as selected by Architect.
- C. Adhesives:
- D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.
 - 1. Test in accordance with ASTM F710.

2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
- C. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
- F. Fully adhere carpet tile to substrate.
- G. Trim carpet tile neatly at walls and around interruptions.
- H. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

END OF SECTION

**SECTION 09 6816
SHEET CARPETING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet, stretched-in with cushion underlay and direct-glued.

1.02 RELATED REQUIREMENTS

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied carpet.
- C. Section 09 6813 - Tile Carpeting.

1.03 REFERENCE STANDARDS

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.
- D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
- E. CRI 104 - Standard for Installation of Commercial Carpet; 2015.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate seaming plan, method of joining seams, direction of carpet pile and pattern, location of edge moldings and edge bindings.
- C. Samples: Submit two samples 18 inch x 18 inch in size illustrating color and pattern for each carpet and cushion material specified.
- D. Manufacturer's Installation Instructions: Indicate special procedures.
- E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- F. Installer's Qualification Statement.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional requirements.
 - 2. Extra Carpet: 100 square feet of each type, color, and pattern installed.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in installing carpet with minimum three years documented experience.

1.06 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.
- B. Maintain minimum 70 degrees F ambient temperature 24 hours prior to, during and 24 hours after installation.
- C. Ventilate installation area during installation and for 72 hours after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS; REFER TO CONTRACT DRAWINGS FOR SPECIFIC PRODUCT SELECTION.

2.02 CARPET: REFER TO CONTRACT DRAWINGS FOR SPECIFIC PRODUCT SELECTION.

2.03 ACCESSORIES

- A. Subfloor Filler: Type recommended by carpet manufacturer.
- B. Moldings and Edge Strips: Embossed aluminum, _____ color.
- C. Adhesives:
 - 1. Compatible with materials being adhered;
- D. Seam Adhesive: Recommended by carpet manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesives to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
 - 1. Test as Follows:
 - a. Internal Relative Humidity: ASTM F2170.
 - b. Moisture Vapor Emission: ASTM F1869.
 - 2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
- C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- D. Clean substrate.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet and cushion in accordance with manufacturer's instructions and CRI 104 (Commercial).
- C. Verify carpet match before cutting to ensure minimal variation between dye lots.
- D. Lay out carpet and locate seams in accordance with shop drawings.
 - 1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
 - 2. Do not locate seams perpendicular through door openings.
 - 3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.

4. Locate change of color or pattern between rooms under door centerline.
 5. Provide monolithic color, pattern, and texture match within any one area.
- E. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

3.04 DIRECT-GLUED CARPET

- A. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to cut edges of woven carpet immediately.
- B. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.
- C. Apply seam adhesive to the base of the edge glued down. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.
- D. Roll with appropriate roller for complete contact of adhesive to carpet backing.
- E. Trim carpet neatly at walls and around interruptions.
- F. Complete installation of edge strips, concealing exposed edges. Bind cut edges where not concealed by edge strips.

3.05 CLEANING

- A. Remove excess adhesive from floor and wall surfaces without damage.
- B. Clean and vacuum carpet surfaces.

END OF SECTION

**SECTION 09 8300
ACOUSTIC FINISHES**

PART 2 PRODUCTS

1.01 ACOUSTIC FINISHES

- A. General:
 - 1. Provide 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. Acoustic Coatings: Spray-applied, vinyl acrylic dry-fall coatings.
 - 1. Provide nonbridging coating to cover acoustical tile and ceiling grid system.
- C. Accessory Materials: Provide primers, sealers, cleaning agents, and clean up materials as required for completion of acoustic finish.

END OF SECTION

**SECTION 09 9113
EXTERIOR PAINTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 2. Exposed surfaces of steel lintels and ledge angles.
 - 3. Mechanical and Electrical:
 - a. On the roof and outdoors, paint equipment that is exposed to weather or to view, including factory-finished materials.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Non-metallic roofing and flashing.
 - 6. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.
 - 7. Floors, unless specifically indicated.
 - 8. Ceramic and other types of tiles.
 - 9. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco.
 - 10. Glass.
 - 11. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 05 5000 - Metal Fabrications: Shop-primed items.
- B. Section 05 5100 - Metal Stairs: Shop-primed items.
- C. Section 09 9123 - Interior Painting.
- D. Section 09 9600 - High-Performance Coatings.

1.03 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.
- B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
- C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- D. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- E. SSPC-SP 2 - Hand Tool Cleaning; 2024.

F. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.06 MOCK-UP

- A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.
- B. Locate where directed by Architect.
- C. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

Evergreen Baptist Church
Phase 5
Broken Arrow, Oklahoma
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Exterior Painting
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Construction Documents

Reed Architecture and Interiors
18 East Hobson Avenue
Sapulpa, Oklahoma

- B. Paints:
1. Behr Process Corporation: www.behr.com/#sle.
 2. PPG Paints: www.ppgpaints.com/#sle.
 3. Pratt & Lambert Paints: www.prattandlambert.com/#sle.
 4. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
 5. Valspar Corporation: www.valsparpaint.com/#sle.

C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Architect after award of contract.

2.03 PAINT SYSTEMS - EXTERIOR

- A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete and primed metal.
1. Two top coats and one coat primer.
 2. Top Coat(s): Exterior Latex; MPI #10, 11, 15, 119, or 214.
 - a. Products:
 - 1) Behr Marquee Exterior Flat [No. 4450]. (MPI #10)
 - 2) Behr Pro e600 Exterior Flat Paint [No.610]. (MPI #10)
 - 3) PPG Paints Speedhide Exterior Latex Flat, 6-610XI Series. (MPI #10)
 - 4) Pratt & Lambert Pro-Hide Gold Exterior Latex, Flat.
 - 5) Sherwin-Williams A-100 Exterior Latex Flat.
 - 6) Valspar Emblem Exterior Latex, No. 56500 Series, Flat.
 - 7) Sherwin-Williams Pro Industrial High Performance Acrylic.
 - 8) Substitutions: Section 01 6000 - Product Requirements.
 3. Top Coat(s): Exterior Alkyd Enamel; MPI #94 or 96.
 - a. Products:
 - 1) PPG Paints Interior/Exterior Industrial Enamel, Gloss, 7-282. (MPI #96)
 - 2) PPG Paints Fast Dry 35 Quick Drying Enamel, Gloss, 95-9000.
 - 3) Substitutions: Section 01 6000 - Product Requirements.
 4. Primer: As recommended by top coat manufacturer for specific substrate.

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
1. Alkali Resistant Water Based Primer; MPI #3.
 - a. Products:
 - 1) Behr Premium Plus Interior/Exterior Multi-Surface Primer and Sealer [No. 436]. (MPI #3)
 - 2) PPG Paints Seal Grip Acrylic Primer, 17-921 Series. (MPI #3)
 - 3) PPG Paints Perma-Crete Interior/Exterior Alkali Resistant Primer, 4-603 Series. (MPI #3)

- 4) Pratt & Lambert Pro-Hide Gold Exterior Acrylic Cement and Stucco Primer. (MPI #3)
 - 5) Sherwin-Williams Loxon Concrete and Masonry Primer Sealer, LX02W50. (MPI #3)
 - 6) Substitutions: Section 01 6000 - Product Requirements.
2. Anti-Corrosive Alkyd Primer for Metal; MPI #79.
 - a. Products:
 - 1) PPG Paints Speedhide Interior/Exterior Rust Inhibitive Steel Primer, 6-212 Series. (MPI #79)
 - 2) PPG Devguard Multi-Purpose Primer, 4160 Series. (MPI #79)
 - 3) Pratt & Lambert Alkyd Shopcoat Primer, OTC Compliant. (MPI #79)
 - 4) Valspar Armor Anti-Rust Oil Metal Primer, No. 21852. (MPI #79)
 - 5) Substitutions: Section 01 6000 - Product Requirements.
3. Interior/Exterior Quick Dry Alkyd Primer for Metal; MPI #76.
 - a. Products:
 - 1) PPG Devguard Multi-Purpose Primer, 4160 Series. (MPI #76)
4. Alkyd Primer for Galvanized Metal.
 - a. Products:
 - 1) PPG Paints Speedhide Interior/Exterior Galvanized Steel Primer, 6-209 Series.
 - 2) Valspar Armor Anti-Rust Oil Galvanized Primer, No. 21850.
5. Rust-Inhibitive Water Based Primer; MPI #107.
 - a. Products:
 - 1) Behr Premium Plus Interior/Exterior Multi-Surface Primer and Sealer [No. 436]. (MPI #107)
 - 2) PPG Paints Pitt-Tech Plus DTM Industrial Primer, 90-912 Series.
6. Stain Blocking Primer; MPI #136.
 - a. Products:
 - 1) PPG Paints Seal Grip Interior/Exterior Alkyd Universal Primer Sealer, 17-941NF Series. (MPI #136)
 - 2) Pratt & Lambert Pro-Hide Gold Exterior Alkyd Stain Blocking Primer. (MPI #136)
 - 3) Substitutions: Section 01 6000 - Product Requirements.
7. Latex Primer for Exterior Wood; MPI #6.
 - a. Products:
 - 1) Kilz Premium Water-Based Primer [No. 1300]. (MPI #6)
 - 2) PPG Paints Seal Grip Acrylic Primer, 17-921 Series. (MPI #6)
 - 3) Pratt & Lambert Pro-Hide Gold Exterior Latex Primer. (MPI #6)
 - 4) Pratt & Lambert Pro-Hide Gold Interior/Exterior Waterborne Primer. (MPI #6)
 - 5) Valspar Latex Exterior Primer, No. 165219. (MPI #6)
 - 6) Substitutions: Section 01 6000 - Product Requirements.

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Masonry, Concrete, and Concrete Masonry Units: 12 percent.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Concrete:
- G. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 - 2. Prepare surface according to SSPC-SP 2.
- H. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance.
- E. Sand metal surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.
- B. Owner will provide field inspection.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

**SECTION 09 9123
INTERIOR PAINTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints and stains.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
 - 2. Elevator pit ladders.
 - 3. Prime surfaces to receive wall coverings.
 - 4. Mechanical and Electrical:
 - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
 - b. In finished areas, paint shop-primed items.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 05 5000 - Metal Fabrications: Shop-primed items.
- B. Section 05 5100 - Metal Stairs: Shop-primed items.
- C. Section 09 9113 - Exterior Painting.
- D. Section 09 9600 - High-Performance Coatings.

1.03 DEFINITIONS

- A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.
- C. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2023.
- D. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
- E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

- F. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- G. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 - 4. Manufacturer's installation instructions.
- C. Samples: Submit two paper chip samples, 8x8 inch in size illustrating range of colors and textures available for each surface finishing product scheduled.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.06 MOCK-UP

- A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.
- B. Provide panel, four feet long by eight feet high, illustrating paint color, texture, and finish.
- C. Provide door and frame assembly illustrating paint color, texture, and finish.
- D. Locate where directed by Architect.
- E. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
 - 1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
- B. Paints:
 - 1. Behr Process Corporation:
 - 2. Diamond Vogel Paints:
 - 3. PPG Paints:
 - 4. Pratt & Lambert Paints:
 - 5. Sherwin-Williams Company:
 - 6. Valspar Corporation:
- C. Transparent Finishes:
 - 1. Behr Process Corporation:
 - 2. PPG Paints Deft Interior Clears/Polyurethanes:
 - 3. Sherwin-Williams Company:
- D. Stains:
 - 1. Behr Process Corporation:
 - 2. PPG Paints Deft Interior Stains:
 - 3. Sherwin-Williams Company:
- E. Primer Sealers: Same manufacturer as top coats.
- F. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
 - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- E. Colors: As indicated on drawings.
 - 1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, wood, uncoated steel, shop primed steel, and galvanized steel.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): Institutional Low Odor/VOC Interior Latex; MPI #143, 144, 145, 146, 147, or 148.
 - a. Products:
 - 1) PPG Paints Pure Performance Interior Latex, 9-100 Series, Flat. (MPI #143)
 - 2) PPG Paints Speedhide zero Latex, 6-4110XI Series, Flat. (MPI #143)
 - 3) Pratt & Lambert RedSeal Supreme Interior, Flat. (MPI #143)
 - 4) Sherwin-Williams Harmony Interior Acrylic Latex, Flat. (MPI #143)
 - 5) Valspar Professional Interior Latex, No. 11600 Series, Flat.
 - 6) Substitutions: Section 01 6000 - Product Requirements.
 - 3. Top Coat Sheen:
 - a. Satin: MPI gloss level 4; use this sheen for items subject to frequent touching by occupants, including door frames and railings.
 - 4. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): Interior Epoxy-Modified Latex; MPI #115 or 215.
 - a. Products:
 - 1) PPG Paints Pitt-Glaze WB Water-Borne Acrylic Epoxy, 16-598 Series, Semi-Gloss.
 - 2) Sherwin-Williams Waterbased Catalyzed Epoxy, Semi-Gloss.
 - 3) Substitutions: Section 01 6000 - Product Requirements.
- C. Paint I-OP-MD-WC - Medium Duty Vertical and Overhead: Including gypsum board, concrete, uncoated steel, shop primed steel, galvanized steel, and aluminum.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): Interior Epoxy-Modified Latex; MPI #115 or 215.
 - a. Products:
 - 1) PPG Paints Pitt-Glaze WB Water-Borne Acrylic Epoxy, 16-598 Series, Semi-Gloss.
 - 2) PPG Paints Pitt-Glaze WB Water-Borne Acrylic Epoxy, 16-599 Series, Gloss.
 - 3) Sherwin-Williams Pro Industrial Waterbased Catalyzed Epoxy, Gloss. (MPI #115)
 - 4) Sherwin-Williams Waterbased Catalyzed Epoxy, Semi-Gloss.
 - 5) Substitutions: Section 01 6000 - Product Requirements.
- D. Paint I-OP-DF - Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, and galvanized piping.
 - 1. Shop primer by others.
 - 2. One top coat.
 - 3. Top Coat: Alkyd Dry Fall; MPI #55, 89, or 225.
 - a. Products:
 - 1) PPG Paints Speedhide Alkyd Dry-Fog, 6-160XI, Flat. (MPI #55)
 - 2) Sherwin-Williams Dryfall Flat. (MPI #55)
 - 3) Substitutions: Section 01 6000 - Product Requirements.
- E. Paint I-TR-C - Transparent Finish on Concrete Floors.

1. As noted on Finish Schedule contract drawings.
2. Sealer: Water Based Sealer/Hardener for Concrete Floors.
 - a. Products:
 - 1) Prosoco Consolideck LS
3. Sealer: For Precast bleacher steps and risers:.
 - a. Ashford Formula by Curecrete Chemical Co..
- F. Paint MI-OP-3A - Ferrous Metals, Unprimed, Alkyd, 3 Coat:
 1. One coat of alkyd primer.
 2. Semi-gloss: Two coats of alkyd enamel; ____.
- G. Paint MI-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:
 1. One coat of latex primer.
 2. Semi-gloss: Two coats of latex enamel.
- H. Paint MI-OP-2L - Ferrous Metals, Primed, Latex, 2 Coat:
 1. Touch-up with latex primer.
 2. Semi-gloss: Two coats of latex enamel.
- I. Paint Mgl-OP-3A - Galvanized Metals, Alkyd, 3 Coat:
 1. One coat galvanize primer.
 2. Semi-gloss: Two coats of alkyd enamel.
- J. Paint GI-OP-3LA - Gypsum Board/Plaster, Latex-Acrylic, 3 Coat:
 1. One coat of alkyd primer sealer.
 2. Flat: Two coats of latex enamel-acrylic.
- K. Paint I-TR-F - Fire-Retardant Coating, Intumescent: (In lieu of Applied Fire Protection).
 1. One coat of fire-retardant primer sealer.
 2. One coat Sherwin-Williams Fire-Tex 5060 1-hour.
 3. No top coat.
- L. Paint FI-OP-2A - Fabrics/Insulation Jackets, Alkyd, 2 Coat:
 1. One coat of alkyd primer sealer.
 2. Flat: One coat of alkyd enamel.

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
 1. Interior Institutional Low Odor/VOC Primer Sealer; MPI #149.
 - a. Products:
 - 1) PPG Paints Pure Performance Interior Latex Primer, 9-900.
 - 2) Pratt & Lambert Pro-Hide Gold Interior Latex Zero VOC Primer. (MPI #149)
 - 3) Valspar Professional Interior Latex Primer, No. 11286. (MPI #149)
 - 4) Substitutions: Section 01 6000 - Product Requirements.
 2. Interior/Exterior Latex Block Filler; MPI #4.
 - a. Products:
 - 1) Kilz Pro-X p50 Block Filler Primer.
 - 2) PPG Paints Speedhide Masonry Hi Fill Latex Block Filler, 6-15. (MPI #4)
 - 3) Pratt & Lambert Pro-Hide Silver Interior/Exterior Latex Block Filler.
 - 4) Valspar Professional Block Filler, No. 589 Series. (MPI #4)
 - 5) Substitutions: Section 01 6000 - Product Requirements.
 3. Interior Latex Primer Sealer; MPI #50.
 - a. Products:
 - 1) Behr Premium Plus Interior All-In-One Primer and Sealer [No. 75]. (MPI #50)

- 2) PPG Paints Speedhide Interior Latex Sealer, 6-2. (MPI #50)
- 3) Pratt & Lambert Multi-Purpose Waterborne Primer. (MPI #50)
- 4) Valspar Professional Interior Latex Primer, No.11286. (MPI #50)
- 5) Substitutions: Section 01 6000 - Product Requirements.
4. Interior Drywall Primer Sealer.
 - a. Products:
 - 1) Behr Premium Plus Interior Drywall Primer and Sealer [No. 73].
 - 2) PPG Paints Speedhide Pro-EV Latex Sealer, 12-900.
 - 3) Substitutions: Section 01 6000 - Product Requirements.
5. Anti-Corrosive Alkyd Primer for Metal; MPI #79.
 - a. Products:
 - 1) PPG Paints Speedhide Interior/Exterior Rust Inhibitive Steel Primer, 6-212 Series. (MPI #79)
 - 2) Valspar Armor Anti-Rust Oil Metal Primer, No. 21852. (MPI #79)
 - 3) Substitutions: Section 01 6000 - Product Requirements.
6. Interior Water Based Primer for Galvanized Metal; MPI #134.
 - a. Products:
 - 1) Behr Premium Plus Interior/Exterior Multi-Surface Primer and Sealer [No. 436]. (MPI #134)
 - 2) PPG Paints Pitt-Tech Plus DTM Industrial Primer, 90-912 Series. (MPI #134)
 - 3) Sherwin-Williams DTM Primer/Finish (MPI #134)

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 1. Gypsum Wallboard: 12 percent.
 2. Masonry, Concrete, and Concrete Masonry Units : 12 percent.
 3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 4. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Concrete:

1. Clean concrete according to ASTM D4258. Allow to dry.
- F. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- G. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- H. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- I. Galvanized Surfaces:
- J. Ferrous Metal:
 1. Solvent clean according to SSPC-SP 1.
 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- K. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- L. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- E. Sand wood and metal surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.
- B. Owner will provide field inspection.

END OF SECTION

**SECTION 09 9600
HIGH-PERFORMANCE COATINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. High performance coatings.
- B. Surface preparation.

1.02 RELATED REQUIREMENTS

- A. Section 09 9113 - Exterior Painting.

1.03 REFERENCE STANDARDS

- A. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.
- B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- C. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).
- D. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals; 2024.
- E. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- F. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide complete list of all products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Manufacturer's installation instructions.
 - 4. If proposal of substitutions is allowed under submittal procedures, explanation of all substitutions proposed.
- C. Samples: Submit two samples 8 by 8 inch in size illustrating colors available for selection.
- D. Manufacturer's Certificate: Certify that high-performance coatings comply with VOC limits specified.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Coating Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.06 FIELD CONDITIONS

- A. Do not install materials when temperature is below 55 degrees F or above 90 degrees F.
- B. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

- C. Restrict traffic from area where coating is being applied or is curing.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. High-Performance Coatings:
 - 1. Dow Chemical Company:
 - 2. PPG Paints:
 - 3. Precision Coatings:
 - 4. Sherwin-Williams Company:
 - 5. Tnemec Company, Inc:
 - 6. Substitutions: Section 01 6000 - Product Requirements.

2.02 TOP COAT MATERIALS

- A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.
- B. Epoxy Coating:
 - 1. Number of coats: Two.
 - 2. Top Coat(s): Polyamide Epoxy; MPI #77.
 - a. Sheen: Gloss.
 - b. Products:
 - 1) PPG Paints; HPC Epoxy, High Gloss, 95-501 Series:
 - 2) Sherwin-Williams; Tile Clad HS; MPI #77:
 - 3) Tnemec Company, Inc; Series 287 Enviro-Pox:
 - 4) Substitutions: Section 01 6000 - Product Requirements.

2.03 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by coating manufacturer.
 - 1. Anti-Corrosive for Metal, Epoxy; MPI #101.
 - a. Products:
 - 1) Sherwin-Williams Dura-Plate 235 Multi Purpose Epoxy.
 - 2) Substitutions: Section 01 6000 - Product Requirements.

2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Do not begin application of coatings until substrates have been properly prepared.
- C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.
- D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

- E. Test shop-applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION

- A. Clean surfaces of loose foreign matter.
- B. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning", and protect from corrosion until coated.
- C. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.03 PRIMING

- A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

3.04 COATING APPLICATION

- A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in "MPI Architectural Painting and Specification Manual".
- B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 PROTECTION

- A. Protect finished work from damage.

END OF SECTION

SECTION 10 1400 SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Room and door signs.
- B. Interior directional and informational signs.
- C. Dimensional Letter signs.

1.02 RELATED REQUIREMENTS

- A. Section 26 5100 - Interior Lighting: Exit signs required by code.

1.03 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
- D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- E. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation.
- C. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Flat Signs: Grip Lock as designated on Specialties Schedule of Contract Drawings.
- B. Plaques: To be determined.
 - 1. Cosco Industries; Cast Aluminum:
 - 2. FASTSIGNS; Cast Aluminum.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
 - 1. Sign Type: Flat signs with engraved panel media as specified.
 - 2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
 - 3. Character Height: 1 inch.
 - 4. Sign Height: 2 inches, unless otherwise indicated.
 - 5. Office Doors: Identify with room names and numbers to be determined later, not those indicated on drawings; in addition, provide "window" section for replaceable occupant name.
 - 6. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers indicated on drawings.
 - 7. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
 - 8. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.
- C. Interior Directional and Informational Signs:
 - 1. Sign Type: Same as room and door signs.
 - 2. Wording of signs is scheduled on drawings.
- D. Building Identification Signs:
 - 1. Use individual metal letters.
 - 2. Mount on outside wall in location indicated on drawings.
- E. Other Dimensional Letter Signs: Wall-mounted where located on contract drawings.

2.03 SIGN TYPES

- A. Flat Signs: Signage media without frame.
 - 1. Edges: Square.
 - 2. Corners: Square.
 - 3. Wall Mounting of One-Sided Signs: Tape adhesive.
 - 4. Wall and Ceiling Mounting of Two-Sided Signs: Aluminum wall bracket, powder coated, color selected from manufacturer's standard colors, attached with screws in predrilled mounting holes, set in clear silicone sealant.
- B. Color and Font: Unless otherwise indicated: Refer to contract drawings
 - 1. Character Font: Helvetica.
 - 2. Character Case: Upper case only.

2.04 TACTILE SIGNAGE MEDIA

- A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:

2.05 DIMENSIONAL LETTERS

- A. Metal Letters: Refer to contract drawings for specific verbiage, size and location.
 - 1. Metal: Aluminum casting.
 - 2. Mounting: Concealed screws.

2.06 ACCESSORIES

- A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
- B. Exposed Screws: Chrome plated.
- C. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION

SECTION 10 2113.19
HDPE TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Solid plastic toilet compartments.
- B. Urinal and vestibule screens.

1.02 RELATED REQUIREMENTS

- A. Section 05 1200 - Structural Steel Framing: Concealed steel support members.
- B. Section 05 5000 - Metal Fabrications: Concealed steel support members.
- C. Section 06 1000 - Rough Carpentry: Blocking and supports.
- D. Section 10 2800 - Toilet and Bath Accessories.

1.03 REFERENCE STANDARDS

- A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- C. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- D. Samples: Submit two samples of partition panels, 8 x 8 inches in size illustrating panel finish, color, and sheen.
- E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Solid Plastic Toilet Compartments:
 - 1. Scranton Products; Hiny Hiders Partitions:
 - 2. ASI Accurate Partitions:
 - 3. Inpro:

2.02 PLASTIC TOILET COMPARTMENTS

- A. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286; floor-mounted unbraced.
 - 1. Doors:
 - a. Thickness: 1 inch.
 - b. Width: 24 inch.

- c. Width for Handicapped Use: 36 inch, out-swinging.
 - d. Height: 55 inch. or as noted on contract drawings.
- 2. Panels:
 - a. Thickness: 1 inch.
 - b. Height: 55 inch. or as noted on contract drawings
- 3. Pilasters:
 - a. Thickness: 1 inch.
 - b. Width: As required to fit space; minimum 3 inch.
- 4. Screens: Without doors; to match compartments; mounted to wall with two panel brackets.

2.03 ACCESSORIES

- A. Pilaster Shoes: Stainless steel, satin finish, 3 inches high; concealing floor fastenings.
- B. Head Rails: Extruded aluminum, anti-grip profile.
 - 1. Size: Manufacturer's standard size.
- C. Wall and Pilaster Brackets: Stainless steel; manufacturer's standard type for conditions indicated on drawings.
- D. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
 - 1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.
- E. Hinges: Stainless steel, manufacturer's standard finish.
- F. Door Hardware: Stainless steel, manufacturer's standard finish.
 - 1. Door Latch: Slide type with exterior emergency access feature.
 - 2. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.
 - 3. Provide door pull for outswinging doors.
- G. Coat Hook: One per compartment, mounted on door.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.

3.02 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

3.03 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.
- C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

**SECTION 10 2600
WALL AND DOOR PROTECTION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner guards.
- B. Protective wall covering.

1.02 RELATED REQUIREMENTS

- A. Section 05 5000 - Metal Fabrications: Anchors for attachment of work of this section, concealed in wall.
- B. Section 06 1000 - Rough Carpentry: Blocking for wall and corner guard anchors.
- C. Section 09 2116 - Gypsum Board Assemblies: Placement of supports in stud wall construction.
- D. Section 09 2216 - Non-Structural Metal Framing: Placement of supports in stud wall construction.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate physical dimensions and features.
- C. Shop Drawings: Include plans, elevation, sections, and attachment details.
- D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
 - 1. Submit two samples of protective wall covering and door surface protection, 6 by 6 inches square.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
 - 1. See Section 01 6000 - Product Requirements, for additional provisions.
 - 2. Extra Stock Materials: 100 square feet of protective wall covering.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Protect work from moisture damage.
- C. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in conformance with manufacturer's recommendations for each type of item.

1.05 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Corner Guards:
 - 1. Babcock-Davis: Stainless Steel.
 - 2. Inpro Stainless Steel:
 - 3. Korogard Interior Products:
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

- B. Protective Wall Covering:
 - 1. Construction Specialties, Inc; Acrovyn High-Impact Wall Covering:
 - 2. Inpro:
 - 3. Korogard Interior Products.

2.02 PRODUCT TYPES

- A. Corner Guards - Surface Mounted:
 - 1. Material: High impact vinyl with full height extruded aluminum retainer.
 - 2. Width of Wings: 2 inches.
 - 3. Corner: Square.
 - 4. Color: As selected from manufacturer's standard colors.
 - 5. Length: One piece.
- B. Protective Wall Covering:
 - 1. Material: High-impact acrylic-modified vinyl.
 - 2. Thickness: 0.040 inch.
 - 3. Color: As selected from manufacturer's standard colors.
- C. Adhesives and Primers: As recommended by manufacturer.
- D. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.
- E. See Section 06 1000 for wood blocking for wall and corner guard anchors.

2.03 FABRICATION

- A. Fabricate components with tight joints, corners and seams.

2.04 SOURCE QUALITY CONTROL

- A. Provide wall and door protection systems of each type from a single source and manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B. Position corner guard 4 inches above finished floor to ceiling.
- C. Coordinate installation of vinyl fabric wall covering specified in Section 09 7200 with corner guard retainer and cover.

END OF SECTION

**SECTION 10 2800
TOILET AND BATH ACCESSORIES**

PART 1 GENERAL

REFER TO CONTRACT DRAWINGS SPECIALTIES SCHEDULE FOR SPECIFIC ACCESSORIES NOT OTHERWISE SPECIFIED HEREIN OR ELSEWHERE. COORDINATE ITEMS TO BE OWNER PROVIDED/CONTRACTOR INSTALLED OR OWNER PROVIDED OWNER INSTALLED.

2.01 SECTION INCLUDES

- A. Commercial toilet accessories.

2.02 RELATED REQUIREMENTS

- A. Section 06 10 00 Rough Carpentry: Concealed supports for accessories, including in wall framing and plates and above ceiling framing.

2.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011 (Reaffirmed 2022).
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- D. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2022.
- E. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2022.
- F. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
- G. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

2.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

2.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

PART 2 PRODUCTS REFER TO CONTRACT DRAWINGS SPECIALTY SCHEDULE.

PART 3 EXECUTION

4.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
- D. Verify that field measurements are as indicated on drawings.
- E. See Section 06 1000 Rough Carpentry for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

4.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

4.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

4.04 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

**SECTION 10 4400
FIRE PROTECTION SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.
- B. Section 09 9123 - Interior Painting: Field paint finish.

1.03 REFERENCE STANDARDS

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.
- B. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features.
- C. Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, installation procedures, and accessories required for complete installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguishers:
 - 1. Larsen's Manufacturing Co.:
 - 2. Kidde, a unit of United Technologies Corp:
 - 3. Nystrom, Inc:
 - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Fire Extinguisher Cabinets and Accessories:
 - 1. Larsen's Manufacturing Co:
 - 2. Kidde, a unit of United Technologies Corp:
 - 3. Nystrom, Inc.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent. Provide brackets at exposed extinguisher locations on second floor concourse and Walking Track.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
 - 1. Class: A:B:C type.
 - 2. Size: 10 pound.
 - 3. Finish: Baked polyester powder coat, color as selected.
 - 4. Temperature range: Minus 40 degrees F to 120 degrees F.

2.03 FIRE EXTINGUISHER CABINETS

- A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.
- B. Cabinet Construction: Non-fire rated.
 - 1. Formed primed steel sheet; 0.036 inch thick base metal.

- C. Fire Rated Cabinet Construction:
 - 1. Steel; double wall or outer and inner boxes with 5/8 inch thick fire barrier material.
- D. Cabinet Configuration: Semi-recessed.
 - 1. Size to accommodate accessories.
 - 2. Trim: Flat rolled edge, with 2 1/2 inch wide face.
- E. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinge.
- F. Door Glazing: Tempered glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.
- G. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- H. Weld, fill, and grind components smooth.
- I. Finish of Cabinet Exterior Trim and Door: Baked enamel, color as selected.
- J. Finish of Cabinet Interior: White colored enamel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure rigidly in place.
- C. Place extinguishers in cabinets.

END OF SECTION

SECTION 10 5113 METAL LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal lockers.

1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2023a.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- D. ASTM A879/A879M - Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface; 2022.
- E. ASTM F1267 - Standard Specification for Metal, Expanded, Steel; 2018 (Reapproved 2023).
- F. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's published data on locker construction, sizes, and accessories.
 - 1. Wired Access Control: Include power requirements and standard wiring diagrams for specified products.
- C. Shop Drawings: Indicate locker plan layout, numbering plan and combination lock code.
- D. Manufacturer's Installation Instructions: Indicate component installation assembly.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Lockers:
 - 1. ASI Storage Solutions:
 - 2. Lyon Workspace Products:
 - 3. Penco Products, Inc:

2.02 LOCKER APPLICATIONS

- A. Student Lockers: Metal lockers, recessed mounted.
 - 1. Width: 12 inches.
 - 2. Depth: 12 inches.
 - 3. Height: 72 inches.
 - 4. Configuration: Two tier.
 - 5. Fittings: Size and configuration as indicated on drawings.
 - a. Hooks: One single prong.
 - 6. Ventilation: Louvers at top and bottom of door panel.
 - 7. Locking: Padlock hasps, for padlocks provided by Owner.
 - a. Locking Action: Positive, automatic type, whereby locker may be locked when open, then closed without unlocking.

2.03 METAL LOCKERS

- A. Locker Case Construction:
 - 1. Heavy-Duty, Welded Construction: Made of formed and welded together sheet steel; metal edges finished smooth without burrs; baked enamel or powder coat finished inside and out.
 - a. Assembly: Do not use bolts, screws, or rivets to assemble locker bodies.
 - b. Locker Body Components: Formed and flanged from steel sheet of the following type and minimum thicknesses:
 - 1) Body and Shelves: 16 gauge, 0.0598 inch.
 - 2) Backs: 18 gauge, 0.0478 inch.
 - 3) Base: 18 gauge, 0.0478 inch.
 - (a) Height: 4 inches.
 - c. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.
 - B. Latches and Door Handles: Manufacturer's standard.
 - C. Coat Hooks: Stainless steel or zinc-plated steel.
 - D. Locks: Locker manufacturer's standard type indicated in Applications article above.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared bases are in correct position and configuration.
- B. Verify bases and embedded anchors are properly sized.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Place and secure on prepared base.
- C. Install lockers plumb and square.
- D. Install fittings if not factory installed.
- E. Replace components that do not operate smoothly.

END OF SECTION

**SECTION 12 3200
MANUFACTURED WOOD CASEWORK**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured standard and custom casework, with cabinet hardware.
- B. Countertops.

1.02 RELATED REQUIREMENTS

- A. Section 01 6000 - Product Requirements: Requirements for sustainably harvested wood.
- B. Section 06 1000 - Rough Carpentry: Blocking and nailers for anchoring casework.
- C. Section 07 9200 - Joint Sealants: Sealing joints between casework and countertops and adjacent walls, floors, and ceilings.
- D. Section 09 2116 - Gypsum Board Assemblies: Reinforcements in metal-framed partitions for anchoring casework.

1.03 DEFINITIONS

- A. Exposed: Portions of casework visible when drawers and cabinet doors are closed, including end panels, bottoms of cases more than 42 inches above finished floor, tops of cases less than 72 inches above finished floor and all members visible in open cases or behind glass doors.
- B. Semi-Exposed: Portions of casework and surfaces behind solid doors, tops of cases more than 72 inches above finished floor and bottoms of cabinets more than 30 inches but less than 42 inches above finished floor.
- C. Concealed: Sleepers, web frames, dust panels and other surfaces not generally visible after installation and cabinets less than 30 inches above finished floor.

1.04 REFERENCE STANDARDS

- A. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- D. BHMA A156.9 - Cabinet Hardware; 2020.
- E. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2020.
- F. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Component dimensions, configurations, construction details, joint details, attachments.
- C. Shop Drawings: Indicate casework types, sizes, and locations, using large scale plans, elevations, and cross sections. Include rough-in and anchors and reinforcements, placement dimensions and tolerances and clearances required.
- D. Samples for Finish Selection: Fully finished, for color selection. Minimum sample size: 6 inches by 6 inches.
 - 1. Plastic laminate samples, for color, texture, and finish selection.
 - 2. Solid phenolic samples, for color, texture, and finish selection.

- E. Casework Samples: Representative of types in the project.
 - 1. Base Cabinet: Cabinet with drawer and door and specified hardware. Type indicated on drawings.
 - 2. Wall Cabinet: Cabinet with shelves and supports, door and specified hardware. Type indicated on drawings.
- F. Manufacturer's Installation Instructions.
- G. Maintenance Data: Manufacturer's recommendations for care and cleaning.
- H. Finish touch-up kit for each type and color of materials provided.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect items provided by this section, including finished surfaces and hardware items during handling and installation. For metal surfaces, use polyethylene film or other protective material standard with the manufacturer.
- B. Acceptance at Site:
 - 1. Do not deliver or install casework until the conditions specified under Part 3, Examination Article of this section have been met. Products delivered to sites that are not enclosed and/or improperly conditioned will not be accepted if warping or damage due to unsatisfactory conditions occurs.
- C. Storage:
 - 1. Store casework in the area of installation.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion, at no additional cost to Owner. Defects include, but are not limited to:
 - 1. Ruptured, cracked, or stained finish coating.
 - 2. Discoloration or lack of finish integrity.
 - 3. Cracking or peeling of finish.
 - 4. Delamination of components.
 - 5. Failure of adhesives.
 - 6. Failure of hardware.

PART 2 PRODUCTS

2.01 CASEWORK, GENERAL

- A. Quality Standard: AWI/AWMAC/WI (AWS), unless noted otherwise.

2.02 FABRICATION

- A. Assembly: Shop assemble casework items for delivery to site in units easily handled and to permit passage through building openings.
- B. Construction: As required for selected grade.
- C. Fittings and Fixture Locations: Cut and drill components for fittings and fixtures.
- D. Hardware Application: Factory-machine casework members for hardware that is not surface applied.
- E. Removable back panels on all base cabinets. Provide partial height back panels at sink cabinets.
- F. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

- G. Scribes and Fillers: Panels of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.
- H. Apron Frames: Construction similar to other cabinets, with modifications.

2.03 PLASTIC-LAMINATE-CLAD CASEWORK

- A. Plastic-Laminate-Clad Casework: Solid wood and wood panel construction; each unit self-contained and not dependent on adjacent units or building structure for rigidity; in sizes necessary to avoid field cutting except for scribes and filler panels. Include adjustable levelers for base cabinets.
 - 1. Style: Flush overlay. Ease doors and drawer fronts slightly at edges.
 - 2. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings.
 - 3. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline.
 - a. Finish: Matte or suede, gloss rating of 5 to 20.
 - b. Surface Color and Pattern: As selected by Architect from manufacturer's full line.
 - c. Exposed Interior Surfaces: Thermally fused laminate.
 - 1) Color: White.

2.04 COUNTERTOPS

- A. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Custom Grade, unless otherwise noted.
- B. Plastic Laminate Countertops: High pressure decorative laminate sheet bonded to substrate. Refer to Contract drawings for specific product.

2.05 CABINET HARDWARE

- A. Manufacturer's standard types, styles and finishes.
- B. Conform to BHMA A156.9 requirements.

2.06 MATERIALS

- A. Wood-Based Materials:
 - 1. Composite Wood Panels: Containing no urea-formaldehyde resin binders.
- B. Semi-Exposed Solid Wood: Dry, sound, plain sawn, no appearance defects, any species similar in color and grain to exposed portions.
- C. Hardwood Plywood: Veneer core; HPVA HP-1 Grade as indicated; same species as exposed solid wood, clear, compatible grain and color, no defects. Band exposed edges with solid wood of same species as veneer.
- D. Concealed Solid Wood or Plywood: Any species and without defects affecting strength or utility.
- E. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications. complying with Grade requirements, and standard with the manufacturer.

2.07 ACCESSORIES

- A. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
 - 1. Color: As selected by Architect from manufacturer's standard range.
 - 2. Use at exposed edges.
- B. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

- C. Concealed Joint Fasteners: Corrosion-resistant, standard with manufacturer.
- D. Grommets: Standard rubber grommets for cut-outs, in color to match adjacent surface.

PART 3 EXECUTION

3.01 PREPARATION

- A. Large Components: Ensure that large components can be moved into final position without damage to other construction.

3.02 INSTALLATION

- A. Perform installation in accordance with manufacturer's instructions.
- B. Use anchoring devices to suit conditions and substrate materials encountered. Use concealed fasteners to the greatest degree possible. Use exposed fasteners only where allowed by approved shop drawings, or where concealed fasteners are impracticable.
- C. Set casework items plumb and square, securely anchored to building structure.
- D. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.
- E. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch. In addition, do not exceed the following tolerances:
 - 1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet.
 - 2. Variation of Faces of Cabinets from a True Plane: 1/8 inch in 10 feet.
 - 3. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch.
 - 4. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch.
- F. Secure wall and floor cabinets to concealed reinforcement at gypsum board assemblies.
- G. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 16 inches on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.
- H. Wall Cabinets: Fasten to hanging strips, and/or wall substrates. Fasten each cabinet through back, near top, at not less than 16 inches on center.
- I. Install hardware uniformly and precisely.
- J. Countertops: Install countertops intended and furnished for field installation in one true plane, with ends abutting at hairline joints, and no raised edges.
- K. Replace units that are damaged, including those that have damaged finishes.

3.03 ADJUSTING

- A. Adjust operating parts, including doors, drawers, hardware, and fixtures to function smoothly.

3.04 CLEANING

- A. Clean casework and other installed surfaces thoroughly.

END OF SECTION

SECTION 12 3600 COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for manufactured casework.

1.02 RELATED REQUIREMENTS

- A. Section 12 3200 - Manufactured Wood Casework.
- B. Section 22 4000 - Plumbing Fixtures: Sinks.

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard; 2022.
- B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- D. AWI (QCP) - Quality Certification Program; Current Edition.
- E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- F. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- G. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- H. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- I. PS 1 - Structural Plywood; 2023.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS: REFER TO CONTRACT DRAWINGS FOR SPECIFIC SELECTIONS

- A. Quality Standard: See 12 3200.
- B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
 - 1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
 - a. Manufacturers: Refer to contract Drawings for specific manufacturer's and selections.
 - 1) Formica Corporation:
 - 2) Panolam Industries International, Inc; Nevamar Standard HPL:
 - 3) Panolam Industries International, Inc; Pionite Standard HPL:
 - 4) Wilsonart:
 - 5) Substitutions: See Section 01 6000 - Product Requirements.
 - b. Finish: Refer to contract drawings.
 - 2. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch thick; covered with matching laminate.
 - 3. Back and End Splashes: Same material, same construction.
 - 4. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Custom Grade.
- C. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
 - 1. Flat Sheet Thickness: 1/2 inch, minimum.
 - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Manufacturers:
 - 1) Avonite Surfaces:
 - 2) Formica Corporation:
 - 3) Wilsonart:
 - 4) Substitutions: See Section 01 6000 - Product Requirements.
 - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 - c. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
 - 3. Other Components Thickness: 1/2 inch, minimum.
 - 4. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.

2.02 MATERIALS

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- B. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf minimum density; minimum 3/4 inch thick; join lengths using metal splines.
- C. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.
- D. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

2.03 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 - 1. Join lengths of tops using best method recommended by manufacturer.
 - 2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
 - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 - 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 - 2. Height: 4 inches, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 INSTALLATION

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.
- C. Attach stainless steel countertops using stainless steel fasteners and clips.
- D. Seal joint between back/end splashes and vertical surfaces.

3.03 CLEANING

- A. Clean countertops surfaces thoroughly.

3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

**SECTION 13 3419
PRE-ENGINEERED METAL BUILDING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufacturer-engineered, shop-fabricated structural steel building frame.
- B. Metal wall and roof panels including soffits, gutters and downspouts, and roof mounted equipment curbs and other equipment as required for a complete installation and as shown on contract drawings.

1.02 RELATED REQUIREMENTS

- A. Section 05 5000 - Metal Fabrications.
- B. Section 07 9200 - Joint Sealants: Sealing joints between accessory components and wall system.
- C. Section 08 5113 - Aluminum Windows.

1.03 REFERENCE STANDARDS

- A. AISC 360 - Specification for Structural Steel Buildings; 2022.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
- E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
- F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.
- G. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality; 2019.
- H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- I. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.
- J. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.
- K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- L. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.
- M. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
- N. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- O. IAS AC472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems; 2018, with Editorial Revision (2019).
- P. MBMA (MBSM) - Metal Building Systems Manual; 2019.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on profiles, component dimensions, fasteners.
- C. Shop Drawings: Indicate assembly dimensions, locations of structural members, connections; wall and roof system dimensions, panel layout, general construction details, anchors and methods of anchorage, and installation; framing anchor bolt settings, sizes, locations from datum, and foundation loads; indicate welded connections with AWS A2.4 welding symbols; indicate net weld lengths; provide professional seal and signature.
- D. Manufacturer's Qualification Statement: Provide documentation showing metal building manufacturer is accredited under IAS AC472.
- E. Erector's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with AISC 360 and MBMA (MBSM).
- B. Perform welding in accordance with AWS D1.1/D1.1M.

1.06 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Buildings Systems:
 - 1. Alliance Steel Inc.
 - 2. Butler Manufacturing Company:
 - 3. Ceco Building Systems:
 - 4. VP Buildings:

2.02 ASSEMBLIES

- A. Single span rigid frame.
- B. Primary Framing: Rigid frame of rafter beams and columns, intermediate columns, braced end frames, and end wall columns, and wind bracing.
- C. Secondary Framing: Purlins, and other items detailed.
- D. Wall System: Preformed metal panels of horizontal and vertical profiles, with sub-girt framing/anchorage assembly, and accessory components.
- E. Roof System: Preformed metal panels oriented parallel to slope, with sub-girt framing/anchorage assembly, insulation, and liner panels, and accessory components.
- F. Roof Slope: As shown on drawings.

2.03 PERFORMANCE REQUIREMENTS

- A. Installed Thermal Resistance of Wall System: R-Value of 19 or of current code requirement.
- B. Installed Thermal Resistance of Roof System: R-Value of 30 or of current code requirement.
- C. Design structural members to withstand dead load, applicable snow load, and design loads due to pressure and suction of wind calculated in accordance with applicable code.
- D. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.

- E. Permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to temperature range in excess of local code requirements.
- F. Size and fabricate wall and roof systems free of distortion or defects detrimental to appearance or performance.

2.04 MATERIALS - FRAMING

- A. Structural Steel Members: ASTM A36/A36M.
- B. Structural Tubing: ASTM A500/A500M Grade B cold-formed.
- C. Plate or Bar Stock: ASTM A529/A529M, Grade 50.
- D. Anchor Bolts: ASTM A307, Grade A, with no preference for protective coatings.
- E. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1; galvanized to ASTM A153/A153M.
- F. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 - 1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
 - 2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.

2.05 MATERIALS - WALLS AND ROOF

- A. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, Designation SS (structural steel), Grade 33 (230), with G90/Z275 coating.
- B. Insulation: Semi-rigid glass fiber type, unfaced and faced at exposed locations, ASTM E84 Class A, flame spread index of 25 or less where exposed, friction fit.
- C. Insulation: ASTM C665 Type I.
 - 1. Facing: Sheet vinyl, manufacturer's standard type, white.
- D. Joint Seal Gaskets: Manufacturer's standard type.
- E. Fasteners: Manufacturer's standard type, galvanized to comply with requirements of ASTM A153/A153M, finish to match adjacent surfaces when exterior exposed.
- F. Sealant: Manufacturer's standard type.
- G. Roof Curbs: Insulated metal same as roofing, designed for imposed equipment loads, anchor fasteners to equipment, counterflashed to metal roof system.
- H. Trim, Closure Pieces, Caps, Flashings, Soffit Panels, Gutters, Downspouts, Rain Water Diverter, Fascias, and Infills: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

2.06 COMPONENTS

- A. Doors and Frames: Specified in Section 08 1113.
- B. Windows: Other than manufacturer's standard specified in Section 08 5113.
- C. Windows: Manufacturer's standard where noted on drawings.
- D. Wall Louvers: as required.

2.07 FABRICATION - FRAMING

- A. Fabricate members in accordance with AISC 360 for plate, bar, tube, or rolled structural shapes.

2.08 FABRICATION - WALL AND ROOF PANELS

- A. Siding: Interior and Exterior: Minimum 26 gauge metal thickness, standard profile indicated, with lapped edges fitted with continuous gaskets.

- B. Roofing: Minimum 24 gauge metal thickness, standard profile, lapped edges fitted with continuous gaskets.
- C. Soffit Panels: Minimum 26 gauge metal thickness, flat profile, perforated for ventilation.
- D. Girts/Purlins: Rolled formed structural shape to receive siding, roofing and liner sheet.
- E. Internal and External Corners: Same material thickness and finish as adjacent material, profile brake formed to required angles. Back brace mitered internal corner.
- F. Expansion Joints: Same material and finish as adjacent material where exposed, manufacturer's standard brake formed type, of profile to suit system.
- G. Flashings, Closure Pieces, Fascia: Same material and finish as adjacent material, profile to suit system.
- H. Fasteners: To maintain load requirements and weather tight installation, same finish as cladding, non-corrosive type.

2.09 FABRICATION - GUTTERS AND DOWNSPOUTS

- A. Fabricate of same material and finish as roofing metal. Size in accordance with SMACNA Standards for this location.
- B. Form gutters and downspouts and scuppers of profile and size indicated to collect and remove water. Fabricate with connection pieces.
- C. Form sections in maximum possible lengths. Hem exposed edges. Allow for expansion at joints.
- D. Fabricate support straps of same material and finish as roofing metal, color as selected.

2.10 FINISHES

- A. Framing Members: Clean, prepare, and shop prime. Do not prime surfaces to be field welded.
- B. Exterior Surfaces of Wall Components and Accessories: Precoated enamel on steel of modified silicone finish, color as selected from manufacturer's standard range.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that foundation, floor slab, mechanical and electrical utilities, and placed anchors are in correct position

3.02 ERECTION - FRAMING

- A. Erect framing in accordance with AISC 360.
- B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing. Locate braced bays as indicated.
- C. Set column base plates with non-shrink grout to achieve full plate bearing.
- D. Do not field cut or alter structural members without approval.
- E. After erection, prime welds, abrasions, and surfaces not shop primed.

3.03 ERECTION - WALL AND ROOF PANELS

- A. Install in accordance with manufacturer's instructions.
- B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.
- C. Fasten cladding system to structural supports, aligned level and plumb.
- D. Locate end laps over supports. End laps minimum 2 inches. Place side laps over bearing.

- E. Provide expansion joints where indicated.
- F. Use concealed fasteners.
- G. Install sealant and gaskets, providing weather tight installation.

3.04 ERECTION - GUTTERS AND DOWNSPOUTS

- A. Rigidly support and secure components. Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.
- B. Slope gutters minimum 1/4 inch/ft.
- C. Connect downspouts to storm sewer system or
- D. Install splash pans under each downspout.

3.05 TOLERANCES

- A. Framing Members: 1/4 inch from level; 1/8 inch from plumb.
- B. Siding and Roofing: 1/8 inch from true position.

END OF SECTION

**SECTION 14 2400
HYDRAULIC ELEVATORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Complete hydraulic elevator systems.
 - 1. Passenger type.
- B. Elevator Maintenance Contract.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Includes elevator machine foundation, enclosed hoistway, elevator pit, divider beams, overhead hoist beams, grouting thresholds, grouting hoistway entrance frames, and all items required for complete turn key installation.
- B. Section 05 1200 - Structural Steel Framing: Includes hoistway framing, divider beams, and overhead hoist beams.
- C. Section 05 5000 - Metal Fabrications: Includes elevator pit ladder, sill supports, divider beams, and overhead hoist beams.
- D. Section 07 1713 Bentonite Panel Waterproofing.: Waterproofing of elevator pit walls and floor.
- E. Section 07 8100 - Applied Fire Protection: Fireproofing of guide rail brackets where attached to building structural members.
- F. Section 07 8400 - Firestopping: Fire rated sealant in hoistway.
- G. Section 09 2116 - Gypsum Board Assemblies: Gypsum shaft walls.
- H. Section 09 6500 - Resilient Flooring: Floor finish in car.
- I. Section 26 0533.13 - Conduit for Electrical Systems:
- J. Section 26 0583 - Wiring Connections:

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- C. AISC 360 - Specification for Structural Steel Buildings; 2022.
- D. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- E. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices; 2022.
- F. ASME A17.2 - Guide for Inspection of Elevators, Escalators, and Moving Walks Includes Inspection Procedures for Electric Traction and Winding Drum Elevators, Hydraulic Elevators, Inclined Elevators, Limited-Use/Limited-Application Elevators, Private Residence Elevators, Escalators, Moving Walks, Dumbwaiters, and Material Lifts; 2023.
- G. ASME QEI-1 - Standard for the Qualification of Elevator Inspectors; 2024.
- H. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- I. ASTM A139/A139M - Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over); 2022.
- J. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

- K. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.
- L. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- M. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- N. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- O. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.
- P. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- Q. ITS (DIR) - Directory of Listed Products; Current Edition.
- R. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- S. NEMA MG 1 - Motors and Generators; 2021.
- T. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- U. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.
- V. PS 1 - Structural Plywood; 2023.
- W. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate work with other installers to provide conduits necessary for installation of wiring including but not limited to:
 - a. Elevator equipment devices remote from elevator machine room or hoistway.
 - b. Elevator pit for .
 - c. Automatic transfer switch from controller cabinet.
 - d. Fire alarm panel from controller cabinet.
- B. Preinstallation Meeting: Convene meeting at least one week prior to start of this work.
 - 1. Review schedule of installation, proper procedures and conditions, and coordination with related work.
- C. Construction Use of Elevator: Not permitted.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on following items:
 - 1. Signal and operating fixtures, operating panels, and indicators.
 - 2. Car design, dimensions, layout, and components.
 - 3. Car and hoistway door and frame details.
 - 4. Electrical characteristics and connection requirements.
- C. Shop Drawings: Include appropriate plans, elevations, sections, diagrams, and details on following items:
 - 1. Elevator Equipment and Machines: Size and location of driving machines, power units, controllers, governors, and other components.
 - 2. Hoistway Components: Size and location of car guide rails, buffers, jack unit and other components.

3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
 4. Clearances and over-travel of car.
 5. Locations in hoistway and machine room of traveling cables and connections .
 6. Location and sizes of hoistway and car doors and frames.
 7. Electrical characteristics and connection requirements.
 8. Indicate arrangement of elevator equipment and allow for clear passage of equipment through access openings.
- D. Samples: Submit samples illustrating car interior finishes, car and hoistway door and frame finishes, and handrail material and finish in the form of cut sheets or finish color selection brochures.
 - E. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
 - F. Testing Agency's Qualification Statement.
 - G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
 - H. Initial Maintenance Contract.
 - I. Maintenance Contract: Submit proposal to Owner for standard one year continuing maintenance contract agreement in accordance with ASME A17.1 and requirements as indicated, starting on date initial maintenance contract is scheduled to expire.
 1. Indicate in proposal the services, obligations, conditions, and terms for agreement period and for renewal options.
 - J. Operation and Maintenance Data:
 1. Parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
 2. Operation and maintenance manual.
 3. Schematic drawings of equipment and hydraulic piping, and wiring diagrams of installed electrical equipment with list of corresponding symbols to identify markings on machine room and hoistway apparatus.

1.06 QUALITY ASSURANCE

- A. Maintain one copy of each quality standard document on site.
- B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.
- C. Products Requiring Fire Resistance Rating: Listed and classified by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
- D. Products Requiring Electrical Connection: Listed and classified by UL (DIR) or testing agency acceptable to authorities having jurisdiction as suitable for the purpose indicated in construction documents.

1.07 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's warranty for elevator operating equipment and devices for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design - Hydraulic Elevators: Otis Hydrolift Holeless/Machine Roomless.

- B. Other Acceptable Manufacturers - Hydraulic Elevators:
 - 1. Mitsubishi Electric US, Inc:
 - 2. Schindler Elevator Corporation:
 - 3. ThyssenKrupp Elevator:
- C. Substitutions: See Section 01 6000 - Product Requirements.
- D. Products other than Basis of Design are subject to compliance with specified requirements and prior approval of Architect. By using products other than Basis of Design, the Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

2.02 HYDRAULIC ELEVATORS

- A. Hydraulic Passenger Elevator:
 - 1. Hydraulic Elevator Equipment:
 - a. Holeless/Machine Roomless hydraulic with cylinder mounted within hoistway.
 - 2. Drive System:
 - a. Variable voltage variable frequency (VVVF) to modulate motor speed.
 - 3. Operation Control Type:
 - a. Selective Collective Automatic Operation Control.
 - 4. Service Control Type:
 - a. Standard service control only.
 - 5. Interior Car Height: 7'-9"
 - 6. Electrical Power: 480 volts; alternating current (AC); three phase; 60 Hz.
 - 7. Rated Net Capacity: 5,000 pounds.
 - 8. Rated Speed: 100 feet per minute.
 - 9. Hoistway Size: As indicated on drawings.
 - 10. Interior Car Platform Size: 6'-0 1/2" inch wide by 9'-1 1/4" inch deep.
 - 11. Elevator Pit Depth: 60 inches
 - 12. Overhead Clearance at Top Floor: as indicated.
 - 13. Travel Distance: 15'-0"
 - 14. Number of Stops: Two
 - 15. Number of Openings: Front.
 - 16. Hydraulic Equipment Location: As indicated on drawings

2.03 COMPONENTS

- A. Elevator Equipment:
 - 1. Motors, Hydraulic Equipment, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70. Refer to Section 26 0583
 - 2. Guide Rails, Cables, Buffers, Attachment Brackets and Anchors: Design criteria for components includes safety factors in accordance with applicable requirements of Elevator Code, ASME A17.1.
- B. Electrical Equipment:
 - 1. Motors: NEMA MG 1.
 - 2. Boxes, Conduit, Wiring, and Devices: As required by NFPA 70.
 - 3. Spare Conductors: Provide ten percent in extra conductors and two pairs of shielded audio cables in traveling cables.
 - 4. Include wiring and connections to elevator devices remote from hoistway.

2.04 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).

- B. Accessibility Requirements: Comply with ADA Standards.
- C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.
- D. Perform welding of steel in accordance with AWS D1.1/D1.1M.
- E. Fabricate and install door and frame assemblies in accordance with NFPA 80 and in compliance with requirements of authorities having jurisdiction.
- F. Perform electrical work in accordance with NFPA 70.

2.05 OPERATION CONTROLS

- A. Elevator Controls: Provide all required controls in compliance with applicable codes.
 - 1. Landing Operating Panels: Metallic type, one for originating "Up" and one for originating "Down" calls, one button only at terminating landings; with illuminating indicators.
 - 2. Landing Indicator Panels: Illuminating.
 - 3. Comply with ADA Standards for elevator controls.
- B. Interconnect elevator control system with building security, fire alarm, card access, smoke alarm, building management control, and other existing building systems.
- C. Door Operation Controls:
 - 1. Program door control to open doors automatically when car arrives at floor landing.
 - 2. Render "Door Close" button inoperative when car is standing at dispatch landing with doors open.
 - 3. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equipped with photo-electric light rays.
- D. Lobby Monitoring Panel: Manufacturer's Standard.
 - 1. Locate status indicator and control panel for each individual elevator and group of elevators as indicated on drawings.
 - 2. Mount panel in console as indicated on drawings.
 - 3. Etch face plate markings in panel, and fill with paint of contrasting color.
 - 4. Include direction indicator displaying landing "Up" and "Down" calls registered at each landing floor.
 - 5. Include position and motion display for direction of travel of each elevator. Display appropriate graphic characters on non-glare screen. Indicate position of cars at rest and in motion.
 - 6. Include "Firefighter's Service Switch" that manually recalls each elevator to main floor.
- E. Provide "Firefighter's Emergency Operation" in accordance with ASME A17.1, applicable building codes, and authorities having jurisdiction (AHJ).
 - 1. Designated Landing: Main Lobby.

2.06 OPERATION CONTROL TYPE

- A. Selective Collective Automatic Operation Control: Applies to car in single elevator shaft.
 - 1. Refer to description provided in ASME A17.1.
 - 2. Automatic operation by means of one button in the car for each landing served and by "UP" and "DOWN" buttons at the landings.
 - 3. Stops are registered by momentary actuation of landing car buttons without consideration of the number of buttons actuated or the sequence buttons are actuated, but the stops are made in the order that landings are reached in each direction of travel.
 - 4. All "UP" landing calls are made when car is traveling in the up direction.
 - 5. All "DOWN" landing calls are made when car is traveling in the down direction.
 - 6. Uppermost and lowermost calls are answered as soon as they are reached without consideration of the car travel direction.

2.07 EMERGENCY POWER

- A. Elevator Emergency Power Supply: Supplied by battery backup; provide elevator system components as required for emergency power characteristics.
- B. Emergency Lighting: Comply with ASME A17.1 elevator lighting requirements.
- C. Provide operational control circuitry for adapting the change from normal to emergency power.

2.08 MATERIALS

- A. Steel Cylinder Casing: ASTM A139/A139M, Grade A steel.
- B. Rolled Steel Sections, Shapes, Rods: ASTM A36/A36M.
- C. Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel), with matte finish.
- D. Stainless Steel Sheet: ASTM A666, Type 304; No. 4 Brushed finish unless otherwise indicated.
- E. Extruded Aluminum: ASTM B221 (ASTM B221M), natural anodized finish unless otherwise indicated.
- F. Plywood: PS 1, Structural I, Grade C-D or better, sanded.
- G. Tempered Glass: 3/8 inch minimum thickness, fully tempered in compliance with ASME A17.1, 16 CFR 1201, ANSI Z97.1, and ASTM C1048 tempered glass requirements.
- H. Plastic Laminate: NEMA LD 3, Type HGS, color as selected by Architect from manufacturer's standard line of colors.

2.09 CAR AND HOISTWAY ENTRANCES

- A. Elevator, :
 - 1. Car and Hoistway Entrances, Main Elevator Lobby:
 - a. Hoistway Fire Rating: 1 Hour.
 - b. Elevator Door Fire Rating: 1 Hour.
 - c. Framed Opening Finish and Material: Brushed stainless steel.
 - d. Car Door Material: Stainless steel, with rigid sandwich panel construction.
 - e. Hoistway Door Material: Powder coat on steel, with rigid sandwich panel construction.
 - f. Door Type: Double leaf.
 - g. Door Operation: Side opening, two speed.
 - 2. Car and Hoistway Entrances: Upper floor
 - a. Hoistway Fire Rating: 1 Hour.
 - b. Elevator Door Fire Rating: 1 Hour.
 - c. Framed Opening Finish and Material: Brushed stainless steel.
 - d. Car Door Material: Stainless steel, with rigid sandwich panel construction.
 - e. Hoistway Door Material: Powder coat on steel, with rigid sandwich panel construction.
 - f. Door Type: Double leaf.
 - g. Door Operation: Side opening, two speed.

2.10 CAR EQUIPMENT AND MATERIALS

- A. Elevator Car:
 - 1. Car Operating Panel: Provide main and auxiliary; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served with "Door Open/Door Close" buttons, "Door Open" button, "Door Close" button, and alarm button.
 - a. Panel Material: Integral with front return; one per car.
 - b. Car Floor Position Indicator: Above door with illuminating position indicators.

- c. Locate alarm button where it is unlikely to be accidentally actuated; not more than 54 inch above car finished floor.
 - d. Provide following within service cabinet as part of car operating panel:
 - 1) Switch for each auxiliary operational control, keyed.
 - 2) Switches for fan, light, inspection control, and ____.
 - 3) Emergency light.
 - 4) Telephone cabinet and hard-wired connection with telephone.
 - 5) Control for each other special feature specified.
 - 6) Convenience outlet receptacle; 110 VAC, 15 amps.
- 2. Ventilation: Single speed fan with grille in ceiling.
- 3. Flooring: Resilient sheet flooring.
- 4. Wall Base: Resilient base, 4 inch high.
- 5. Front Return Panel: Match material of car door.
- 6. Door Wall: Plastic laminate on plywood.
- 7. Side Walls: Plastic laminate on plywood.
- 8. Rear Wall: Plastic laminate on plywood.
- 9. Hand Rail: Stainless steel, at all three sides. Provide open clearance space 1-1/2 inch (38 mm) wide to face of wall.
 - a. Stainless Steel Finish: No. 4 Brushed.
- 10. Ceiling:
 - a. Canopy Ceiling: Plastic laminate on plywood.
 - b. Frame Finish: Color anodized aluminum.
 - c. Lighting: Compact fluorescent downlights.
- 11. Provide emergency access panel for egress from car at ceiling.
- B. Car Accessories:
 - 1. Certificate Frame: Stainless steel frame glazed with tempered glass, and attached with tamper-proof screws.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting this work.
- B. Verify that auxiliary spaces are ready for work of this section.
- C. Verify hoistway shaft and openings are of correct size and within tolerance.
- D. Verify location and size of machine foundation and position of machine foundation bolts.
- E. Verify that electrical power is available and of correct characteristics.

3.02 INSTALLATION

- A. Coordinate this work with installation of hoistway wall construction.
- B. Install system components, and connect equipment to building utilities.
- C. Provide conduit, electrical boxes, wiring, and accessories.
- D. Install hydraulic piping between cylinder and pump unit.
- E. Mount machines, motors, and pumps on vibration and acoustic isolators.
 - 1. Place on structural supports and bearing plates.
 - 2. Securely fasten to building supports.
 - 3. Prevent lateral displacement.
- F. Install hoistway, elevator equipment, and components in accordance with approved shop drawings.

- G. Install guide rails to allow for thermal expansion and contraction movement of guide rails.
- H. Accurately machine and align guide rails, forming smooth joints with machined splice plates.
- I. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.
- J. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime two coats.
- K. Wood Surfaces not Exposed to Public View: Finish with one coat primer; one coat enamel.
- L. Adjust equipment for smooth and quiet operation.

3.03 TOLERANCES

- A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1 and ASME A17.2.
- B. Car Movement on Aligned Guide Rails: Smooth movement, without any objectionable lateral or oscillating movement or vibration.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Testing and inspection by regulatory agencies certified in accordance with ASME QEI 1 will be performed at their discretion.
- C. Perform testing and inspection in accordance with requirements.
 - 1. Inspectors shall be certified in accordance with ASME QEI-1.
 - 2. Perform tests as required by ASME A17.2.
 - 3. Provide at least two weeks written notice of date and time of tests and inspections.
 - 4. Supply instruments and execute specific tests.
- D. Operational Tests:
 - 1. Perform operational tests in the presence of Owner and Architect.
 - 2. At an agreed time, and the building occupied with normal building traffic, conduct tests to verify performance.
 - a. Furnish event recording of each landing call registrations, time initiated, and response time throughout entire working day.

3.05 ADJUSTING

- A. Adjust for smooth acceleration and deceleration of car to minimize passenger discomfort.
- B. Adjust with automatic floor leveling feature at each floor landing to reach 1/4 inch maximum from flush with sill.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 - Demonstration and Training, for additional requirements.
- C. Demonstrate proper operation of equipment to Owner's designated representative.
- D. Demonstration: Demonstrate operation of system to Owner's personnel.
 - 1. Use operation and maintenance data as reference during demonstration.
 - 2. Briefly describe function, operation, cleaning and maintenance of each component.

3.07 PROTECTION

- A. Do not permit construction traffic within car after cleaning.
- B. Protect installed products until Date of Substantial Completion.

- C. Touch-up, repair, or replace damaged products and materials prior to Date of Substantial Completion.

3.08 MAINTENANCE

- A. Refer to Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to initial maintenance service.
- B. Provide Initial Maintenance Contract of elevator system and components in accordance with ASME A17.1 and requirements as indicated for 12 months from Date of Substantial Completion.
- C. Submit proposal for continuation of Maintenance Contract in accordance with ASME A17.1 and requirements as indicated for installed elevator equipment.
- D. Perform maintenance contract services using competent and qualified personnel under the supervision and direct employ of the elevator manufacturer or original installer.
- E. Maintenance contract services shall not be assigned or transferred to any agent or other entity without prior written consent of Owner.
- F. Examine system components periodically.
- G. Include systematic examination, adjustment, and lubrication of elevator equipment.
- H. Provide emergency call back service during regular working hours throughout period of this maintenance contract.
- I. Maintain an adequate stock of parts for replacement or emergency purposes, and have personnel available to ensure the fulfillment of this maintenance contract without unreasonable loss of time.

END OF SECTION

SECTION 21 0930

AUTOMATIC FIRE SUPPRESSION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wet-Pipe Sprinkler Systems for buildings and structures.
 - 2. Piping, accessories, and other components charged with water to suppress fire.

1.2 DEFINITIONS

- A. Pipe sizes used in this Section are nominal pipe size (NPS) specified in inches. Tube sizes are standard tube size specified in inches.
- B. Working plans as used in this Section refer to documents (including drawings and calculations) prepared pursuant to requirements in NFPA 13 for obtaining approval of authority having jurisdiction.
- C. Other definitions for fire protection systems are included in referenced NFPA standards.

1.3 SYSTEM DESCRIPTION

- A. Wet-Pipe Sprinkler System: System with automatic sprinklers attached to piping system containing water and connected to water supply so that water discharges immediately from sprinklers when they are opened by fire.
- B. Sprinkler System Protection Limits: All spaces within areas indicated. Include closets, toilet and locker room areas, each landing of each stair, and special applications areas.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

- A. Design and obtain approval from authority having jurisdiction for fire protection systems specified.
- B. Minimum Pipe Sizes: Not smaller than sizes indicated for connection to water supply piping, standpipes, and branches from standpipes to sprinklers.
- C. Conduct fire hydrant flow tests as required to obtain hydraulic data needed to prepare design for hydraulically calculated systems.
- D. Hydraulically design sprinkler systems according to:
 - 1. Sprinkler System Occupancy Hazard Classifications, as follows.
 - a. Office and Public Areas: Light hazard.
 - b. Storage Areas: Ordinary hazard.
 - c. Equipment Rooms: Ordinary hazard.
 - d. Service Areas: Ordinary hazard.
 - 2. Minimum density and Maximum Sprinkler spacing requirements for Automatic Sprinkler System Hydraulic Design: Per NFPA guidelines and authority having jurisdiction.
- E. Components and Installation: Capable of producing piping systems with the following minimum working pressure ratings except where indicated otherwise.
 - 1. Sprinkler Systems: 125 psig (1200 kPa).
 - 2. Standpipe and Systems: 125 psig (1200 kPa).

1.5 SUBMITTALS

- A. Product data for fire protection system components. Include the following:
 - 1. Backflow preventers.
 - 2. Valves.
 - 3. Specialty valves, accessories, and devices.
 - 4. Alarm devices. Include electrical data.
 - 5. Fire department connections. Include type of fire department connection; number, size, type, and arrangement of inlets; size and direction of outlet; and finish.
 - 6. Hose valves. Include size, type, and finish.
 - 7. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other data.
- B. Sprinkler system drawings identified as "working plans," prepared according to NFPA 13. Submit required number of sets to authority having jurisdiction for review, comment, and approval. Include system hydraulic calculations where applicable.
- C. Test reports and certificates as described in NFPA 13. Include "Contractor's Material & Test Certificate for Aboveground Piping" and "Contractor's Material & Test Certificate for Underground Piping."
- D. Maintenance data for each type of fire protection specialty specified, for inclusion in Operating and Maintenance Manual specified in Division 1 Section "Project Closeout."
- E. 2 copies of NFPA 13A "Recommended Practice for the Inspection, Testing and Maintenance of Sprinkler Systems." Deliver to Owner's maintenance personnel.
- F. 2 copies of NFPA 14A "Recommended Practice for the Inspection, Testing and Maintenance of Standpipe and Hose Systems." Deliver to Owner's maintenance personnel.
- G. 2 copies of NFPA 25 "Standard for Inspection, Testing and Maintenance of Water Based Fire Protection Systems." Deliver to Owner's maintenance personnel.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firms whose equipment, specialties, and accessories are listed by product name and manufacturer in UL Fire Protection Equipment Directory and FM Approval Guide and that conform to other requirements indicated.
- B. Listing/Approval Stamp, Label, or Other Marking: On equipment, specialties, and accessories made to specified standards.
- C. Listing and Labeling: Equipment, specialties, and accessories that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in "National Electrical Code," Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- D. Comply with requirements of authority having jurisdiction for submittals, approvals, materials, hose threads, installation, inspections, and testing.
- E. Comply with requirements of Owner's insurance underwriter for submittals, approvals, materials, installation, inspections, and testing.
- F. Installer's Qualifications: Firms qualified to install and alter fire protection piping, equipment, specialties, and accessories, and repair and service equipment. A qualified firm is one that is experienced (minimum of 5 previous projects similar in size and scope to this Project) in such work, familiar with precautions required, and in compliance with the requirements of the authority having jurisdiction. Submit evidence of qualifications to the Architect upon request. Refer to Division 1 Section "Reference Standards and Definitions" for definition of "Installer."

- G. NFPA Standards: Equipment, specialties, accessories, installation, and testing complying with the following:
1. NFPA 13 "Standard for the Installation of Sprinkler Systems."
 2. NFPA 14 "Standard for the Installation of Standpipe and Hose Systems."
 3. NFPA 26 "Recommended Practice for the Supervision of Valves Controlling Water Supplies for Fire Protection."
 4. NFPA 70 "National Electrical Code."
 5. NFPA 231 "Standard for General Storage."

1.7 MAINTENANCE

- A. Spare sprinklers and sprinkler wrenches. Deliver to the Owner's maintenance personnel.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specialty Valves and Water Motor Alarms and Air-Pressure Maintenance Devices: Subject to compliance with requirements, provide products by one of the following.
1. ASCOA Fire Systems, Figgie International Co.
 2. Central Sprinkler Corp.
 3. Firematic Sprinkler Devices, Inc.
 4. Gem Sprinkler Co. Div., Grinnell Corp.
 5. Globe Fire Sprinkler Corp.
 6. Reliable Automatic Sprinkler Co., Inc.
 7. Star Sprinkler Corp.
 8. Viking Corp.
- B. Alarm Check Valves: Subject to compliance with requirements, provide products by one of the following.
1. Ames Co., Inc.
 2. Cla-Val Co.
 3. Hersey Products, Inc., Grinnell Corp.
 4. Kennedy Valve Div., McWane, Inc.
 5. Viking Corp.
 6. Watts Regulator Co.
- C. Backflow Preventers: Subject to compliance with requirements, provide products by one of the following.
1. Ames Co., Inc.
 2. Cla-Val Co.
 3. Conbraco Industries, Inc.
 4. Febco.
 5. Hersey Products, Inc., Grinnell Corp.
 6. Watts Regulator Co.
 7. Wilkins Regulator Div., Zurn Industries, Inc.
- D. Water flow Indicators and Supervisory Switches: Subject to compliance with requirements, provide products by one of the following.
1. Gamewell Co.
 2. Gem Sprinkler Co. Div., Grinnell Corp.
 3. Potter Electric Signal Co.
 4. Reliable Automatic Sprinkler Co., Inc.
 5. System Sensor Div., Pittway Corp.
 6. Victaulic Company of America.
 7. Watts Regulator Co.

- E. Fire Department Connections: Subject to compliance with requirements, provide products by one of the following.
1. Badger-Powhatan, Figgie International Co.
 2. Croker Div., Fire-End and Croker Corp.
 3. Elkhart Brass Mfg. Co., Inc.
 4. Firematic Sprinkler Devices, Inc.
 5. Gem Sprinkler Co. Div., Grinnell Corp.
 6. Guardian Fire Equipment, Inc.
 7. Potter-Roemer Div., Smith Industries, Inc.
 8. Reliable Automatic Sprinkler Co., Inc.
 9. Sierra Fire Equipment Co.
- F. Sprinklers: Subject to compliance with requirements, provide products by one of the following.
1. ASCOA Fire Systems, Figgie International Co.
 2. Central Sprinkler Corp.
 3. Firematic Sprinkler Devices, Inc.
 4. Gem Sprinkler Co. Div., Grinnell Corp.
 5. Globe Fire Sprinkler Corp.
 6. Reliable Automatic Sprinkler Co., Inc.
 7. Star Sprinkler Corp.
 8. Viking Corp.
- G. Hose Valves: Subject to compliance with requirements, provide products by one of the following.
1. Badger-Powhatan, Figgie International Co.
 2. Croker Div., Fire-End and Croker Corp.
 3. Elkhart Brass Mfg. Co., Inc.
 4. Guardian Fire Equipment, Inc.
 5. Potter-Roemer Div., Smith Industries, Inc.
 6. Sierra Fire Equipment Co.
- H. Indicator Valves: Subject to compliance with requirements, provide products by one of the following.
1. Gem Sprinkler Co. Div., Grinnell Corp.
 2. Grinnell Supply Sales Co., Grinnell Corp.
 3. Kennedy Valve Div., McWane, Inc.
 4. Milwaukee Valve Co., Inc.
 5. Nibco, Inc.
 6. Sprink-Line by Sprink, Inc.
 7. Victaulic Company of America.
- I. Fire Protection Service Gate and Check Valves: Subject to compliance with requirements, provide products by one of the following.
1. Gem Sprinkler Co. Div., Grinnell Corp.
 2. Kennedy Valve Div., McWane, Inc.
 3. Nibco, Inc.
 4. Stockham Valves and Fittings, Inc.
 5. Victaulic Company of America.
- J. Grooved Couplings for Steel Piping: Subject to compliance with requirements, provide products by one of the following.
1. Grinnell Supply Sales Co., Grinnell Corp.
 2. Gustin-Bacon Div., Tyler Pipe Subsid., Tyler Corp.
 3. Sprink-Line by Sprink, Inc.
 4. Stockham Valves and Fittings, Inc.
 5. Victaulic Company of America.
- K. Grooved Couplings for AWWA Ductile-Iron Piping: Subject to compliance with requirements, provide products by one of the following.
1. Gustin-Bacon Div., Tyler Pipe Subsid., Tyler Corp.

2. Victaulic Company of America.

2.2 PIPES AND TUBES

- A. Refer to Part 3 Articles "Sprinkler System Piping Applications" and "Standpipe System Piping Applications" for identification of systems where pipe and fitting materials specified below are used.
- B. Ductile-Iron Pipe: AWWA C115, ductile-iron barrel with iron-alloy threaded flanges, 250_psig minimum working pressure rating, and AWWA C104 cement-mortar lining.
1 Option: Pipe may be AWWA pattern, cut-grooved for grooved-coupling joints.
- C. Steel Pipe: ASTM A53, Schedule 40 in sizes 6 inches and smaller and Schedule 30 in sizes 8 inches and larger, black and galvanized, plain and threaded ends, for welded, threaded, cut-groove, and rolled-groove joints. Schedule 10 threaded pipe is PROHIBITED.

2.3 PIPE AND TUBE FITTINGS

- A. Cast-Iron Threaded Flanges: ASME B16.1, Class 150, raised ground face, bolt holes spot faced.
- B. Ductile-Iron and Gray-Iron Flanged Fittings: AWWA C110, 250_psig minimum pressure rating, with AWWA C104 cement-mortar lining.
- C. Cast-Iron Threaded Fittings: ASME B16.4, Class 150, standard pattern, with threads according to ASME B1.20.1.
- D. Grooved-End Fittings for Ductile-Iron Pipe: ASTM A536 ductile-iron or ASTM A47 malleable-iron, AWWA pipe-size, designed to accept AWWA C606 grooved couplings. Include cement lining or Food and Drug Administration (FDA)-approved interior coating.
- E. Steel Fittings: ASTM A234/A234M, seamless or welded; ASME B16.9, butt-welding; or ASME B16.11, socket-welding type for welded joints.
- F. Steel Flanges and Flanged Fittings: ASME B16.5.
- G. Grooved-End Fittings for Steel Pipe: UL listed and FM approved, ASTM A536, Grade 65-45-12 ductile iron or ASTM A47 Grade 32510 malleable iron, with grooves or shoulders designed to accept grooved couplings.

2.4 JOINING MATERIALS

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for joining materials not included in this Section.
- B. Flanged Joints for Ductile-Iron Pipe and Ductile-Iron or Cast-Iron Fittings: AWWA C115 ductile-iron or gray-iron pipe flanges, rubber gaskets, and high-strength steel bolts and nuts.
- D. Couplings for Grooved-End Steel Pipe and Grooved-End Ferrous Fittings: UL 213, AWWA C606, ASTM A536 ductile-iron or ASTM A47 malleable-iron housing, with enamel finish. Include synthetic-rubber gasket with central-cavity, pressure-responsive design; ASTM A183 carbon-steel bolts and nuts; and locking pin, toggle, or lugs to secure grooved pipe and fittings.
- E. Couplings for Grooved-End Ductile-Iron Pipe and Fittings: UL 213, AWWA C606, ASTM A536 ductile-iron housing, with enamel finish. Include synthetic-rubber gasket with central-cavity, pressure-responsive design, and ASTM A183 carbon-steel bolts and nuts to secure grooved pipe and fittings.

2.5 GENERAL-DUTY VALVES

- A. Refer to Division 23 Section "Valves" for general-duty gate, ball, butterfly, globe, and check valves.

2.6 FIRE PROTECTION SERVICE VALVES

- A. General: UL-listed and FM-approved, with 175 psig non-shock minimum working pressure rating.
 - 1. Option: Valves for use with grooved piping may be grooved type.
- B. Gate Valves, 2 Inches and Smaller: UL 262, cast-bronze, threaded ends, solid wedge, outside screw and yoke, rising stem.
- C. Indicating Valves, 2-1/2 Inches and Smaller: Butterfly or ball type, bronze body with threaded ends, and integral indicating device.
 - 1. Indicator: Visual.
- D. Gate Valves, 2-1/2 Inches and Larger: UL 262, iron body, bronze mounted, taper wedge, outside screw and yoke, rising stem. Include replaceable, bronze, wedge facing rings and flanged ends.
- E. Swing Check Valves, 2-1/2 Inches and Larger: UL 312, cast-iron body and bolted cap, with bronze disc or cast-iron disc with bronze disc ring and flanged ends.
- F. Butterfly Check Valves, 4 Inches and Larger: UL 312, split-clapper style, cast-iron body with rubber seal, bronze alloy discs, stainless-steel spring and hinge pin.

2.7 SPECIALTY VALVES

- A. Alarm Check Valves: UL 193, 175 psig working pressure, designed for horizontal or vertical installation, with cast-iron flanged inlet and outlet, bronze grooved seat with O-ring seals, and single-hinge pin and latch design. Include trim sets for bypass, drain, electric sprinkler alarm switch, pressure gages, precision retarding chamber, and fill line attachment with strainer.
 - 1. Option: Grooved-end connections for use with grooved-end piping.
- B. Ball Drip Valves: UL 1726, automatic drain valve, 3/4 inch size, spring-loaded, ball check device with threaded ends.

2.8 BACKFLOW PREVENTERS

- A. General: ASSE standard backflow preventers, of size indicated for maximum flow rate indicated and maximum pressure loss indicated.
 - 1. Working Pressure: 150 psig minimum except where indicated otherwise.
 - 2. Bronze, cast-iron, steel, or stainless-steel body with flanged ends.
 - 3. Interior Lining: FDA-approved epoxy coating, for backflow preventers having cast-iron or steel body.
 - 4. Interior Components: Corrosion-resistant materials.
 - 5. Strainer on inlet, where strainer is indicated.
- B. Double-Check Detector Assembly Backflow Preventers: UL 312 and ASSE 1048, consisting of OS&Y gate valves on inlet and outlet and strainer on inlet. Include 2 positive-seating check valves and test cocks, and bypass with displacement-type water meter, valves, and double-check backflow preventer, for continuous pressure application.
 - 1. Pressure Loss: 5 psig maximum, through middle third of flow range.

2.9 SPRINKLERS

- A. Automatic Sprinklers: With heat-responsive element conforming to:
 - 1. UL 199, for applications except residential.

- 2 UL 1626, for residential applications.
- 3 UL 1767, for early-suppression, fast-response applications.

- B. Sprinkler types and categories are as indicated and as required by application. Furnish automatic sprinklers with nominal ½ inch orifice for "Ordinary" temperature classification rating except where otherwise indicated and required by application.
- C. Sprinkler types, features, and options include:
 - 1. Coated, painted, or plated sprinklers.
 - 2. Concealed ceiling sprinklers, including cover plate.
 - 3. Extended coverage sprinklers.
 - 4. Flow-control sprinklers.
 - 5. Flush ceiling sprinklers, including escutcheon.
 - 6. Pendent sprinklers.
 - 7. Pendent, dry-type sprinklers.
 - 8. Quick-response sprinklers.
 - 9. Recessed sprinklers, including escutcheon.
 - 10. Sidewall sprinklers.
 - 11. Sidewall, dry-type sprinklers.
 - 12. Upright sprinklers.
- D. Sprinkler Finishes: Chrome-plated, bronze, and painted.
- E. Special Coatings: Wax, lead, and corrosion-resistant paint.
- F. Sprinkler Escutcheons: Materials, types, and finishes for following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 - 1. Ceiling Mounting: Plastic, white finish, 1piece, flat.
 - 2. Sidewall Mounting: Plastic, white finish, 1piece, flat.
- G. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.
- H. Sprinkler Cabinets: Finished steel cabinet and hinged cover, with space for minimum of 6 spare sprinklers plus sprinkler wrench, suitable for wall mounting. Include number of sprinklers required by NFPA 13 and 1 wrench for sprinklers. Include separate cabinet with sprinklers and wrench for each style sprinkler on Project.

2.10 SPECIALTY SPRINKLER FITTINGS

- A. Specialty Fittings: UL-listed and FM-approved, made of steel, ductile iron, or other materials compatible with system materials and applications where used.
- C. Locking-Lug Fittings: UL 213, ductile-iron body with locking-lug ends, for use with plain-end steel pipe.
- E. Mechanical-Cross Fittings: UL 213, ductile-iron housing with pressure-responsive gaskets, bolts, and threaded or locking-lug outlets.
- F. Drop-Nipple Fittings: UL 1474, with threaded inlet, threaded outlet, and seals; adjustable.
- G. Sprinkler Alarm Test Fittings: Ductile-iron housing with 1-1/2 inch inlet and outlet, integral test valves, combination orifice and sight glass, and threaded or locking-lug ends.

2.11 ALARM DEVICES

- A. Alarm Devices: Types and sizes that will match piping and equipment connections.
- B. Water flow Indicators: UL 346, electrical-supervision type, vane-type water flow detector, rated to 250 psig, and designed for horizontal or vertical installation. Include 2 SPDT (single-pole, double-throw)

circuit switches to provide isolated alarm and auxiliary contacts, 7 ampere, 125 volts a.c. (7 A, 125 V a.c.) and 0.25 ampere, 24 volts d.c. (0.25 A, 24 V d.c.); complete with factory-set, field-adjustable retard element to prevent false signals and tamper-proof cover that sends a signal when cover is removed.

- C. Pressure Switches: UL 753, water flow switch with retard, electrical-supervision type, SPDT (single-pole, double-throw), normally closed contacts, designed to operate on rising pressure and signal water flow.
- D. Supervisory Switches: UL 753, for valves, electrical-supervision type, SPDT (single-pole, double-throw), normally closed contacts, designed to signal controlled valve in other than full open position.
- E. Supervisory Switches: UL 753, for indicator posts, electrical-supervision type, SPDT (single-pole, double throw), normally closed contacts, designed to signal controlled valve in other than full open position.

2.12 PRESSURE GAGES

- A. Pressure Gages: UL 393, 3-1/2 to 4-1/2 inch diameter dial with dial range of 0-250 psig.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for hose valves, hose racks, and cabinets to verify actual locations of piping connections prior to installing cabinets.
- B. Examine walls and partitions for suitable thickness, fire- and smoke-rated construction, framing for cabinets, and other conditions where cabinets are to be installed.
- C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 SPRINKLER SYSTEM PIPING APPLICATIONS

- A. Refer to Part 2 of this Section for detailed specifications on pipe and fittings products listed below. Use pipe, tube, fittings, and joining methods according to the following applications. Piping may be joined with flanges instead of indicated joints. Use grooved-end fittings with grooved couplings made by the same manufacturer and comply with listing when used together for grooved-coupling joints.
- B. Pipe Between Fire Department Connections and Check Valves: Use galvanized-steel pipe instead of black-steel pipe when steel pipe is specified for applications below. Do not use welded joints.
- C. Sizes 2 Inches and Smaller: ASTM A53, A135, or A795; Schedule 40 steel pipe with threaded ends, cast-iron or malleable-iron threaded fittings, and threaded joints.
- F. Sizes 2 Inches and Smaller: ASTM A53, A135, or A795; Schedule 40 steel pipe with cut-groove ends, grooved-end steel pipe fittings, and grooved-coupling joints.
- G. Sizes 2 Inches and Smaller: ASTM A53, A135, or A795; Schedule 40 steel pipe with rolled-groove ends, grooved-end steel pipe fittings, and grooved-coupling joints.
- J. Sizes 2-1/2 Inches and larger: ASTM A53, A135, or A795; Schedule 40 steel pipe with threaded ends, cast-iron or malleable-iron threaded fittings, and threaded joints.
- K. Sizes 2-1/2 Inches and larger: ASTM A53, A135, or A795; Schedule 40 steel pipe, welding type steel fittings, and welded joints.
- L. Sizes 2-1/2 Inches and larger: ASTM A53, A135, or A795; Schedule 40 steel pipe with cut-groove ends, grooved-end steel pipe fittings, and grooved-coupling joints.

- M. Sizes 2-1/2 Inches and larger: ASTM A53, A135, or A795; Schedule 40 steel pipe with rolled-groove ends, grooved-end steel pipe fittings, and grooved-coupling joints.

3.3 VALVE APPLICATIONS

- A. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use gate, ball, or butterfly valves.
 - 2. Throttling Duty: Use globe, ball, or butterfly valves.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Grooved-End Pipe and Grooved-End Fitting Joints: Use grooved-end fittings and grooved couplings that are made by the same manufacturer and that are listed for use together. Groove pipe and assemble joints with grooved coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
 - 1. Groove Type: Cut.
 - 2. Groove Type: Rolled.
- C. Dissimilar Materials Piping Joints: Make joints using adapters compatible with both piping materials.
- D. Handling of Solvent Cements, Primers, and Cleaners: Comply with procedures in ASTM F402 for safe handling when joining plastic pipe and fittings with solvent cements.

3.5 SERVICE ENTRANCE PIPING

- A. Connect fire protection piping to water service piping of size and in location indicated for service entrance to building.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to fire service piping, in the location acceptable to authority having jurisdiction.

3.6 PIPING INSTALLATIONS

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- B. Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved "working plans" for sprinkler piping require written approval from authority having jurisdiction. File written approval with the Architect prior to deviating from approved "working plans."
- C. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes 2 inches and smaller. Unions are not required on flanged devices or in piping installations using grooved couplings.
- E. Install flanges or flange adapters on valves, apparatus, and equipment having 2-1/2 inch and larger connections.
- F. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve, sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.

- H. Install sprinkler zone control valves, test assemblies, and drain headers adjacent to standpipes when sprinkler piping is connected to standpipe.
- I. Install ball drip valves to drain piping between fire department connections and check valves, and where required. Drain to floor drain or to outside of building.
- K. Install alarm devices in piping systems.
- L. Hangers and Supports: Comply with NFPA 13. Install according to NFPA 13 and NFPA 14.
 - 1 Install hanger and support spacing and locations for steel piping joined with grooved mechanical couplings according to manufacturer's written instructions for rigid systems.
- M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than 1/4 inch and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

3.7 SPECIALTY SPRINKLER FITTING INSTALLATIONS

- A. Install specialty sprinkler fittings according to manufacturer's written instructions.

3.8 VALVE INSTALLATIONS

- A. Refer to Division 23 Section "Valves" for installation of general-duty valves. Install fire-protection specialty valves, trim, fittings, controls, and specialties according to NFPA 13 and NFPA 14, manufacturer's written instructions, and the authority having jurisdiction.
- B. Gate Valves: Install fire-protection service valves supervised-open, located to control sources of water supply except from fire department connections. Where there is more than one control valve, provide permanently marked identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water supply connection. Install backflow preventers instead of check valves in potable water supply sources.
- D. Alarm Check Valves: Install valves in vertical position for proper direction of flow, including bypass check valve and retard chamber drain line connection.

3.9 BACKFLOW PREVENTER INSTALLATION

- A. Install backflow preventers of type, size, and capacity required by Code and authority having jurisdiction. Install air-gap fitting on units with atmospheric vent connection and pipe relief outlet drain to nearest floor drain. Do not install bypass around backflow preventer.

3.10 SPRINKLER APPLICATIONS

- A. Rooms without Ceilings: Upright sprinklers or pendent.
- B. Rooms with Suspended Ceilings: Pendent, recessed, flush, and concealed sprinklers, as indicated.
- C. Wall Mounting: Sidewall sprinklers.
- D. Spaces Subject to Freezing: Upright, pendent dry-type, and sidewall dry-type sprinklers.
- E. Special Applications: Use extended-coverage, flow-control, and quick-response sprinklers where required.
- F. Sprinkler Finishes: Use sprinklers with following finishes:

1. Upright, Pendent, and Sidewall Sprinklers: Chrome-plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax-coated where exposed to acids, chemicals, or other corrosive fumes.
2. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
3. Flush Sprinklers: Bright chrome, with painted white escutcheon.
4. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.

3.11 SPRINKLER INSTALLATIONS

- A. Install sprinklers in suspended ceilings in center of acoustical panels and tiles.
- B. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical panels.
- C. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers supplied from heated space.

3.12 CONNECTIONS

- A. Connect to specialty valves, hose valves, specialties, fire department connections, and accessories.
- B. Connect water supplies to standpipe and sprinkler systems. Include backflow preventers.
- C. Electrical Connections: Power wiring is specified in Division 26.
- D. Connect alarm devices to fire alarm system.

3.13 FIELD QUALITY CONTROL

- A. Perform field acceptance tests of each fire protection system.
 1. Flush, test, and inspect sprinkler piping systems according to NFPA 13 Chapter "System Acceptance."
 2. Flush, test, and inspect standpipe systems according to NFPA 14 Chapter "Tests and Inspection."
- B. Replace piping system components that do not pass test procedures specified, then retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
 1. Report test results promptly and in writing to Architect.
 2. Report test results promptly and in writing to authority having jurisdiction when required.

3.14 CLEANING

- A. Clean dirt and debris from sprinklers. Replace sprinklers having paint other than factory finish with new sprinklers. Cleaning and reuse of painted sprinklers is prohibited.

3.15 COMMISSIONING

- A. Starting Procedures: Follow manufacturer's written procedures. If no procedures are prescribed by manufacturer, proceed as follows:
 1. Verify that specialty valves, trim, fittings, controls, and accessories have been installed correctly and operate correctly.
 2. Verify that excess pressure pumps and accessories have been installed correctly and operate correctly.
 3. Verify that specified tests of piping are complete.
 4. Check that damaged sprinklers and sprinklers with paint or coating not specified have been replaced with new, correct type of sprinklers.
 5. Check that sprinklers are correct type, have correct finish and temperature ratings, and have guards where required for applications.
 6. Check that potable water supplies have correct type of backflow preventer.

7. Check that hose valves and fire department connections have threads compatible with local fire department equipment and have correct pressure rating.
8. Fill wet-pipe sprinkler systems with water.
9. Check for correct type and size hose valves.
10. Check for correct type and size hose valves, racks, hoses, and nozzles.
11. Energize circuits to electrical equipment and devices.
12. Start and run excess pressure pumps.
13. Adjust operating controls and pressure settings.

B. Coordinate with fire alarm system tests. Operate systems as required.

3.16 DEMONSTRATION

A. Demonstrate equipment, specialties, and accessories to designated Owner's representative. Review operating and maintenance information.

B. Schedule demonstration with at least 7 days' advance notice.

END OF SECTION

SECTION 22 0140
DOMESTIC WATER PIPING

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 domestic water piping inside the building.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing domestic water piping systems with 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Water Samples: Specified in Part 3 "Cleaning" Article.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.2 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
 - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- B. Hard Copper Tube: ASTM B 88, Types L and M, water tube, drawn temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
 - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 - 4. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
 - a. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

PART 3 - EXECUTION

3.1 PIPE AND FITTING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- C. Domestic Water Piping on Service Side of Water Meter inside the Building: Use[**any of**] the following piping materials for each size range:
 - 1. NPS 4 to NPS 6: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
 - 2. NPS 4 to NPS 6: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
- D. Under-Building-Slab, Domestic Water Piping on House Side of Water Meter, NPS 4 and Smaller: Soft copper tube, Type K ; copper pressure fittings; and soldered joints.
- E. Aboveground Domestic Water Piping: Use the following piping materials for each size range:
 - 1. NPS 1 and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
 - 2. NPS 1-1/4 and NPS 1-1/2: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
 - 3. NPS 2: Hard copper tube, Type L; copper pressure fittings; and soldered joints.

4. NPS 2-1/2 to NPS 3-1/2: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
5. NPS 4 to NPS 6: Hard copper tube, Type L; copper pressure fittings; and soldered joints.

3.2 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 and larger.
 2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
 3. Hot-Water-Piping, Balancing Duty: Memory-stop balancing valves.
 4. Drain Duty: Hose-end drain valves.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.
- C. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Use calibrated balancing valves.

3.3 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."
- B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 23 Section "Basic Mechanical Materials and Methods."
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance.
- E. Install domestic water piping level without pitch and plumb.

3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

- C. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2104. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet: MSS Type 49, spring cushion rolls, if indicated.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to water-service piping with shutoff valve, and extend and connect to the following:
 - 1. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."

3.7 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.

7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.9 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION

SECTION 22 0145

HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes hangers and supports for mechanical systems piping and equipment.
- B. Related Sections; The following Sections contain requirements that relate to this Section:
 - 1. Division 5 Section "Metal Fabrications" for materials for attaching hangers and supports to building structure.
 - 2. Division 22 Section "Vibration Control" for vibration-isolation hangers and supports.

1.3 DEFINITIONS

- A. Terminology used in this Section is defined in MSS SP-90.

1.4 PERFORMANCE REQUIREMENTS

- A. Design hangers and supports, for piping and equipment.
- B. Design and obtain approval from authority with jurisdiction over hangers and supports for piping and equipment.

1.5 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each type of hanger and support.
- C. Submit pipe hanger and support schedule showing manufacturer's Figure No., size, location, and features for each required pipe hanger and support.
- D. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.
- E. Shop drawings for each type of hanger and support, indicating dimensions, weights, required clearances, and methods of component assembly.
- F. Licensed Engineer's hanger and support drawings specified in the "Quality Assurance" Article.
- G. Licensed Engineer's hanger and support installation report specified in the "Field Quality Control" Article.

1.6 QUALITY ASSURANCE

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

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.
- B. Qualify welding processes and welding operators according to ASME "Boiler and Pressure Vessel Code, "Section IX, "Welding and Brazing Qualifications."
- C. NFPA Compliance: Comply with NFPA 13 for hangers and supports used as components of fire protection systems.
- D. Listing and Labeling: Provide hangers and supports that are listed and labeled as defined in NFPA 70, Article 100.
 1. UL and FM Compliance: Hangers, supports, and components include listing and labeling by UL and FM where used for fire protection piping systems.
 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- E. Licensed Operators: Use operators that are licensed by powder-operated tool manufacturers to operate their tools and fasteners.
- F. Licensed Engineer: Prepare hanger and support design drawings, and calculations for piping and equipment. Include seal and signature of Registered Engineer, licensed in jurisdiction where Project is located, certifying compliance with specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Hangers, Supports, and Components: Factory-fabricated according to MSS SP-58.
 1. Components include galvanized coatings where installed for piping and equipment that will not have a field-applied finish.
 2. Pipe attachments include nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing. Tape is not acceptable.
- B. Thermal-Hanger Shield Inserts: 100-psi (690kPa) average compressive strength, waterproofed calcium silicate, encased with sheet metal shield. Insert and shield cover entire circumference of pipe and are of length indicated by manufacturer for pipe size and thickness of insulation.
- C. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Fasteners for fire protection systems include UL listing and FM approval.
- D. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Fasteners for fire protection systems include UL listing and FM approval.

2.2 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.
- B. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex-head, track bolts and nuts.
- C. Washers: ASTM F 844, steel, plain, flat washers.
- D. Grout: ASTM C 1107, Grade B, nonshrink. nonmetallic.

1. Characteristics include post-hardening, volume-adjusting, dry, hydraulic-cement-type grout that is nonstaining, noncorrosive, nongaseous and is recommended for both interior and exterior applications.
2. Design Mix; 5000-psi (34.5MPa), 28-day compressive strength.
3. Water: Potable.
4. Packaging: Premixed and factory-packaged.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger requirements are specified in the Section specifying the equipment and systems.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping specification Sections.

3.2 HANGER AND SUPPORT INSTALLATION

- A. General: Comply with MSS SP-69 and SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Arrange for grouping of parallel runs of horizontal piping supported together on field fabricated, heavy-duty trapeze hangers where possible.
- C. Install supports with maximum spacings complying with MSS SP-69 and as specified in individual piping sections.
- D. Where pipes of various sizes are supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
- E. Install building attachments within concrete or to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed: fasten insert to forms. Install reinforcing bars through openings at top of inserts.
- F. Install concrete inserts in new construction prior to placing concrete.
- G. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Do not use in lightweight concrete slabs or in concrete slabs less than 4 inches (100 mm) thick.
- H. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install according to fastener manufacturer's written instructions. Do not use in lightweight concrete slabs or in concrete slabs less than 4 inches (100 mm) thick.
- I. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- J. Heavy-Duty Steel Trapezes: Field-fabricate from ASTM A 36 steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.
- K. Support fire protection systems piping independent of other piping.

- L. Install hangers and supports to allow controlled movement of piping systems, permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- M. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so that maximum pipe deflections allowed by ASME B31.9 "Building Services Piping" is not exceeded.
- O. Insulated Piping: Comply with the following installation requirements.
 - 1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.
 - 2. Saddles: Install protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.
 - 3. Shields: install MSS Type 40, protective shields on cold piping with vapor barrier. Shields span an arc of 180 degrees (3.1 rad) and have dimensions in inches (mm) not less than the following:

NFS (inches)	LENGTH (inches)	THICKNESS (inches)
1/4 to 3-1/2	12	0.048
4	12	0.060
5 and 6	16	0.060
8 to 14	24	0.075
 - 4. Pipes 8 Inches (200 mm) and Larger: Include wood inserts.
 - 5. Insert Material: Length at least as long as the protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation of same thickness as piping.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural steel stands to suspend equipment from structure above or support equipment above floor.
- B. Grouting: Place grout under supports for equipment, and make a smooth bearing surface.

3.4 METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for pipe and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for manual shielded metal-arc welding, appearance and quality of welds, methods used in correcting welding work, and 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. Finish welds at exposed connections so that no roughness shows after finishing, and so that contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

- A. Touching Up: Clean field welds and abraded areas of shop paint and paint exposed areas immediately after erection of 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 by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal is specified in Division 9 Section "Painting."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.7 FIELD QUALITY CONTROL

- A. Licensed Engineer's Report: Prepare Hanger and Support installation report. Include seal and signature of Registered Engineer, licensed in jurisdiction where Project is located, certifying compliance with specifications.

END OF SECTION

SECTION 22 0150
SANITARY WASTE AND VENT PIPING

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 for soil, waste, and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.

1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Shop Drawings:

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.2 PVC PIPE AND FITTINGS (Where allowed by authority having jurisdiction)

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
 - 1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 31 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:
 - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- B. Aboveground, soil and waste piping NPS 5 and larger shall be the following:
 - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- C. Aboveground, vent piping NPS 4 and smaller shall be the following:
 - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- D. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:
 - 1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.3 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."
- B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- C. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- D. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.

Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

- E. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- F. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- G. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- H. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."
- B. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 HANGER AND SUPPORT INSTALLATION

- A. For pipe hangers and support Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Install individual, straight, horizontal piping runs according to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- D. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.

- E. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 - 2. NPS 3: 48 inches with 1/2-inch rod.
 - 3. NPS 4 and 5: 48 inches with 5/8-inch rod.
- F. Install supports for vertical PVC piping every 48 inches.
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection.

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PROTECTION

- A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION

SECTION 22 0410

PLUMBING FIXTURES

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 this Section.
- B. Requirements of the following Division 22 Sections apply to this Section:
 - 1. Basic Mechanical Requirements.
 - 2. Electrical Requirements for Mechanical Equipment.
 - 3. Basic Mechanical Materials and Methods.

1.2 SUMMARY

- A. This Section includes plumbing fixtures, trim, fittings and accessories, appliances, appurtenances, equipment and supports associated with plumbing fixtures.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 7 Section "Joint Sealants" for sealing between fixtures and walls, floors, and counters.
 - 2. Division 22 Section "Valves" for valves used as supply stops.
 - 3. Division 22 Section "Plumbing Specialties" for backflow preventers and other specialties not specified in this section.
- C. Products installed but not furnished under this Section include:
 - 1. Owner-supplied fixtures and fittings, as indicated.
 - 2. Accessories, appliances, appurtenances, and equipment specified in other sections, requiring plumbing services or fixture-related devices, as indicated.

1.3 DEFINITIONS

- A. Accessible: Describes a plumbing fixture, building, facility, or portion thereof that can be approached, entered, and used by physically handicapped people.
- B. Accessory: Device that adds effectiveness, convenience, or improved appearance to a fixture but is not essential to its operation.
- C. Appliance: Device or machine designed and intended to perform a specific function.
- D. Appurtenance: Device or assembly designed to perform some useful function when attached to or used with a fixture.
- E. Equipment: Device used with plumbing fixtures or plumbing systems to perform a certain function for plumbing fixtures but that is not part of the fixture.
- F. Fitting: Fitting installed on or attached to a fixture to control the flow of water into or out of the fixture.
- G. Fixture: Installed receptor connected to the water distribution system, that receives and makes available potable water and discharges the used liquid or liquid-borne wastes directly or indirectly into the drainage system. The term "Fixture" means the actual receptor, except when used in a general ap-

plication where terms "Fixture" and "Plumbing Fixture" include associated trim, fittings, accessories, appliances, appurtenances, support, and equipment.

- H. Roughing-In: Installation of piping and support for the fixture prior to the actual installation of the fixture.
- I. Support: Device normally concealed in building construction, for supporting and securing plumbing fixtures to walls and structural members. Supports for urinals, lavatories, and sinks are made in types suitable for fixture construction and the mounting required. Categories of supports are:
 - 1. Carrier: Floor-mounted support for wall-mounted water closet, and support fixed to wall construction for wall-hung fixture.
 - 2. Chair Carrier: Support for wall-hung fixture, having steel pipe uprights that transfer weight to the floor.
 - 3. Chair Carrier, Heavy Duty: Support for wall-hung fixture, having rectangular steel uprights that transfer weight to the floor.
 - 4. Reinforcement: Wood blocking or steel plate built into wall construction, for securing fixture to wall.
- J. Trim: Hardware and miscellaneous parts, specific to a fixture and normally supplied with it required to complete fixture assembly and installation.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of plumbing fixture specified, including fixture and trim, fittings, accessories, appliances, appurtenances, equipment, supports, construction details, dimensions of components, and finishes.
- C. Wiring diagrams for field-installed wiring of electrically operated units.
- D. Maintenance data for plumbing fixtures and components to include in the operation and maintenance manuals specified in Division 1 -

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category from one source and by a single manufacturer.
 - 1. Exception: Where fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for this category.
- B. Regulatory Requirements: Comply with requirements of CABOA117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; regarding plumbing fixtures for physically handicapped people.
- C. Regulatory Requirements: Comply with requirements of Architectural and Transportation Barriers Compliance Board's (ATBCB) "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" regarding plumbing fixtures for physically handicapped people.
- D. Energy Policy Act Requirements: Comply with requirements of Public Law 102-486, "Energy Policy Act," regarding water flow rate and water consumption of plumbing fixtures.
- E. Listing and Labeling: Provide electrically operated fixtures and components specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
 2. Listing and Labeling Agency Qualifications' A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Design Concept: The drawings indicate types of plumbing fixtures and are based on the specific descriptions, manufacturers, models, and numbers indicated. Plumbing fixtures having equal performance characteristics by other manufacturers may be considered provided that deviations in dimensions, operation, color or finish, or other characteristics are minor and do not change the design concept or intended performance as judged by the Engineer. Burden of proof for equality of plumbing fixtures is on the proposer, final decision is by the Engineer.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver plumbing fixtures in manufacturer's protective packing, crating, and covering.
- B. Store plumbing fixtures on elevated platforms in a dry location.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer uniformly shall be as specified in Section 15010: Basic Mechanical Requirements.
- B. Subject to compliance with specified requirements, provide plumbing fixtures and trim of one of the following for each type of fixture or trim:
1. Plumbing Fixtures:
 - a. American Standard
 - b. Crane
 - c. Eljer
 - d. Kohler
 2. Stainless Steel Sinks:
 - a. American Standard
 - b. Elkay Mfg. Co.
 - c. Just Mfg. Co.
 3. Shower Receptors, Molded Tubs and Shower Units, Mop Basins:
 - a. Bradley Corp.
 - b. Eljer
 - c. Florestone Products Co., Inc.
 - d. Kohler
 - e. Stem-Williams Co., Inc.
 4. Faucets and Plumbing Trim:
 - a. American Standard
 - b. Delta Faucet Co.
 - c. Eljer
 - d. Elkay Mfg. Co.
 - e. Kohler
 - f. Moen
 - g. Sloan Valve Co.
 - h. Speakman Co.
 - i. Symmons Engineering Co.
 - j. T & S Brass and Bronze Works. Inc,
 - k. Zurn.Industries, Inc.

5. Flush Valves:
 - a. Delany Co.
 - b. Sloan Valve Co.
 - c. Zurn Industries, Inc.
6. Water Closet Seats:
 - a. Bemis Mfg. Co.
 - b. Beneke Corp.
 - c. Church Products
 - d. Olsonite Corp.
7. Water Coolers:
 - a. Elkay Mfg. Co.
8. Fixture Supports:
 - a. Kohler
 - b. Wade
 - c. Zurn Industries, Inc.

2.2 PLUMBING FIXTURES. GENERAL

- A. Provide plumbing fixtures and trim, fittings, other components, and supports as scheduled in the drawings.

2.3 FAUCETS

- A. Faucets General Unless otherwise specified, provide faucets that are cast brass with polished chrome-plated finish.

2.4 FITTINGS, EXCEPT FAUCETS

- A. Fittings General: Unless otherwise specified, provide fittings fabricated of brass, with a polished chrome plated finish.
- B. Fittings installed concealed inside plumbing fixture or within wall construction may be without chrome plate finish.
- C. Escutcheons: Polished chrome-plated, sheet steel wall flange with friction clips or set-screw.
- D. Deep Pattern Escutcheons: Wall flange with set screw or sheet steel wall flange with friction clips, of depth adequate to conceal protruding roughing-in fittings.

2.5 FLUSHOMETERS

- A. Provide flushometers compatible with fixtures, with features and of consumption indicated.
- B. Construction: Cast-brass body, brass or copper pipe or tubing inlet with wall flange and tailpiece with spud, screwdriver check stop, vacuum breaker, and brass lever handle actuation except where other variations are specified. Type shall be diaphragm operation except where other type is specified.
- C. Finish: Exposed metal parts shall be polished chrome-plated, except components installed in a concealed location may be rough brass or unfinished.

2.6 TOILET SEATS

- A. General: Provide toilet seats compatible with water closets, and of type, color, and features indicated.

2.7 SHOWER RECEPTORS

- A. Shower Receptors: Provide shower receptors of shape, dimensions, color, and other characteristics specified.

2.8 PLUMBING FIXTURE SUPPORTS

- A. Supports: ASME All 2.6.1 M. categories and types as required for wall-hanging fixtures specified, and wall reinforcement.
- B. Support categories are:
 - 1. Carriers: Supports for wall-hanging water closets and fixtures supported from wall construction. Water closet carriers shall have an additional faceplate and coupling when used for wide pipe spaces. Provide tiling frame or setting gage with carriers for wall-hanging water closets.
 - 2. Chair Carriers: Supports with steel pipe uprights for wall-hanging fixtures. Urinal chair carriers shall have bearing plates.
 - 3. Chair Carriers, Heavy Duty: Supports with rectangular steel uprights for wall-hanging fixtures.
 - 4. Reinforcement: 2-inch by 4-inch wood blocking between studs or 1/4-inch by 6-inch steel plates attached to studs, in wall construction, to secure floor-mounted and special fixtures to wall.
- C. Support Types: Provide support of category specified, of type having features required to match fixture.
- D. Provide supports specified as part of fixture description, in lieu of category and type requirements above.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for potable cold water and hot water supplies and soil, waste, and vent piping systems to verify actual locations of piping connections prior to installing fixtures.
- B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 APPLICATION

- A. Install plumbing fixtures and specified components, in accordance with designations and locations indicated on Drawings.
- B. Install supports for plumbing fixtures in accordance with categories indicated, and of type required.

3.3 INSTALLATION OF PLUMBING FIXTURES

- A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturers' written installation instructions, roughing-in drawings, and referenced standards.
- B. Install floor-mounted, floor-outlet water closets with closet flanges and gasket seals.

- C. Install floor-mounted, back-outlet water closets with fittings and gasket seals.
- D. Install wall-hanging, back-outlet water closets with support manufacturer's tiling frame or setting gage.
- E. Install wall-hanging, back-outlet urinals with gasket seals.
- F. Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate when supports are specified, and to building wall construction where no support is indicated.
- G. Fasten floor-mounted fixtures and special fixtures having holes for securing fixture to wall construction, to reinforcement built into walls.
- H. Fasten wall-mounted fittings to reinforcement built into walls.
- I. Fasten counter-mounting-type plumbing fixtures to casework.
- J. Secure supplies behind wall or within wall pipe space, providing rigid installation.
- K. Set shower receptors and mop basins in leveling bed of cement grout.
- L. Install stop valve in an accessible location in each water supply to each fixture.
- M. Install trap on fixture outlet except for fixtures having integral trap.
- N. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork. Use deep pattern escutcheons where required to conceal protruding pipe fittings.
- O. Seal fixtures to walls, floors, and counters using a sanitary-type, one-part, mildew-resistant, silicone sealant in accordance with sealing requirements specified in Division 7 Section "Joint Sealers." Match sealant color to fixture color.

3.4 CONNECTIONS

- A. Piping installation requirements are specified in other sections of Division 22. The Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:
- B. Install piping connections between plumbing fixtures and piping systems and plumbing equipment specified in other sections of Division 22.
- C. Install piping connections indicated between appliances and equipment specified in other sections, direct connected to plumbing piping systems.

3.5 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.

3.6 ADJUSTING AND CLEANING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust disposers, hot water dispensers, and controls. Replace damaged and malfunctioning units and controls.
- C. Adjust water pressure at drinking fountains, electric water coolers, and faucets, shower valves, and flushometers having controls, to provide proper flow and stream.
- D. Replace washers of leaking and dripping faucets and stops.
- E. Clean fixtures, fittings, and spout and drain strainers with manufacturers' recommended cleaning methods and materials.
- F. Review the data in Operating and Maintenance Manuals. Refer to Division 1 Section "Project Closeout."

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of fixtures for temporary facilities, except when approved in writing by the Owner.

3.8 FIXTURE SCHEDULE

- A. Provide plumbing fixtures as scheduled in the drawings.

END OF SECTION

SECTION 22 0430

PLUMBING 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 plumbing specialties for water distribution systems; soil, waste, and vent systems; and storm drainage systems.
- B. Related Sections: The following sections contain requirements that relate to this Section:
 - 1. Division 23 Section "Basic Mechanical Materials and Methods" for piping-joining materials, joint construction, basic installation requirements, and labeling and identifying requirements.
 - 2. Division 22 Section "Valves" for gate, ball, butterfly, globe, and check valves.
 - 3. Division 22 Section "Meters and Gages" for thermometers, pressure gages, and fittings.
 - 4. Division 22 Section "Plumbing Piping" for piping and connections.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing piping systems with following minimum working pressure ratings, except where otherwise indicated:
 - 1. Water Distribution Systems, Below Ground: 150 psig.
 - 2. Water Distribution Systems, Above Ground: 125 psig.
 - 3. Soil, Waste, and Vent Systems: 10-foot head of water.
 - 4. Storm Drainage Systems: 10-foot head of water.
 - 5. Sanitary Sewage, Pumped Piping Systems: 75 psig.
 - 6. Storm Sewage, Pumped Piping Systems: 75 psig.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Submit product data including rated capacities of selected models and weights (shipping, installation, and operation). Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components: and piping and wiring connections for the following plumbing specialty products:
 - 1. Backflow preventers.
 - 2. Water pressure regulators.
 - 3. Water filters.
 - 4. Thermostatic water-mixing valves and water-tempering valves.
 - 5. Strainers.
 - 6. Hose bibbs, wall hydrants, and post and sanitary hydrants.
 - 7. Drain valves.
 - 8. Water hammer arresters.
 - 9. Cleanouts, cover plates, and access panels.
 - 10. Air-admittance valves.
 - 11. Vent caps, vent terminals, and roof flashing assemblies.
 - 12. Floor drains, open receptors, trench drains, and roof drains.

13. Sleeve penetration systems.
14. Grease interceptors and solids interceptors.

- C. Maintenance data for inclusion in Operating and Maintenance manuals as specified in Division 1 Section "Project Closeout" for the following:
1. Backflow preventers.
 2. Water pressure regulators.
 3. Thermostatic water-mixing valves and water-tempering valves.
 4. Sanitary hydrants.
 5. Backwater valves.
 6. Solids interceptors.

1.5 QUALITY ASSURANCE

- A. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
- B. Electrical Component Standard: NFPA 70, "National Electrical Code."
- C. Listing and Labeling: Provide equipment that is listed and labeled.
1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- D. Design Concept: The Drawings indicate capacities, sizes, and dimensional requirements of system components. Components having equal performance characteristics that deviate from the indicated size and dimensions may be considered, provided deviations do not change the design concept or intended performance. The burden of proof for equality of products is on the Contractor.

1.6 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials matching products installed as described below. Package them with protective covering for storage and identify with labels clearly describing contents.
- B. Water Filter Cartridges: Furnish quantity not less than 200 percent of amount of each type and size installed.
- C. Operating Keys (Handles): Furnish 1 extra key for each key-operated hose bibb and hydrant installed.

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:
1. Backflow Preventers:
 - a. Ames Co., Inc.
 - b. Watts Regulator Co.
 - c. Wilkins Regulator Div., Zurn Industries, Inc.
 2. Water Pressure Regulators:
 - a. Watts Regulator Co.
 - b. Wilkins Regulator Div., Zurn Industries, Inc.
 3. Thermostatic Water-Mixing Valves:
 - a. Symmons Industries, Inc.
 - e. Watts Regulator Co.
 4. Water-Tempering Valves:

- a. Watts Regulator Co.
- 5. Wall Hydrants and Post Hydrants:
 - a. Josam Co.
 - b. Smith by Jay R. Smith Mfg. Co. Div, Smith Industries, Inc.
 - c. Wade Div, Tyler Pipe.
 - d. Watts Regulator Co.
 - e. Woodford Manufacturing Co. Div, WCM Industries, Inc.
 - f. Zurn by Hydromechanics Div., Zurn Industries, Inc.
- 6. Water Hammer Arresters:
 - a. Josam Co.
 - b. Smith by Jay R. Smith Mfg. Co. Div., Smith Industries, Inc.
 - c. Sioux Chief Manufacturing Co., Inc.
 - d. Wade Div., Tyler Pipe.
 - e. Watts Regulator Co.
 - f. Zurn by Hydromechanics Div., Zurn Industries, Inc.
- 7. Drainage Piping Specialties, including backwater valves, expansion joints, floor drains, roof drains, trench drains, interceptors, drains, and vent caps:
 - a. Josam Mfg. Co.
 - b. Smith by Jay R. Smith Mfg. Co. Div., Smith Industries, Inc.
 - c. Zurn by Hydromechanics Div., Zurn Industries Inc.
- 8. Sleeve Penetration Systems:
 - a. Preset Systems, Inc.
- 9. Interceptors:
 - a. Josam Mfg. Co.
 - b. Smith Mfg. Co.
 - c. Wade Div; Tyler Pipe
 - d. Zurn Industries; Hydromechanics Div.

2.2 BACKFLOW PREVENTERS

- A. General: ASSE Standard, backflow preventers, of size required for maximum flow rate a minimum pressure loss.
 - 1. Working Pressure: 150 psig minimum except where indicated otherwise.
 - 2. 2 Inches and Smaller: Bronze body with threaded ends.
 - 3. 2-1/2 Inches and Larger: Bronze, cast-iron, steel, or stainless-steel body with flanged ends.
 - a. Interior Lining: FDA-approved epoxy coating, for backflow preventers having cast-iron or steel body.
 - 4. Interior Components: Corrosion-resistant materials.
 - 5. Exterior Finish: Polished chrome plate when used in chrome-plated piping system.
 - 6. Strainer on inlet, where strainer is indicated.
- B. Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.
- C. Hose Connection Vacuum Breakers: ASSE 1011, nickel plated, with non-removable and manual drain features, and ASME B1.20.7 garden-hose threads on outlet. Units attached to rough-bronze-finish hose connections may be rough bronze.
- D. Intermediate Atmospheric-Vent Backflow Preventers: ASSE 1012, consisting of inlet screen and 2 independent check valves with intermediate atmospheric vent for continuous pressure application.
- E. Double-Check Backflow Prevention Assemblies: ASSE 1015, consisting of shutoff valves on inlet and outlet and strainer on inlet. Include test cocks with 2 positive-seating check valves for continuous pressure application.
 - 1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
- F. Anti-siphon, Pressure-Type Vacuum Breakers: ASSE 1020, consisting of valves, spring-loaded check valve, and spring-loaded floating disc. Include test cocks and atmospheric vent for continuous pressure application.

1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
- G. Dual-Check-Valve-Type Backflow Preventers: ASSE 1024, consisting of union inlet and 2 independent check valves for continuous pressure application.

2.3 WATER PRESSURE REGULATORS

- A. General: ASSE 1003, water pressure regulators, rated for initial working pressure of 150 psig minimum, of size, flow rate, and inlet and outlet pressures indicated. Include integral factory-installed or separate field-installed Y type strainer.
1. 2 Inches and Smaller: Bronze body with threaded ends.
 2. 2-1/2 Inches and Larger: Bronze or cast-iron body with flanged ends.
 - a. Interior Lining: PDA-approved epoxy coating, for regulators with a cast-iron body.
 3. Interior Components: Corrosion-resistant materials.
 4. Exterior Finish: Polished chrome plate when used in chrome plated piping system.
- B. Single-seated, direct-operated type.
- C. Single-seated, direct-operated, integral-bypass type.
- D. Pilot-operated type, single- or double-seated, cast-iron body main valve, with bronze-body pilot valve.

2.4 THERMOSTATIC WATER-MIXING VALVES

- A. General: ASSE 1017, manually adjustable, thermostatic water-mixing valve with bronze body. Include checkstop and union on hot-water and cold-water supply inlets, adjustable temperature setting, and capacity required.
1. Operation and Pressure Rating: Bimetal thermostat, 125 psig minimum.
 2. Operation and Pressure Rating: Liquid-filled motor, 100 psig minimum.
- B. Thermostatic Water-Mixing Valves: Unit, with options as indicated.
1. Piping, of sizes and in arrangement, with valves and unions.
 2. Piping Component Finish: Polished chrome plate.
 3. Cabinet: Stainless-steel box with stainless-steel, hinged door.
 4. Cabinet Mounting: Recessed.
 5. Thermometer.

2.5 MISCELLANEOUS PIPING SPECIALTIES

- A. Piping specialties such as escutcheons, dielectric fittings, sleeves, and sleeve seals are specified in Division 23 Section "Basic Mechanical Materials and Methods."
- B. Strainers: To be Flow Design with dual ports and bottom blow down valve including a hose connection Y pattern, full size of connecting piping. Include Type 304 stainless-steel screens with 3/64-inch perforations except where other screens are indicated.
1. Pressure Rating: 125-psig minimum steam working pressure unless higher rating is required.
 2. Sizes 2 Inches and Smaller: Bronze body, with female threaded ends.
 3. Sizes 2-1/2 Inches and Larger: Cast-iron body, with interior FDA-approved epoxy coating and flanged ends.
 4. Y-Type Strainers: Screwed screen retainer with centered blowdown, and factory- or field-installed, hose-end drain valve.
 5. T-Type Strainers: Malleable-iron or ductile-iron body with grooved ends; access end cap with drain plug and access coupling with EDPM gasket.
 6. Basket-Type Strainers: Bolted flange or clamp cover, and basket having lift-out handle.
 - a. Simplex Type: Single unit, with 1 basket.

- b. Duplex Type: Double unit, with bronze or stainless-steel diverter valve and 2 baskets.
 - c. Drain: Factory- or field-installed hose-end, drain valve.
- C. Hose Bibbs: Bronze body, with renewable composition disc, 1/2- or 3/4-inch threaded or solder-joint inlet. Provide ASME B1.20.7 garden-hose threads on outlet and integral or field-installed, non-removable, drainable, hose-connection vacuum breaker.
 - 1. Finish: Rough brass.
 - 2. Operation: Wheel handle.
- D. Wall Hydrants: ASME A112.21.3M or ASSE 1019, non-freeze, automatic draining, anti-backflow type, key operation, with 3/4- or 1-inch threaded or solder-joint inlet, and ASME B1.20.7 garden-hose threads on outlet. Provide 1 operating key.
 - 1. Type: Projecting.
 - 2. Type: Recessed.
 - 3. Finish: Rough bronze.
- E. Hose-End, Drain Valves: 3/4-inch ball valve, rated for 400 psig WOG. Include 2-piece bronze body conforming to ASTM B 62, standard port, chrome-plated brass ball, replaceable "TFE" seats and seals, blowout-proof stem, and vinyl-covered steel handle.
 - 1. Inlet: Solder-joint or threaded.
 - 2. Outlet: Short-threaded nipple with ASME B1.20.7 garden-hose thread and cap.
- F. Water Hammer Arresters: ASME A112.26.1 M, ASSE 1010, or PDI WH-201, bellows or piston type with pressurized cushioning chamber. Sizes are based on water-supply fixture units, ASME A112.26.1 M sizes "A" through "F" and PDI WH-201 sizes "A" through "F."
- G. Air-Admittance Valves: ASSE 1051, plastic housing with mechanical-operation sealing diaphragm, designed to admit air into drainage and vent system piping and prevent transmission of sewer gas into building.
 - 1. Fixture Vent Valve: Designed for installation on waste piping (instead of vent connection) for single fixture, in sizes 1-1/4 through 2 inches.
 - 2. Stack Vent Valve: Designed for installation as terminal on soil, waste, and vent stacks (instead of stack vent extending through roof), in sizes 2 through 4 inches.
- H. Stack Flashing Fittings: Counterflashing-type, cast-iron fitting, with bottom recess for termination of roofing membrane, and with threaded or hub top for extension of vent pipe.
- I. Vent Caps: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and set-screws to secure to vent pipe.
- J. Vent Terminals: Commercially manufactured, shop-fabricated or field-fabricated, frost-proof assembly constructed of galvanized steel, copper, or lead-coated copper. Size to provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing, as indicated.
- K. Roof Flashing Assemblies: Manufactured assembly consisting of 4-psf lead flashing collar with boot and skirt extending at least 8 inches from pipe, with galvanized steel boot reinforcement and counterflashing fitting. Low-silhouette model with vandal-proof vent cap.
- L. Deep-Seal Traps: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap seal primer valve connection.
 - 1. NPS 2: 4-inch minimum water seal.
 - 2. NPS 2-1/2 and larger: 5-inch minimum water seal.

2.6 CLEANOUTS

- A. General: size cleanouts same size as connected drainage piping.

- B. Cleanouts: ASME A112.36.2M, cast-iron body with straight threads and gasket seal or taper threads for plug, flashing flange and clamping ring, and a brass closure plug. Cleanouts for installation in floors not having membrane waterproofing may be furnished without clamping ring.

2.7 FLOOR DRAINS

- A. General: Size outlets as indicated on Product Data Sheet or drawings.
- B. Floor Drains: ASME A112.21.1M, cast-iron body, with seepage flange and clamping device. Floor drains for installation in floors not having membrane waterproofing may have seepage flange without clamping device. Floor drains for use as area drains in exterior slab on grade may be furnished with anchor flange instead of seepage flange and clamping device. Floor drains for areas with vinyl flooring shall have a clamp down drain to allow the covering to flash into the drain.
- C. Floor drain type designations and sizes are indicated on Drawings.
- D. Trench Drains: ASME A112.21.1M, cast-iron body, with seepage flange and clamping device. Trench drains for installation in floors not having membrane waterproofing may have seepage flange without clamping device. Trench drains for use as area drains in exterior slab on grade may be furnished with anchor flange or other anchoring device instead of seepage flange and clamping device.
- E. Trench drain type designations and sizes are indicated on Drawings.

2.8 INTERCEPTORS

- A. General: Units of type, operation, flow rate, storage or retention capacity; with integral or field-installed cleanout on outlet; and other features indicated.
- B. Arrangement: Interior baffles, removable cover, flow control fitting, and cleanout on outlet. Cast iron or steel with corrosion-resistant coating.
- C. Solids Interceptors: Features shall include settlement chambers; baffles; removable basket, strainer, screens, or other means of cleaning; and removable cover.
 - 1. Material: Cast iron or concrete as indicated on drawings.

2.9 SLEEVE PENETRATION SYSTEMS

- A. Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.
 - 1. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on 1 end for installation in cast-in-place concrete slabs.
 - 2. Stack Fitting: ASTM A 46, cast-iron, hubless-pattern, wye branch stack fitting with neoprene O ring at base and cast-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.
 - a. Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical waste and vent stacks.

2.10 FLASHING MATERIALS

- A. Lead: ASTM B 749, Type L51121, copper-bearing sheet, at least 4 psf (0.0625-inch thick) for general use, and at least 6 psf (0.0937-inch thick) for burning (welding).
- B. Elastic Membrane: Non-reinforced flexible, black elastic, sheet, 50 to 65-mils thick and complying with the following:
 - 1. Shore A Hardness: ASTM D 2240, 50 to 70.
 - 2. Tensile Strength: ASTM D 412. 1200 psi.

3. Tear Resistance: ASTM D 624, Die C, 20 lb per linear inch.
 4. Ultimate Elongation: ASTM D 412, 250 percent.
 5. Low-Temperature Brittleness: ASTM D 746, minus 30 deg F (minus 35 deg C).
 6. Resistance to Ozone Aging: ASTM D 1149, no cracks for 10 percent elongated sample for 100 hours in 50-mPa ozone at 104 deg F (70 deg C).
 7. Resistance to Heat Aging: ASTM D 573, maximum hardness increase of 15 points, elongation reduction of 40 percent, and tensile strength reduction of 30 percent, for 70 hours at 212 deg F (100 deg C).
- C. Copper ASTM B 370, sheet, 16 oz. per sq. ft. (0.0216-inch thick).
1. General Use: Temper H00 (formerly cold-rolled).
 2. Forming Use: Temper 060 (formerly soft).
- D. Zinc-Coated Steel: ASTM A 526, sheet, with 0.20 percent copper, G90 hot-dip galvanized, mill phosphatized where indicated for painting; 0.0359-inch thick (20 gage).
- E. Fasteners: Metal compatible with material and substrate being fastened.
- F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units as required for installation; matching or compatible with material being installed.
- G. Solder ASTM B 32, Alloy Sn50.
- H. Bituminous Coating: SSPC-12, solvent type, bituminous mastic.

2.11 ROOF DRAINS

- A. Roof Drains: Comply with ASME A112.21.2M.
1. Body Material: Cast iron.
 2. Dimensions of Body: See drawings for size of body.
 3. Combination Flashing Ring and Gravel Stop: Required.
 4. Outlet: Bottom.
 5. Dome Material: Aluminum.
 6. Extension Collars: Not required except for overflow drains.
 7. Underdeck Clamp: Required.
 8. Sump Receiver: Not required.

PART 3 - EXECUTION

3.1 PIPING SPECIALTY INSTALLATION

- A. Install backflow preventers of type, size, and capacity required, at each water supply connection to mechanical equipment and systems, and to other equipment and systems as required. Comply with plumbing code and authority having jurisdiction. Locate in same room as equipment being connected. Install air-gap fitting on units having atmospheric vent connection and pipe relief outlet drain to nearest floor drain. Do not install bypass around backflow preventer.
- B. Install pressure-regulating valves with inlet and outlet shutoff valves and balance cock bypass. Install pressure gage on valve outlet and install valved bypass.
- C. Install strainers on supply side of each control valve, pressure-regulating valve, and solenoid valve.
- D. Install hose bibbs with integral or field-installed vacuum breaker.

- E. Install wall hydrants with integral or field-installed vacuum breaker.
- F. Install expansion Joints on vertical risers, stacks, and conductors as required,
- G. Install cleanouts in above-ground piping and building drain piping as required, and according to the following:
 - 1. Size same as drainage piping up to 4-inch size. Use 4-inch size for larger drainage piping.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 50 feet for piping 4 inches and smaller and 100 feet for larger piping.
 - 4. Locate at base of each vertical soil or waste stack.
- H. Install cleanout deck plates (covers) with top flush with finished floor, for floor cleanouts for piping below floors.
 - 1. Install cleanout wall access covers with frame and cover flush with finished wall. For cleanouts located in concealed piping.
- J. Install flashing flange and clamping device with each stack and cleanout passing through floors having waterproof membrane.
- K. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to the manufacturer's written instructions.
- L. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

3.2 FLOOR DRAIN INSTALLATION

- A. Install floor drains according to manufacturer's written instructions, in locations indicated.
- B. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.
- C. Set drain elevation depressed below finished slab elevation as listed below to provide proper floor slope to drain:
 - 1. 5-Foot Drain Area Radius: 1/2-inch depression.
 - 2. 10-Foot Drain Area Radius: 3/4-inch depression.
 - 3. 15-Foot Drain Area Radius: 1-inch depression.
 - 4. 20-Foot Drain Area Radius: 1-1/4-inch depression.
 - 5. 25-Foot Drain Area Radius: 1-1/2-inch depression.
- D. Trap drains and provide trap-primer connection for floor drains connected to sanitary building drain.
- E. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.
- F. Position drains for easy accessibility and maintenance.

3.3 INTERCEPTOR INSTALLATION

- A. General: Comply with unit manufacturer's written installation instructions and with local authority for trapping and venting.
- B. Install units with clear space for servicing.
- C. Install waste piping, flow control fitting, vent piping, and accessories as necessary.
- D. Above-Floor Installation: Set unit with bottom resting on floor.

- E. Flush with Floor Installation: Set unit and extension when required, with cover flush with finished floor.
- F. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
- G. Install cleanout immediately downstream of interceptor units not having integral cleanout on outlet.

3.4 CONNECTIONS

- A. Supply Runouts to Fixtures: Install hot- and cold-water supply piping runouts to fixtures of sizes indicated, but not smaller than required by plumbing code.
- B. Drainage Runouts to Fixtures: Provide drainage and vent piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated, but not smaller than required by plumbing code.
- C. Locate drainage piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.
- D. Interceptor Connections: Connect piping, flow control fittings, and accessories as required.
 - 1. Grease Interceptors: Connect inlet and outlet to unit, and flow control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff type unit.
 - 2. Solids Interceptors: Connect inlet and outlet.
- E. Electrical Connections: Power wiring and disconnect switches are specified in Division -26.
 - 1. Grounding: Connect unit components to ground according to the National Electrical Code and Division 26 Section "Grounding."

3.5 FLASHING INSTALLATION

- A. Provide flashing manufactured in a single piece except where large pans, sumps, or other drainage shapes are required.
- B. Install 4-psf lead flashing or 16-oz.-per sq. ft. copper, except when another weight or material is specified.
- C. Install 6-psf lead flashing or heavier where burning (welding) of lead sheets is required.
- D. Solder joints of copper sheets where required.
- E. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with membrane waterproofing.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum sleeve length of 10 inches, and skirt or flange extending at least 8 inches around pipe:
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- F. Set flashing on floors and roofs in solid coating of bituminous cement.
- G. Secure flashing into sleeve and specialty clamping ring or device.
- H. Install flashing for piping passing through roofs with counter flashing or commercially made flashing fittings, according to Division 7 Section "Flashing and Sheet Metal."
- I. Extend flashing up vent pipe passing through roofs and turn down into pipe or secure flashing into cast-iron sleeve having caulking recess.

- J. Fabricate and install lead sheet flashing and pans, sumps, and other drainage shapes as required, including drain connection.
- K. Fabricate and install copper sheet flashing and pans, sumps, and other drainage shapes as required, including drain connection.
- L. Fabricate and install galvanized-steel sheet flashing and pans, sumps, and other drainage shapes as required, including drain connection.
- M. Fabricate and install elastic-membrane sheet flashing and pans, sumps, and other drainage shapes as required, including drain connection.

3.6 COMMISSIONING

- A. Preparation: Perform the following checks before start-up:
 - 1. Systems tests are complete.
 - 2. Damaged and defective specialties and accessories have been replaced or repaired.
 - 3. There is clear space for servicing of specialties.
- B. Before operating systems, perform these steps:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open valves to full open position.
 - 3. Remove and clean strainers.
 - 4. Verify drainage and vent piping are clear of obstructions. Flush with water until clear.
- C. Starting Procedures: Follow manufacturer's written procedures. If no procedures are prescribed by manufacturer, proceed as follows:
 - 1. Energize circuits for grease recovery units. Start and run units through complete sequence of operations.

3.7 ADJUSTING

- A. Adjust operation and correct deficiencies discovered during commissioning.

3.8 DEMONSTRATION

- A. Train Owner's maintenance personnel on procedures related to startup and servicing of interceptors.

3.9 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of day or when work stops.

END OF SECTION

SECTION 22 0441
DOMESTIC WATER PUMPS

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 all-bronze and bronze-fitted centrifugal pumps for domestic cold- and hot-water circulation:
 - 1. Close-coupled, in-line, sealless centrifugal pumps.

1.3 SUBMITTALS

- A. Product Data: For each type and size of domestic water pump specified. Include certified performance curves with operating points plotted on curves; and rated capacities of selected models, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power wiring.
- C. Operation and Maintenance Data: For domestic water pumps operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of domestic water pumps and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- 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. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.

- C. Comply with pump manufacturer's written rigging instructions for handling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 CLOSE COUPLED, IN-LINE, SEALLESS CENTRIFUGAL PUMPS

A. Acceptable Manufacturers:

1. Armstrong Pumps Inc.
2. Bell & Gossett Domestic Pump; ITT Industries.
3. Grundfos Pumps Corp.
4. Taco, Inc.

B. Description: Factory-assembled and -tested, single-stage, close-coupled, in-line, sealless centrifugal pumps as defined in HI 5.1-5.6.

1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge-type unit with motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally.
2. Casing: Bronze, with threaded companion-flange connections.
3. Impeller: Corrosion-resistant material.
4. Motor: Single speed, unless otherwise indicated. Comply with requirements in Division 23 Section "Motors."

C. Capacities and Characteristics: See Drawings

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.2 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- D. Install in-line, sealless centrifugal pumps with motor and pump shafts horizontal.

- E. Install continuous-thread hanger rods of sufficient size to support pump weight. Fabricate brackets or supports as required.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps to allow service and maintenance.
- C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles. Refer to Division 22 Section "Domestic Water Piping."
 - 1. Install shutoff valve and strainer on suction side of pumps, and check valve and throttling valve on discharge side of pumps. Install valves same size as connected piping.
- D. Ground equipment and connect wiring according to Division 26 Sections.

END OF SECTION

SECTION 22 0457

DOMESTIC WATER HEATERS

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 fuel-fired water heaters:
 - 1. Commercial, high-efficiency, gas water heaters.
 - 2. Water heater accessories.

1.3 SUBMITTALS

- A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Product Certificates: For each type of commercial water heater, signed by product manufacturer.
- D. Source quality-control test reports.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For water heaters to include in emergency, operation, and maintenance manuals.
- G. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain same type of water heaters through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of water heaters and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- 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. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

E. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

1.5 COORDINATION

- A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
2. Warranty Period(s): From date of Substantial Completion:
 - a. Gas Water Heaters:
 - 1) Storage Tank: 10 years.
 - 2) Controls and Other Components: Three years.

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.

- B. Commercial, High-Efficiency, Gas Water Heaters: Comply with ANSI Z21.10.3/CSA 4.3.

1. Manufacturers:
 - a. A.O. Smith

- b. Bradford White
 - c. PVI Industries, LLC.
 - d. Rheem
 - e. State
- 2. Storage-Tank Construction: ASME code steel with 150-psig working-pressure rating.
 - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - 1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Lining: Glass or Nickel plate complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
- 3. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - e. Jacket: Steel with enameled finish.
 - f. Combination Temperature and Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
- 4. Burner: Comply with UL 795 for power-burner water heaters and for natural gas fuel.
 - a. Automatic Ignition: ANSI Z21.20, electric, automatic, gas-ignition system.
- 5. Temperature Control: Adjustable thermostat.
- 6. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
- 7. Special Requirements: NSF 5 construction.

2.2 WATER HEATER ACCESSORIES

- A. Gas Shutoff Valves: ANSI Z21.15/CGA 9.1, manually operated. Furnish for installation in piping.
- B. Gas Pressure Regulators: ANSI Z21.18, appliance type. Include pressure rating, capacity, and pressure differential required between gas supply and water heater.
- C. Gas Automatic Valves: ANSI Z21.21, appliance, electrically operated, on-off automatic valve.
- D. Combination Temperature and Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select each relief valve with sensing element that extends into storage tank.
 - 1. Gas Water Heaters: ANSI Z21.22/CSA 4.4.

- E. Pressure Relief Valves: Include pressure setting less than working-pressure rating of water heater.
 - 1. Gas Water Heaters: ANSI Z21.22/CSA 4.4.
- F. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

2.3 SOURCE QUALITY CONTROL

- A. Test and inspect water heater storage tanks, specified to be ASME code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial water heater storage tanks before shipment to minimum of one and one-half times pressure rating.
- C. Prepare test reports.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

- A. Install commercial water heaters on concrete bases.
 - 1. Concrete base construction requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."
- B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Anchor to substrate.
- D. Install gas water heaters according to NFPA 54.
- E. Install gas shutoff valves on gas supplies to gas water heaters without shutoff valves.
- F. Install gas pressure regulators on gas supplies to gas water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
- G. Install automatic gas valves on gas supplies to gas water heaters, if required for operation of safety control.
- H. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater, relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- I. Install water heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 22 Section "Plumbing Specialties" for hose-end drain valves.

- J. Install thermometer on outlet piping of water heaters. Refer to Division 22 Section "Meters and Gages" for thermometers.
- K. Install pressure gage(s) on outlet piping of commercial, fuel-fired water heater piping. Refer to Division 22 Section "Meters and Gages" for pressure gages.
- L. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve and thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Division 23 Section "Valves" for general-duty valves and to Division 22 Section "Meters and Gages" for thermometers.
- M. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
- N. Fill water heaters with water.
- O. Charge compression tanks with air.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Connect wiring according to Division 26 Section "Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial water heaters. Refer to Division 1.

END OF SECTION

22 0457-6

SECTION 22 0496

NATURAL GAS PIPING

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 piping, specialties, and accessories for natural gas systems within building and to exterior gas meters, located within five feet of building.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 33 Section "Gas Hydrocarbon Piping" for natural gas service piping.
 - 2. Division 22 Section "Meters and Gages" for pressure gages and fittings.

1.3 DEFINITIONS

- A. Low-Pressure Natural Gas Piping: Operating pressures up to 2 psig.
- B. Gas Service: Operating pressure indicated.
- C. Gas Service: Pipe from gas main or other source to gas point of delivery for building being served. Piping includes gas service piping, gas valve, service pressure regulator, meter bar or meter support, and gas meter.
- F. Gas Delivery Point: Gas meter or service pressure regulator outlet, or gas service valve if gas meter is not provided.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

- A. Minimum Working-Pressure Ratings: Except where otherwise indicated, minimum pressure requirements are as follows:
 - 1. Low-Pressure Natural Gas Piping: 2 psig.
 - 2. Medium-Pressure Natural Gas Piping: 5 psig.
 - 3. High-Pressure Natural Gas Piping: 35 psig.
- B. Approximate values of natural gas supplied for these systems are as follows:
 - 1. Heating Value: 1000 Btu/cu. ft.
 - 2. Specific Gravity: 0.6.
 - 3. Service Line Pressure: 30 to 35 psig.

1.5 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 natural gas specialty and special-duty valve. Include pressure rating, rated capacity, and settings of selected models.

- C. Coordination Drawings for natural gas piping, including required clearances and relationship to other services for same work areas.
- D. Test reports specified in "Field Quality Control" Article in Part 3.
- E. Maintenance data for natural gas specialties and special-duty valves to include in the operation and maintenance manual specified in Division 1 Section "Contract Closeout."

1.6 QUALITY ASSURANCE

- A. Comply with NFPA 54, "National Fuel Gas Code," for gas piping materials and components; installations; and inspecting, testing, and purging.
- B. Comply with NFPA 70, "National Electrical Code," for electrical connections between wiring and electrically operated control devices.
- C. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.
- D. Listing and Labeling: Provide equipment and accessories specified in this Section that are listed and labeled.
 - 1. Terms "Listed" and "Labeled": As defined in National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- E. Product Options: Drawings indicate size, profiles, connections, dimensional requirements, and characteristics of natural gas piping equipment, specialties, and accessories and are based on specific types and models indicated. Other manufacturers' equipment and components with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and legally dispose of liquids from drips in gas piping. Handle cautiously to avoid spillage and ignition. Notify gas supplier. Handle flammable liquids used by Installer with proper precautions and do not leave on premises from end of one day to beginning of next day.

1.8 SEQUENCING AND SCHEDULING

- A. Notification of Interruption of Service: Notify each affected user when gas supply will be turned off.

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. Gas Stops, 2-Inch NPS (DNSO) and Smaller:
 - a. Hammond Valve Corp.
 - b. Jornar International, Ltd.
 - c. Maxitrol Co.
 - d. McDonald: A.Y. McDonald Mfg. Co.
 - e. Milwaukee Valve Co., Inc.
 - f. Mueller Co.
 - g. National Meter.
 - 2. Gas Valves, 2-Inch NPS (DN50) and Smaller:

- a. Conbraco Industries, Inc.; Apollo Div.
- b. Core Industries, Inc.; Mueller Steam Specialty Div.
- c. Huber: J.M. Huber Corp.; Flow Control Div.
- d. McDonald: A.Y. McDonald Mfg. Co.
- e. Milliken Valve Co., Inc.
- f. Milwaukee Valve Co., Inc.
- g. Mueller Co.
- h. National Meter.
- i. Nordstrom Valves, Inc.
- j. Olson Technologies, Inc.
- 3. Gas Valves, 2-1/2-Inch NPS (DN65) and Larger:
 - a. Core Industries, Inc.; Mueller Steam Specialty Div.
 - b. Huber: J.M. Huber Corp.; Flow Control Div.
 - c. Milliken Valve Co., Inc.
 - d. Nordstrom Valves, Inc.
 - e. Olson Technologies, Inc.
 - f. Xomox Corp.
- 4. Plastic Gas Valves:
 - a. Kerotest Manufacturing Corp.
 - b. Perfection Corp., Gas Products Div.
- 5. Solenoid Valves:
 - a. Automatic Valve Co., Inc.
 - b. Automatic Switch Co.
 - c. Goyen Valve Corp.
 - d. Honeywell, Inc.; Skinner Valve Div.
 - e. ITT Fluid Technology Corp.; ITT Controls.
 - f. Magnatrol Valve Corp.
- 6. Gas Pressure Regulators:
 - a. American Meter Co.
 - b. Equimeter, Inc.
 - c. Fisher Controls International, Inc.
 - d. Maxitrol Co.
 - e. National Meter.
 - f. Richards Industries, Inc.; Jordan Valve Div.
 - g. Schiumberger Industries; Gas Div.

2.2 PIPES AND TUBES

- A. Steel Pipe: ASTM A 53; Type E, electric-resistance welded or Type S, seamless; Grade B; Schedule 40; black. Above ground only,
- B. Plastic Pipe: ASTM D 2513, polyethylene (PE), DR 11 or DR 11.5.

2.3 PIPE AND TUBE FITTINGS

- A. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends conforming to ASME B1.20.1.
- B. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends conforming to ASME B1.20.1.
- C. Cast-Iron Flanges and Flanged Fittings: ASME B16.1, Classes 125 and 250.
- D. Steel Fittings: ASME B16.9, wrought steel, butt-welding type; and ASME B16.11, forged steel.
- E. Steel Flanges and Flanged Fittings: ASME B16.5.

- F. Plastic Pipe Fittings: ASTM D 2513, polyethylene, butt-fusion type; and ASTM D 2683, polyethylene, socket-fusion type.
- G. Transition Fittings: Type, material, and end connections to match piping being joined.

2.4 JOINING MATERIALS

- A. Common Joining Materials: Refer to Division 23 Section "Basic Mechanical Materials and Methods" for joining materials not included in this Section.
- B. Brazing Filler Metals: AWS A5.B, Silver Classification BAg-1. Filler metal containing phosphorus is prohibited.
- C. Joint Compound and Tape: Suitable for natural gas.
- D. Gasket Material: Thickness, material, and type suitable for natural gas.

2.5 VALVES

- A. Manual Valves: Conform to standards listed or, where appropriate, to ANSI Z21.15.
- B. Gas Valves, 2-Inch NPS (DN50) and Smaller: 125 psig (860 kPa) WOG minimum, equivalent to ASME B16.33, lubricated, straightaway pattern, cast-iron or ductile-iron body. Include tapered plug, O-ring seals, square or flat head, and threaded ends conforming to ASME B1.20.1.
- C. Gas Valves, 2-1/2-Inch NPS (DN65) and Larger: MSS SP-78, Class 125 or Class 175 WOG, lubricated-plug type, semisteel body, wrench operated, with flanged ends.
- D. Plastic Gas Valves: ASME B16.40, polyethylene (PE), SDR 11.

2.6 SPECIALTY VALVES

- A. Solenoid Valves: Bronze, aluminum, or cast-iron body; 120 VAC, 60 Hz, Class B continuous-duty molded coil; UL labeled and FM approved. Include NEMA ISC 6, Type 4, coil enclosure and electrically opened and closed dual coils. Valve position is normally closed. Include threaded ends conforming to ASME B1.20.1 for 2-inch NPS (DN50) and smaller and flanged ends for 2-1/2-inch NPS (DN65) and larger.

2.7 PIPING SPECIALTIES

- A. Gas Pressure Regulators: ANSI Z21.18, single-stage, steel-jacketed, corrosion-resistant pressure regulators. Include atmospheric vent, elevation compensator, with threaded ends conforming to ASME B1.20.1 for 2-inch NPS (DN50) and smaller and flanged ends for 2-1/2-inch NPS (DN65) and larger. Regulator pressure ratings, inlet and outlet pressures, and flow volume in cubic feet per hour (liters per second) of natural gas at specific gravity are as indicated.
 1. Service Pressure Regulators: Inlet pressure rating not less than natural gas distribution system service pressure.
 2. Line Gas Pressure Regulators: Inlet pressure rating not less than system pressure.
 3. Appliance Gas Pressure Regulators: Inlet pressure rating not less than system pressure, with capacity and pressure setting matching appliance.
 4. Gas Pressure Regulator Vents: Factory- or field-installed corrosion-resistant screen in opening when not connected to vent piping.
- B. Flexible Connectors: ANSI Z21.24, copper alloy.
- C. Strainers: Y pattern, full size of connecting piping. Include stainless-steel screens with 3/64-inch (1.2-mm) perforations, except where other screens are indicated.

1. Pressure Rating: 125-psig (860-kPa) minimum steam or 175-psig (1200-kPa) WOG working pressure, except where otherwise indicated.
 2. 2-Inch NPS (DN50) and Smaller: Bronze body, with threaded ends conforming to ASME B1.20.1.
 3. 2-1/2-Inch NPS (DN65) and Larger: Cast-iron body, with flanged ends.
 4. Screwed screen retainer with centered blow-down and pipe plug.
- D. Quick-Disconnect Devices: ANSI Z21.41, ANSI Z21.41 a, and ANSI Z21.41 b convenience outlets and matching plug connector.

2.8 PROTECTIVE COATING

- A. Furnish pipe and fittings with factory-applied, corrosion-resistant polyethylene coating for use in corrosive atmosphere, including underground. Coating properties include the following:
1. Applied to pipe and fittings treated with compatible primer before applying tape.
 2. Overall Thickness: 20 mils (0.5 mm), synthetic adhesive.
 3. Water-Vapor Transmission Rate: Maximum 0.10 gal./100 sq. in. (0.59 Usq. m).
 4. Water Absorption: 0.02 percent maximum.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Close equipment shutoff valves before turning off gas to premises or section of piping. Perform leakage test as specified in "Field Quality Control" Article to determine that all equipment is turned off in affected piping section.
- B. Comply with NFPA 54 Paragraph "Prevention of Accidental Ignition."

3.2 SERVICE ENTRANCE PIPING

- A. Extend natural gas piping and connect to gas distribution system piping in location and size indicated for gas service entrance to building.
1. Gas distribution system piping, service pressure regulator, and gas meter will be provided by gas utility.
- B. Install shutoff valve, downstream from gas meter, outside building at gas service entrance.

3.3 PIPING APPLICATIONS

- A. General: Flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating may be used in applications below, except where otherwise indicated.
- B. Low-Pressure, 0.5 to 2 psig (3.45 to 13.8 kPa), Natural Gas Systems: Use the following:
1. 1-Inch NPS (DN25) and Smaller: Steel pipe, butt-welding fittings, and welded joints.
 2. 1-1/4-Inch NPS (DN32) and Larger: Steel pipe, butt-welding fittings, and welded joints.
- C. Underground Natural Gas Systems, All Pressures: Steel pipe, butt-welding fittings, and welded joints.

3.4 VALVE APPLICATIONS

- A. Use gas stops for shutoff to appliances with 2-inch NPS (DN50) or smaller low-pressure gas.
- B. Use gas valves for shutoff to appliances with 2-1/2-inch NPS (DN65) or larger low-pressure gas supply and all sizes for low-pressure gas supply.
- C. Use gas valves of sizes indicated for gas service piping, meters, mains, and where indicated.

3.5 PIPING INSTALLATIONS

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping installation requirements.
- B. Concealed Locations: Except as specified below, install concealed gas piping in airtight conduit constructed of Schedule 40, seamless, black steel pipe with welded joints. Vent conduit to outside and terminate with screened vent cap.
 - 1. Above-Ceiling Locations: Gas piping may be installed in accessible spaces, subject to approval of authorities having jurisdiction, whether or not such spaces are used as plenums. Do not locate valves in such spaces.
 - 2. In Partitions: Do not install concealed piping in solid partitions. Protect tubing from physical damage when installed inside partitions or hollow walls.
 - a. Exception: Tubing passing through partitions or walls.
 - 3. In Walls: Gas piping with welded joints and protective wrapping specified in "Protective Coating" Article in Part 2 may be installed in masonry walls, subject to approval of authorities having jurisdiction.
 - 4. Prohibited Locations: Do not install gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - a. Exception: Accessible above-ceiling space specified above.
- C. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of gas meters. Locate where readily accessible to permit cleaning and emptying. Do not install where condensate would be subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches (75 mm) long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.
- D. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels, except where indicated to be exposed to view.
- E. Install gas piping at uniform grade of 0.1 percent slope upward toward risers.
- F. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- G. Connect branch piping from top or side of horizontal piping.
- H. Install unions in pipes 2-inch NPS (DN50) and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.
 - 1. Install strainers on supply side of each control valve, gas pressure regulator, solenoid valve, and elsewhere as indicated.
- J. Install dielectric fittings (unions and flanges) with ferrous and brass or bronze end connections, separated by insulating material, where piping of dissimilar metals is joined.
- K. Install flanges on valves, specialties, and equipment having 2-1/2-inch NPS (DN65) and larger connections.
- L. Anchor piping to ensure proper direction of piping expansion and contraction. Install expansion joints, expansion loops, and pipe guides as indicated.
- M. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.

3.6 JOINT CONSTRUCTION

- A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

- B. Use materials suitable for natural gas service.
 - 1. Brazed Joints: Make joints with brazing alloy having melting point greater than 1000 deg F (540 deg C). Brazing alloys containing phosphorus are prohibited.

3.7 VALVE INSTALLATION

- A. Install valves in readily accessible locations, protected from damage. Tag valves with metal tag indicating piping supplied. Attach tag to valve with metal chain.
 - 1. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for valve tags.
- B. Install gas valve upstream from each gas pressure regulator.
- C. Install pressure relief or pressure-limiting devices so they can be readily operated to determine if valve is free; test to determine pressure at which they will operate; and examine for leakage when in closed position.

3.8 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 22 Section "Hangers and Supports" for pipe hanger and support devices.
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. 1/2-Inch NPS (DN15): Maximum span, six (6') feet (1829 mm); minimum rod size, 3/8 inch (10mm).
 - 2. 3/4- and 1-Inch NPS (DN20 and DN25): Maximum span, eight (8') feet (2438 mm); minimum rod size, 3/8 inch (10 mm).
 - 3. 1-1/4-Inch NPS (DN32): Maximum span, nine (9') feet (2743 mm); minimum rod size, 3/8 inch (10 mm).
 - 4. 1-1/2-and2-Inch NPS (DN40 and DN50): Maximum span, nine (9') feet (2473 mm); minimum rod size, 3/8 inch (10mm).
 - 5. 2-1/2- to 3-1 /2-Inch NPS (DN65 to DN90): Maximum span, ten (10') feet (3 m); minimum rod size, 1/2 inch (13 mm).
- C. Support horizontal, corrugated stainless-steel tubing according to manufacturer's written instructions.
- D. Support vertical pipe and tube at each floor.

3.9 CONNECTIONS

- A. Install gas piping next to equipment and appliances using gas to allow service and maintenance.
- B. Connect gas piping to equipment and appliances using gas with shutoff valves and unions. Install gas valve upstream from and within six (6') feet (1800 mm) of each appliance using gas. Install union or flanged connection downstream from valve. Include flexible connectors when indicated.
- C. Sediment Traps: Install tee fitting with capped nipple in bottom forming drip, as close as practical to inlet for appliance using gas.
- D. Electrical Connections: Wiring is specified in Division 26 Sections.

3.10 ELECTRICAL BONDING AND GROUNDING

- A. Install aboveground portions of natural gas piping systems that are upstream from equipment shutoff valves, electrically continuous, and bonded to grounding electrode according to NFPA 70.
- B. Do not use gas piping as grounding electrode.

3.11 FIELD QUALITY CONTROL

- A. Inspect, test, and purge piping according to NFPA 54, Part 4 "Gas Piping Inspection, Testing, and Purging" and requirements of authorities having jurisdiction.
- B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.
- C. Report test results promptly and in writing to Engineer and authorities having jurisdiction.
- D. Verify capacities and pressure ratings of gas meters, regulators, valves, and specialties.
- E. Verify correct pressure settings for pressure regulators.
- F. Verify that specified piping tests are complete.

3.12 ADJUSTING

- A. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

END OF SECTION

SECTION 23 0010

BASIC MECHANICAL REQUIREMENTS

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 this and the other sections of Division 23.

1.2 SUMMARY

- A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:
 - 1. Submittals.
 - 2. Coordination drawings.
 - 3. Record documents.
 - 4. Maintenance manuals.
 - 5. Rough-ins.
 - 6. Mechanical installations.
 - 7. Cutting and patching.
- B. Related Sections:

The following sections contain requirements that relate to this section:

 - 1. Division 23 Section "ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT," for factory-installed motors, controllers, accessories, and connections.
 - 2. Division 23 Section "BASIC MECHANICAL MATERIALS AND METHODS," for materials and methods common to the remainder of Division 23, plus general related specifications including:
 - a. Access to mechanical installations.
 - b. Excavation for mechanical installations within the building boundaries, and from building to utilities connections.

1.3 PLANS AND SPECIFICATIONS

- A. All Specifications, Architectural, Structural, Mechanical and Electrical drawings have been made to form a basis for the installation of the work and constitute an integral part of this Contract. The Drawings and Specifications shall be considered as mutually supportive and any work required by one but not by the other, shall be performed as though required by both. The drawings indicate the general layout of the complete Mechanical Systems. Data presented on the drawings is as accurate as preliminary surveys and planning can determine, but extreme accuracy is not guaranteed. Field verification of scale dimensions on the plans is the responsibility of the Contractor since final locations, distances, heights, etc. will be governed by actual field conditions.
- B. Contractor shall carefully examine all Architectural, Structural, Plumbing, Mechanical, Fire Protection and Electrical drawings to avert possible installation conflicts. Discrepancies shown on different Drawings or between Drawings and Specifications, or other necessary changes shall be brought to the attention of the Engineer for a decision to resolve the conflicts. Any items omitted from a schedule, but shown on the drawings, or omitted from the drawings, but shown in the schedules shall be furnished and installed at no extra cost. It shall be the responsibility of the Contractor to check all schedules with the drawings in order to verify all quantities and special requirements before ordering equipment.

- C. The Drawings and Specifications are presumed to be accurate, but extreme accuracy is not guaranteed. Any errors or ambiguities in contract documents that are discovered by the Contractor shall be reported to the Engineer before work is started. Omission or specific reference to any item necessary for complete installation, Code compliance and proper operation thereof shall not relieve the Contractor from the responsibility of furnishing the same at no extra cost. In case of a dispute concerning the true intent and meaning of the documents, the Engineer shall interpret the same, and shall be accepted by the Contractor as final. Changes from the drawings to make the work conform to the structure and to fit the work of other trades shall be submitted to the Engineer for review and documented acceptance before deviations are made.

1.4 QUALITY ASSURANCE, CODES, STANDARDS, PERMITS AND SYMBOLS

- A. General: Refer to the Division 1 sections for general administrative/procedural requirements related to compliance with codes and standards. Specifically, for the mechanical work (in addition to standards specified in individual work sections), the following standards are imposed, as applicable to the work in each instance.
- B. Governing Regulations: The applicability of primary general governing regulations to the project is indicated (but not necessarily specified) in Division-1 sections of these specifications. In general, the applicability (as determined by the Contractor) of construction regulations by every lawful authority having jurisdiction over the work must be complied with, regardless of the requirements of the Contract Documents including these specifications. Report conflicts to the Engineer promptly upon discovery, for resolution in accordance with specified terms.
- C. Imposed Codes and Standards: Applicable provisions of the following codes and standards are hereby imposed on a general basis for the mechanical work in addition to specific applications specified by individual work sections of these specifications.
1. AABA Associated Air Balance Council
 2. ACIL American Council of Independent Laboratories
 3. AGA American Gas Association
 4. AMCA Air Moving and Conditioning Association
 5. ANSI American National Standards Institute
 6. ARI Air-Conditioning and Refrigeration Institute
 7. ASHRAE American Society of Heating, Refrigerating & Air Conditioning Engineers, Inc.
 8. ASME American Society of Mechanical Engineers
 9. ASTM American Society for Testing & Materials
 10. AWS American Welding Society, Inc.
 11. AWWA American Water Works Association, Inc.
 12. FM Factory Mutual Engineering Corp.
 13. FS Federal Specification (General Services Administration)
 14. HI Hydronics Institute
 15. IBR Standards by the Hydronics Institute
 16. MIL Military Standardization Documents
 17. MSS Manufacturer's Standardization Society of the Valves & Fitting Industry
 18. NEC National Electrical Code by NFPA
 19. NEMA National Electrical Manufacturers Association
 20. NFPA National Fire Protection Association
 21. NSF National Sanitation Foundation
 22. OSHA Occupation Safety & Health Administration
 23. PDI Plumbing and Drainage Institute
 24. PS Product Standard of NBS (U.S. Dept. of Commerce)
 25. SMACNA Sheet Metal & Air Conditioning Contractors National Association, Inc.
 26. TIMA Thermal Insulation Manufacturers Association
 27. UL Underwriters' Laboratories, Inc.
 28. BOCA Building Code 1996
 29. International Plumbing Code 1996
 30. International Mechanical Code 1996

- D. Conflicting Requirements: Where application of a trade association standard or publication appears to be in conflict with the requirements of the contract documents, the Engineer will determine which must be complied with, and in general the more stringent will be required for the performance of the mechanical work.
- E. Permits: Where governing regulations and imposed codes and standards require notices, permits, licenses, inspections, tests, and similar items or actions in order to lawfully proceed with the required mechanical work. Obtain those items and take those actions in accordance with the regulations of the governing authority. The costs of such permits, licenses, inspections, etc, are the obligation of the Contractor.
- F. Symbols: Except as otherwise indicated, refer to the "ASHRAE Handbook of Fundamentals" for definitions of symbols used on the drawings to show mechanical work.

1.5 SUBMITTALS

- A. General: Refer to Division 1 Sections for general requirements concerning work-related submittals. Refer to other Division 1 Sections for administrative submittals. For mechanical work, the following quantities are required for each category of submittal (in lieu of quantities specified in Division 1), unless otherwise indicated in individual work sections of Division 23 (quantity does not include copies required by governing authorities, or by Contractor for its own purposes).
- B. Product Listing: 4 sets, typewritten list.
Prepare the product listing for mechanical work separately from the listings of products for other work. Include listing of each significant item of equipment and material used in the work; and indicate the generic name, product name, manufacturer, model number, related specification section numbers, and estimated date for start of installation. Bulk rough-in materials, including pipe and sheet metal taken from Contractor's stock need not be listed. For principal equipment item, list the power and fuel consumption ratings, and the primary output ratings. Submit list within 30 days of Contract Date.
- C. Shop Drawings: 6 sets, including 2 for maintenance manuals.
- D. Product Data Manuals: 6 bound sets, including 2 for maintenance manuals. Organize each submittal manual with index and thumb-tab marker for each section of information; bind in 2", 3-ring, vinyl-covered binder with pockets to contain folded sheets, properly labeled on spine and face of binder. Partial submittals will not be acceptable.
- E. Samples: 4 sets for final submission,
- F. Certifications, Test Reports, and Warranties (Guarantees): 4 copies including 2 for maintenance manuals.
- G. Maintenance Manuals: Prepare 6 copies with 3 complete descriptions of functions, normal operating characteristics and limitations, performance curves, engineering data and test with complete nomenclature, commercial numbers of replacement parts. Manufacturers printed operation procedures to include start-up, break-in, routine and normal operating instructions, maintenance procedures for preventive maintenance, trouble shooting, disassembly repair and lubrication charts and schedules.
- H. Testing, Adjusting, and Balancing Qualifications, Certifications, and Test Reports: 4 copies. Tester Qualifications and Certifications shall be submitted no later than ninety (90) days prior to the estimated completion date of the Project; TAB Preliminary and Final Reports no later than thirty (30) days after completion of the work.
 - 1. Additional copies may be required by individual sections of these Specifications.

1.6 COORDINATION DRAWINGS

- A. In congested locations where several elements of mechanical, or combined mechanical and other work, must be sequenced and positioned with precision in order to fit into the available space, prepare and submit a set of coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
1. Indicate the proposed locations of piping, ductwork, equipment, and materials. Include the following:
 - a. Clearances for installing and maintaining insulation.
 - b. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
 - c. Equipment connections and support details.
 - d. Exterior wall and foundation penetrations.
 - e. Fire-rated wall and floor penetrations.
 - f. Sizes and location of required concrete pads and bases.
 - g. Valve stem movement.
 2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
 3. When directed by the Engineer, prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
 4. When directed by the Engineer, prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

1.7 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements in Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, indicate the following installed conditions:
1. Ductwork mains and branches, size and location, for both exterior and interior: locations of dampers and other control devices: filters, boxes, and terminal units requiring periodic maintenance or repair.
 2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams complete with valve tag chart. Refer to Division 23 Section: "Mechanical Identification." Indicate actual inverts and horizontal locations of underground piping.
 3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 4. Accepted substitutions.
 5. Contract Modifications, actual equipment and materials installed.
- B. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified in Division 1 Section "FIELD ENGINEERING" to record the locations and invert elevations of underground installations.

1.8 MAINTENANCE MANUALS

- A. Prepare maintenance manuals in accordance with Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, include the following information for equipment items:
1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
 3. Maintenance procedures for routine preventative maintenance and troubleshooting: disassembly, repair, and reassembly; aligning and adjusting instructions.
 4. Servicing instructions and lubrication charts and schedules.

1.9 WARRANTIES

- A. Refer to the Division 1 Section: SPECIFIC WARRANTIES for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.
- B. Compile and assemble the warranties specified in Division 23, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.
- C. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond: duration of warranty or bond: and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

PART 2-PRODUCTS

2.1 PRODUCTS, MECHANICAL WORK

- A. General: Refer to Division 1 sections for general requirements on products, materials and equipment. The following provisions expand or modify the requirements as applicable to mechanical work.
- B. Compatibility: Provide products which are compatible with other products of the mechanical work and with other work requiring interface with the mechanical work. Provide products with the proper or correct power characteristics, fuel-burning characteristics and similar adaptations for the project. Coordinate the selections from among options (if any) for compatibility of products.
- C. When two or more items of same material or equipment are required (plumbing fixtures, pumps, valves, air conditioning units, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings, sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in mechanical work, except as otherwise indicated.
- D. Special Requirements for Materials and Equipment;
 - 1. Unless otherwise specified, or accepted by the Engineer, all materials used in construction on this project shall be of domestic manufacture. Domestic manufacture shall be interpreted to mean manufactured or produced from raw materials within the confines of the Continental United States, its territories, or possessions.
 - 2. All mechanical equipment installed in the project shall be represented locally by a competent Manufacturer's Representative fully qualified in the service and repair of his equipment. Spare parts for all equipment shall be readily available within a radius of 500 miles.
 - 3. All materials and equipment proposed for installation by the Contractor shall be available for immediate delivery so as to expedite completion of the project. The Contractor shall not knowingly order any such materials or equipment which may cause undue delay to any portion of the construction. No requests for additional compensation or construction time will be considered based on a delay by an equipment Manufacturer.
 - 4. At the discretion of the Engineer a notarized statement shall be furnished by the Contractor in compliance with all of the above. This statement shall contain the following:
 - a. Manufacturer's name and location.
 - b. Source of raw materials or point of manufacture.
 - c. Name, address, and qualifications of local manufacturer's representative.
 - d. Delivery schedule stating date and point of delivery.
 - 5. Patent Infringement: The Contractor shall protect the Owner from all actions, judgements and decrees, involving the infringement of patent rights, arising from the installation by the Contractor of any machinery and appliances or materials in the building, or arising from the use of any patented process by the Contractor. The Contractor shall pay all costs and expenses which may be incurred by the

Owner in the defense of legal action from infringement of patents, including all royalties and license fees.

E. Acceptable Base Bid Materials and Substitution Requirements:

1. All Base Bid proposals shall be made on the basis of the specific manufacturers named in the drawing schedule (basis-of-design). Where more than one manufacturer is named for a particular item of equipment, each manufacturer's equipment will be considered acceptable for bidding purposes.
2. Where materials or items of equipment are not specified by manufacturer's name, or the words "or accepted" are used, then manufacturer's equipment which meets the specifications will be acceptable, pending submittal review and documented acceptance by Engineer.
3. For purposes of competitive bidding a bidder may submit in writing to the Engineer at least ten (10) working days prior to scheduled opening dates, a substitution for a particular item of equipment as defined above. These items will be considered by the Engineer for substitution and must be accepted in writing prior to bidding.
4. Contractor is responsible for any design and/or field modifications arising from use of: acceptable manufacturer (other basis-of-design) or accepted substitution items at no additional Contract time or financial compensation.
5. It is to be emphasized that all Contractor's Base Bids shall be based on equipment named in the Drawing schedules. Submission of substitute items of equipment by, Contractor shall be in no way binding on the Engineer for acceptance. Final acceptance of all equipment and materials shall be made only after final test and acceptance of the project.

2.2 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.
- B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.
- C. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.
- D. Handle items of mechanical equipment carefully to prevent damage, breakage, denting, and scoring to components, enclosures, and finish. Do not install damaged equipment or components; return any damaged items to manufacturer and replace with new.

PART 3 - EXECUTION

3.1 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications for rough-in requirements.

3.2 MECHANICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other building components. Install all piping, conduit, duct and accessories to permit full access to all equipment, equipment access door, panels and covers. Engineer shall settle conflicts in the field at no cost to the owner.
 2. Verify all dimensions by field measurements.
 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 8. Install systems, materials, and equipment to conform with accepted submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements refer conflict to the Engineer for documented resolution prior to installation.
 9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.
 10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
 11. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "ACCESS DOORS" and Division 23 Section "BASIC MECHANICAL MATERIALS AND METHODS."
 12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
- C. Manufacturer's Equipment: Indicated equipment connections shown on the drawings are necessarily based on equipment of a given Manufacturer. Contractor assumes responsibility for proper arrangement of pipes, ducts, etc., to connect accepted equipment in a proper and accepted manner. Follow equipment Manufacturer's detailed instructions and recommendations in the installation and connection of all equipment. No equipment installation or connections shall be made in a manner that voids the Manufacturer's warranty or violates Code requirements.
- D. Provide sufficient safe and proper facilities at all times for the inspection of the work by the Engineer.
- E. Protect all work from damage and protect the Owner's property from injury or loss during the performance of the Contract. Make good any damage, injury or loss, except such as may be directly due to errors in the Contract Documents or caused by agents or employees of the Owner. Adequately protect adjacent property as provided by law and the Contract Documents. Provide and maintain all passageways, guard fences, lights and other facilities for protection required by public authority or local conditions.
- F. The Contractor shall be responsible for damage to the work of other Contractors or to the building, or to its contents, people, etc. which are caused by leaks in any of the equipment installed or due to material failures, disconnected pipes, fittings or over-flows, and shall make all repairs to merchandise, fixtures and equipment so damaged at no additional cost.

3.3 CUTTING AND PATCHING

- A. General: Perform cutting and patching in accordance with Division 1 Section "CUTTING AND PATCHING." In addition to the requirements specified in Division 1, the following requirements apply:
1. Protection of installed Work: During cutting and patching operations, protect adjacent installations.

- B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
 - 1. Uncover Work to provide for installation of ill-timed Work.
 - 2. Remove and replace defective Work.
 - 3. Remove and replace Work not conforming to requirements of the Contract Documents.
 - 4. Remove samples of installed Work as specified for testing.
 - 5. Install equipment and materials in existing structures.
- C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work.
- D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
 - 1. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched. Refer to Division 1 Section "DEFINITIONS AND STANDARDS" for definition of "experienced Installer."

3.4 NAMEPLATE DATA

- A. Provide permanent operational data nameplate on each item of power operated mechanical equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

3.5 MECHANICAL WORK CLOSEOUT

- A. General: Refer to the Division 1 sections for general closeout requirements. Maintain a daily log of operational data on mechanical equipment and systems through the closeout period: record hours of operation, assigned personnel, fuel consumption and similar information; submit copy to Owner.
- B. Equipment Start-up: Where specifically required, equipment shall not be placed in operation until a competent installation and service representative of the Manufacturer has made on-the-job inspection of the installation and has certified that the equipment is properly installed, adjusted and lubricated and that preliminary operating instructions have been given and the equipment is ready for operation.
- C. Closeout Equipment Systems Operations:
 - 1. Sequence operations properly so that work of project will not be damaged or endangered. Coordinate with seasonal requirements. Operate each item of equipment and each system in a test run of appropriate duration (with the Engineer present, and with the Owner's operating personnel present), to demonstrate sustained, satisfactory performance. Adjust and correct operations as required for proper performance. Clean and lubricate each system, and replace dirty filters, excessively worn parts and similar expendable items of the work.
 - 2. Operating Instructions: Conduct a 2-day walk-through instruction seminar for the Owner's personnel to be involved in the continued operation and maintenance of mechanical equipment and systems. Explain the identification system, operational diagrams, emergency and alarm provisions, sequencing requirements, seasonal provisions, security, safety, efficiency and similar features of the systems. Specific requirements where required, are listed in each individual spec section.
 - 3. Turn-Over of Operation: At the time of substantial completion, turn over the prime responsibility for operation of the mechanical equipment systems to the Owner's operating personnel. However, until the time of final acceptance, provide one full-time operating engineer, who is completely familiar with the work, to consult with and continue training the Owner's personnel. The contractor shall demonstrate the complete and correct operation of each piece of equipment and the total heating and air condition system. Also demonstrate the preventive maintenance and care of all equipment. No less than three

days of training. The Owner requires completed and accepted maintenance manual and notice seven days in advance.

D. Noise and Vibration:

1. General: All mechanical and electrical equipment and systems shall operate without objectionable noise and/or vibration as determined by Instruments and in the opinion of the Engineer.
2. If any objectionable noise or vibration is produced and transmitted to occupied portions of the building by equipment, apparatus, piping, ductwork, conduit, or other parts of mechanical and electrical work, or by any part of the building structure, the Contractor shall take immediate steps to correct the source of the noise and/or vibration or to completely isolate it in an accepted manner. Such necessary changes and/or additions shall be made without any additional cost.
3. The Contractor and the Manufacturers of all equipment furnished for the Project are herein charged with the responsibility of notifying the Engineer in writing of any condition that may exist which might produce objectionable noise and/or vibration within occupied spaces. Manufacturers are further specifically charged with the responsibility of advising the Engineer in writing of any equipment selections which may produce objectionable noise and/or vibration.

3.6 CLEANING

- A. Refer to the Division 1 Sections covering Project Closeout and/or Final Cleaning for general requirements for final cleaning.
- B. Refer to Division 23 Section: TESTING, ADJUSTING AND BALANCING for requirements for cleaning filters, strainers, and mechanical systems prior to final acceptance.

END OF SECTION

SECTION 23 0030

ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Related Sections: Separate electrical components and materials required for field installation and electrical connections are specified in Division 26.
- B. Refer to Division 23 Section "Motors" for requirements for motors furnished as part of mechanical equipment.

1.2 SUMMARY

- A. This section specifies the basic requirements for electrical wiring of mechanical equipment and for electrical components which are not an integral part of packaged mechanical equipment. These components include, but are not limited to motors, starters, disconnect switches, and control devices not furnished as an integral part of packaged mechanical equipment.
- B. Specific electrical requirements (i.e. horsepower and electrical characteristics) for mechanical equipment are scheduled on the Drawings, or specified within the individual equipment specification sections.
- C. It is the responsibility of the Division 23 Contractor, including all Manufacturers, Suppliers, and/or Sub-Contractors furnishing equipment to promptly and adequately notify the Division 26 Contractor of all electrical requirements for their equipment, including starters, disconnects, safety devices, controls, interlocks, power and control wiring.

1.3 REFERENCES

- A. NEMA Standards ICS 2: Industrial Control Devices, Controllers, and Assemblies.
- B. NEMA Standard 250: Enclosures for Electrical Equipment.
- C. NEMA Standard KS 1: Enclosed Switches.
- D. Comply with National Electrical Code (NFPA 70).

1.4 SUBMITTALS

- A. Submit product data for starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification sections.

1.5 QUALITY ASSURANCE

- A. All electrical components and materials shall be UL labeled.

PART 2 - PRODUCTS

2.1 ELECTRICAL WIRING

- A. Refer to Division 26 sections for the following work, which is defined as work of Division 26, unless otherwise specified:
 - 1. Power supply wiring from power source to power connection on mechanical equipment work of Division 26. Power supply wiring is defined to include starters, disconnects, and required electrical devices,

except where specified to be furnished or factory-installed by the manufacturer as part of his equipment.

2. Interlock wiring between electrically-operated equipment units: and between equipment and field-installed control devices is work of Division 26. Interlock wiring specified as factory-installed is work of the section where specified.
3. Control wiring between field-installed controls, indicating devices, and unit control panels is work of Division 23.

2.2 STARTERS, ELECTRICAL DEVICES, AND CONNECTIONS

- A. Motor Starter Manufacturer: Where an item of mechanical equipment must be integrally furnished with a motor starter, provide motor starters for mechanical equipment manufactured by one of the following:
 1. Siemens Co.
 2. Cutler-Hammer, Inc.
 3. General Electric Co.
 4. Square D Co.
- B. Motor Starter Characteristics:
 1. Enclosures: NEMA 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA 3R with conduit hubs.
 2. Type and size of starter shall be as recommended by motor manufacturer and the driven equipment manufacturer for applicable protection and start-up condition.
- C. Manual switches shall have:
 1. Pilot lights indicating ON position.
 2. Overload protection: Melting alloy type thermal overload relays.
- D. Magnetic Starters:
 1. Maintained contact push buttons and pilot lights, properly arranged for single speed or multi-speed operation as indicated.
 2. Trip-free thermal overload relays, each phase.
 3. Interlocks, pneumatic switches and similar devices as required for coordination with control requirements of Division 23 Controls sections.
 4. Built-in 120 volts control circuit transformer, fused from line side, where service exceeds 240 volts.
 5. Externally operated manual reset.
 6. Under-voltage release or protection.
- E. Motor connections:
 1. Flexible conduit, except where plug-in electrical cords are specifically indicated.

2.3 CAPACITORS

- A. Features:
 1. Individual unit cells
 2. All welded steel housing
 3. Each capacitor internally fused
 4. Non-flammable synthetic liquid impregnate
 5. Craft tissue insulation
 6. Aluminum foil electrodes
- B. KVAR size shall be as required to correct motor power factor to 90 percent or better and shall be installed on all motors 1 horsepower and larger, that have an uncorrected power factor of less than 85 percent at rated load.
- C. Disconnect Switches:

1. Fusible switches: Fused, each phase: heavy duty: horsepower rated; non-teasible quick-make, quick-break mechanism; dead front line side shield, solderless tugs suitable for copper or aluminum conductors; spring reinforced fuse clips; electro silver plated current carrying parts; hinged doors; operating lever arranged for locking in the "OPEN" position; arc quenchers; capacity and characteristics as indicated.
2. Non-fusible switches: For equipment 2 horsepower and smaller, shall be horsepower rated: toggle switch type; quantity of poles and voltage rating as indicated. For equipment larger than 2 horsepower, switches shall be the same as fusible type.

2.4 VARIABLE SPEED MOTOR CONTROLLERS

- A. General: Provided under Division 26.

2.5 EQUIPMENT FABRICATION

- A. General: Fabricate mechanical equipment for secure mounting of motors and other items included in the work. Provide either permanent alignment of motors with equipment, or adjustable mounting as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable and removable guards for motor drives, arranged for lubrication and similar running-maintenance without removal of guards.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL EQUIPMENT

- A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, securely anchored to resist torque, drive thrusts, and other external forces inherent in the mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws, except motors of 1/3 hp and less may be secured with Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

3.2 ELECTRICAL WIRING

- A. Verify that electrical wiring installation is in accordance with manufacturer's requirements and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to manufacturer of mechanical equipment.

END OF SECTION

SECTION 23 0050

BASIC MECHANICAL MATERIALS AND METHODS

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. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Mechanical sleeve seals.
 - 5. Sleeves.
 - 6. Escutcheons.
 - 7. Grout.
 - 8. Mechanical demolition.
 - 9. Equipment installation requirements common to equipment sections.
 - 10. Painting and finishing.
 - 11. Concrete bases.
 - 12. Supports and anchorages.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Piping materials.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Mechanical sleeve seals.
 - 5. Escutcheons.
 - 6. Supports and anchorages.

1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors shall be all aluminum, painted to match wall or ceiling color, sized for proper access to required items.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- C. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- E. Solvent Cements for Joining Plastic Piping:
 - 1. ABS Piping: ASTM D 2235.
 - 2. CPVC Piping: ASTM F 493.
 - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - 4. PVC to ABS Piping Transition: ASTM D 3138.

2.3 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser Industries, Inc.; DMD Div.
 - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson.
 - 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
 - 3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
 - 4. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Manufacturers:
 - a. Eslon Thermoplastics.
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Manufacturers:
 - a. Thompson Plastics, Inc.
- D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
 - 1. Manufacturers:
 - a. NIBCO INC.
 - b. NIBCO, Inc.; Chemtrol Div.
- E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.
 - 1. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Fernco, Inc.
 - c. Mission Rubber Company.

2.4 DIELECTRIC FITTINGS

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

- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
 - 1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Eclipse, Inc.
 - d. Epco Sales, Inc.
 - e. Hart Industries, International, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- E. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Manufacturers:
 - a. Perfection Corp.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Co., Inc.
 - d. Victaulic Co. of America.

2.5 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 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.

2.6 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.7 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Polished chrome-plated.
- E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.8 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000 psi, 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 MECHANICAL DEMOLITION

- A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.

- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - g. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
 - 2. Existing Piping: Use the following:
 - a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
 - b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge and spring clips.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - e. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
 - f. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
 - g. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. PVC Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.

T. Verify final equipment locations for roughing-in.

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

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Braze Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 - 5. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - 6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

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

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

- A. Painting of mechanical systems, equipment, and components is specified in Division 9.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3.

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS D1.1.

3.9 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.10 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION

SECTION 23 0071

MECHANICAL VIBRATION ISOLATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Elastomeric isolation pads and mounts.
2. Restrained elastomeric isolation mounts.
3. Freestanding and restrained spring isolators.
4. Housed spring mounts.
5. Elastomeric hangers.
6. Spring hangers.
7. Spring hangers with vertical-limit stops.
8. Thrust limits.
9. Pipe riser resilient supports.
10. Resilient pipe guides.
11. Freestanding and restrained air spring isolators.
12. Restrained vibration isolation roof-curb rails.
13. Restraining cables.
14. Steel and inertia, vibration isolation equipment bases.

1.2 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3.

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 manufacturers specified.

2.2 VIBRATION ISOLATORS

A. Available Manufacturers:

1. Ace Mounting Co., Inc.
2. Amber/Booth Company, Inc.
3. B-Line Systems, Inc.
4. California Dynamics Corp.
5. Isolation Technology, Inc.

6. Kinetics Noise Control, Inc.
 7. Mason Industries, Inc.
 8. Vibration Eliminator Co., Inc.
 9. Vibration Isolation Co., Inc.
 10. Vibration Mountings & Controls/Korfund.
- B. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
1. Material: Standard neoprene.
- C. Elastomeric Mounts Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
- D. 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 the 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 100 psig (690 kPa).
 6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- E. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.
1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
 2. Base: Factory drilled for bolting to structure.
 3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch (6-mm) travel before contacting a resilient collar.
- F. Elastomeric Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.
- G. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation for compliance with requirements, installation tolerances, and other conditions affecting performance.
- 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 INSTALLATION

- A. Roof curbs to be installed by metal building manufacturer.
- B. Install thrust limits at centerline of thrust, symmetrical on either side of equipment.

3.3 CLEANING

- A. After completing equipment installation, inspect vibration isolation devices. Remove paint splatters and other spots, dirt, and debris.

END OF SECTION

SECTION 23 0075

MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following mechanical identification materials and their installation:

1. Equipment nameplates.
2. Equipment markers.
3. Equipment signs.
4. Access panel and door markers.
5. Pipe markers.
6. Duct markers.
7. Stencils.
8. Valve tags.
9. Valve schedules.
10. Warning tags.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with location of access panels and doors.

- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
 - 1. Data:
 - a. Manufacturer, product name, model number, and serial number.
 - b. Capacity, operating and power characteristics, and essential data.
 - c. Labels of tested compliances.
 - 2. Location: Accessible and visible.
 - 3. Fasteners: As required to mount on equipment.
- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
 - 1. Terminology: Match schedules as closely as possible.
 - 2. Data:
 - a. Name and plan number.
 - b. Equipment service.
 - c. Design capacity.
 - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
 - 3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
- C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
 - 1. Data: Instructions for operation of equipment and for safety procedures.
 - 2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
 - 3. Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
 - 4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.
- D. Access Panel and Door Markers: 1/16-inch-thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.
 - 1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.2 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
 - 1. Colors: Comply with ASME A13.1, unless otherwise indicated.
 - 2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
 - 3. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers extending 360 degrees around pipe at each location.
 - 4. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
 - 5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
- B. Pre-tensioned Pipe Markers: Pre-coiled semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.
- C. Shaped Pipe Markers: Preformed semi-rigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.
- D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.
- E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils (0.08 mm) thick with pressure-sensitive, permanent-type, self-adhesive back.
 - 1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
 - 2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

2.3 DUCT IDENTIFICATION DEVICES

- A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

2.4 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door markers, equipment markers, equipment signs, and similar operational instructions.
 - 1. Stencil Material: Metal or fiberboard.

2. Stencil Paint: Exterior, gloss, alkyd enamel black, unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.

2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers, with numbering scheme approved by Architect. Provide 5/32-inch (4-mm) hole for fastener.
 1. Material: 0.032-inch- (0.8-mm-) thick brass.
 2. Material: 0.0375-inch- (1-mm-) thick stainless steel.
 3. Material: 3/32-inch- (2.4-mm-) thick laminated plastic with 2 black surfaces and white inner layer.
 4. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

2.6 VALVE SCHEDULES

- A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
 2. Frame: Extruded aluminum.
 3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.7 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
 1. Size: Approximately 4 by 7 inches (100 by 178 mm).
 2. Fasteners: Brass grommet and wire
 3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
 4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
 - 1. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
 - 2. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 - 3. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
 - 4. Fans, blowers, primary balancing dampers, and mixing boxes.
 - 5. Packaged HVAC central-station and zone-type units.
- B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
 - 1. Letter Size: Minimum 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
 - 3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
 - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
 - b. Fire department hose valves and hose stations.
 - c. Meters, gages, thermometers, and similar units.
 - d. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
 - e. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 - f. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
 - g. Fans, blowers, primary balancing dampers, and mixing boxes.
 - h. Packaged HVAC central-station and zone-type units.
 - i. Tanks and pressure vessels.
 - j. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
- C. Stenciled Equipment Marker Option: Stenciled markers may be provided instead of laminated-plastic equipment markers, at Installer's option, if lettering larger than 1 inch (25 mm) high is needed for proper identification because of distance from normal location of required identification.

- D. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.
1. Identify mechanical equipment with equipment markers in the following color codes:
 - a. Green: For cooling equipment and components.
 - b. Yellow: For heating equipment and components.
 - c. Orange: For combination cooling and heating equipment and components.
 - d. Brown: For energy-reclamation equipment and components.
 2. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
 4. Include signs for the following general categories of equipment:
 - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
 - b. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
 - c. Pumps, compressors, chillers, condensers, and similar motor-driven units.
 - d. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
 - e. Fans, blowers, primary balancing dampers, and mixing boxes.
 - f. Packaged HVAC central-station and zone-type units.
 - g. Tanks and pressure vessels.
 - h. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
- E. Stenciled Equipment Sign Option: Stenciled signs may be provided instead of laminated-plastic equipment signs, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.
- F. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pre-tensioned pipe markers. Use size to ensure a tight fit.
 2. Pipes with OD, Including Insulation, 6 Inches and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.
- B. Stenciled Pipe Marker Option: Stenciled markers may be provided instead of manufactured pipe markers, at Installer's option. Install stenciled pipe markers with painted, color-coded bands or rectangles on each piping system.
1. Identification Paint: Use for contrasting background.
 2. Stencil Paint: Use for pipe marking.

- C. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:
1. Near each valve and control device.
 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 5. Near major equipment items and other points of origination and termination.
 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.4 DUCT IDENTIFICATION

- A. Install duct markers with permanent adhesive on air ducts in the following color codes:
1. Green: For cold-air supply ducts.
 2. Yellow: For hot-air supply ducts.
 3. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
 5. Letter Size: Minimum 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- B. Stenciled Duct Marker Option: Stenciled markers, showing service and direction of flow, may be provided instead of laminated-plastic duct markers, at Installer's option, if lettering larger than 1 inch (25 mm) high is needed for proper identification because of distance from normal location of required identification.
- C. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:
1. Valve-Tag Size and Shape:
 - a. Cold Water: 1-1/2 inches (38 mm) round.

- b. Hot Water: 1-1/2 inches (38 mm) round
- c. Gas: 1-1/2 inches (38 mm) and 2 inches (50 mm) round

3.6 VALVE-SCHEDULE INSTALLATION

- A. Mount valve schedule on wall in accessible location in each major equipment room.

3.7 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

3.8 ADJUSTING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.9 CLEANING

- A. Clean faces of mechanical identification devices.

END OF SECTION

SECTION 23 0100

VALVES

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 this section.
- B. Requirements of the following Division 23 Sections apply to this section:
 - 1. "Basic Mechanical Requirements"
 - 2. "Basic Mechanical Materials and Methods"

1.2 SUMMARY

- A. This Section includes general duty valves common to most mechanical piping systems.
 - 1. Special purpose valves are specified in individual piping system specifications.
- B. Valve tags and charts are specified in Division 23 Section "MECHANICAL IDENTIFICATION."

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data, including body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions.

1.4 QUALITY ASSURANCE

- A. Single Source Responsibility: Comply with the requirements specified in Division 1 Section – "MATERIALS AND EQUIPMENT" under - Source Limitations.
- B. American Society of Mechanical Engineers (ASME) Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.
- C. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Compliance: Comply with the various MSS Standard Practices referenced.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves for shipping as follows:
 - 1. Ensure valves are dry and internally protected against rust and corrosion.
 - 2. Protect valve ends against damage to threads, flange faces, and weld-end preps.
 - 3. Set valves in best position for handling. Set globe and gate valves closed to prevent rattling; set ball and plug valves open to minimize exposure of functional surfaces; set butterfly valves closed or slightly open; and block swing check valves in either closed or open position.
- B. Storage: Use the following precautions during storage:
 - 1. Do not remove valve end protectors unless necessary for inspection; then reinstall for storage.

2. Protect valves from weather. Store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement in watertight enclosures.
- C. Handling: Use a sling to handle valves whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels and stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products from one of the manufacturers listed in valve schedule.

2.2 VALVE FEATURES, GENERAL

- A. Valve Design: Rising stem or rising outside screw and yoke stems.
1. Non-rising stem valves may be used where headroom prevents full extension of rising stems.
- B. Pressure and Temperature Ratings: As scheduled and required to suit system pressures and temperatures.
- C. Sizes: Same size as upstream pipe, unless otherwise indicated.
- D. Operators: Provide the following special operator features:
1. Handwheels, fastened to valve stem, for valves other than quarter turn.
 2. Lever handles, on quarter-turn valves 3-inch and smaller, except for plug valves. Provide plug valves with square heads: provide one wrench for every 10 plug valves.
 3. Chain-wheel operators, for valves 2-1/2-inch and larger, install 72 inches or higher above finished floor elevation. Extend chains to an elevation of 5'-0" above finished floor elevation.
 4. Gear drive operators, on quarter-turn valves.
- E. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.
- F. Bypass and Drain Connections: Comply with MSS SP-45 bypass and drain connections.
- G. End Connections: As indicated in the valve specifications.
1. Threads: Comply with ANSI B1.20.1.
 2. Flanges: Comply with ANSI B16.1 for cast iron, ANSI 816.5 for steel, and ANSI B16.24 for bronze valves.
 3. Solder-Joint: Comply with ANSI B16.16.
 - a. Caution: Where soldered end connections are used, use solder having a melting point below 840 deg F for gate, globe, and check valves; below 421 deg F for ball valves.

2.3 GATE VALVES

- A. Gate Valves, 2-Inch and Smaller: MSS SP-80; Class 150, body and union bonnet of ASTM B 62 cast bronze; with threaded or solder ends, solid disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel. Do not use solder end valves for hot water heating applications.

- B. Gate Valves, 2-1/2-Inch and Larger: MSS SP-70: Class 150 iron body, bronze mounted, with body and bonnet conforming to ASTM A 126 Class B; with flanged ends, "Teflon" impregnated packing, and two-piece backing gland assembly.

2.4 BALL VALVES

- A. Ball Valves. 600 WOG. 316 S.S. ball & stem with extended stem on insulated piping. Apollo 7014_04, Jamesbury 356 or Stockham S216BRIRT.

2.5 PLUG VALVES

- A. Plug Valves, 2-Inch and Smaller: Rated at 150 psi WOG, bronze body, with straightaway pattern, square head and threaded ends.
- B. Plug Valves, 2-1/2-Inch and Larger: MSS SP-78; rated at 175 psi WOG; lubricated plug type, with semi-steel body, single gland, wrench operated, and flanged ends.

2.6 GLOBE VALVES

- A. Globe Valves, 2-Inch and Smaller: MSS SP-80: Class 150: body and screwed bonnet of ASTM B 62 cast bronze: with threaded or solder ends, brass or replaceable composition disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel. Provide Class 150 valves meeting the above where system pressure requires.
- B. Globe Valves, 2-1/2-Inch and Larger: MSS SP-85: Class 150 iron body and bolted bonnet conforming to ASTM A 126, Class B; with outside screw and yoke, bronze mounted, flanged ends, and "Teflon" impregnated packing, and two-piece backing gland assembly.

2.7 BUTTERFLY VALVES

- A. Butterfly Valves. Cast-Iron Body, lug type, EPDM seat & body liner, 316 S.S. Extended shaft, Aluminum bronze disc with gear operator (Chain operator if 84 inches AFP.) 1501b permanent open end shut off. Centerline series 200.
- B. Butterfly Valves, 2-1/2-Inch and Larger: MSS SP-67; rated at 200 psi: cast-iron body conforming to ASTM A 126, Class B. Provide valves with field replaceable EPDM sleeve, stainless steel stem, and EPDM O-ring stem seals. Provide lever operators with locks for sizes through 3 inches and gear operators with position indicator for sizes 4 through 12 inches. Provide lug type only. Valves to be designed for dead end service.

2.8 CHECK VALVES

- A. Swing Check Valves, 2-Inch and Smaller: MSS SP-80i Class 150, cast-bronze body and cap conforming to ASTM B 62; with horizontal swing, Y-pattern, and bronze disc; and having threaded or solder ends. Provide valves capable of being reground while the valve remains in the line. Provide Class 150 valves meeting the above specifications, with threaded end connections, where system pressure requires or where Class 125 valves are not available.
- B. Swing Check Valves, 2-1/2-Inch and Larger: MSS SP-71; Class 150 (Class 175 FM approved for fire protection piping systems), cast iron body and bolted cap conforming to ASTM A 126, Class B; horizontal swing, and bronze disc or cast-iron disc with bronze disc ring, and flanged ends. Provide valves capable of being refitted while the valve remains in the line.

- C. Wafer Check Valves: Class 250, cast-iron body; with replaceable bronze seat, and non-slam design lapped and balanced twin bronze flappers and stainless steel trim and torsion spring. Provide valves designed to open and close at approximately one foot differential pressure.
- D. Lift Check Valves, 2-Inch and Smaller: Class 150; cast-bronze body and cap conforming to ASTM B 62; horizontal or angle pattern, lift-type valve, with stainless steel spring, bronze disc holder with renewable "Teflon" disc, and threaded ends. Provide valves capable of being refitted and ground while the valve remains in the line.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior through the end ports for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks used to prevent disc movement during shipping and handling.
- B. Actuate valve through an open-close and close-open cycle. Examine functionally significant features, such as guides and seats made accessible by such actuation. Following examination, return the valve closure member to the shipping position.
- C. Examine threads on both the valve and the mating pipe for form (i.e., out-of-round or local indentation) and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.
- E. Prior to valve installation, examine the piping for cleanliness, freedom from foreign materials, and proper alignment.
- F. Replace defective valves with new valves.

3.2 VALVE ENDS SELECTION

- A. Select valves with the following ends or types of pipe/tube connections:
 - 1. Copper Tube Size, 2-Inch and Smaller: Solder ends, except provide threaded ends for hot water heating.
 - 2. Steel Pipe Sizes, 2-Inch and Smaller: threaded end.
 - 3. Steel Pipe Sizes 2-1/2 Inch and Larger: flanged.

3.3 VALVE INSTALLATIONS

- A. Valves to be installed at each branch, riser and to isolate each floor, also each piece of equipment. Valves are to be accessible from the floor or install a chain operator. Valves above a hard ceiling to have an access door with a complete description of the valves function written on the backside in one inch bold lettering.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves and unions for each fixture and item of equipment arranged to allow equipment removal without system shutdown. Unions are not required on flanged devices.

- D. Install three-valve bypass around each pressure reducing valve using throttling-type valves.
- E. Install valves in horizontal piping with stem at or above the center of the pipe.
- F. Install valves in a position to allow full stem movement.
- G. Installation of Check Valves: Install for proper direction of flow as follows:
 - 1. Swing Check Valves: Horizontal position with hinge pin level.
 - 2. Wafer Check Valves: Horizontal or vertical position, between flanges.
 - 3. Lift Check Valve: With stem upright and plumb.

3.4 SOLDER CONNECTIONS

- A. Cut tube square and to exact lengths.
- B. Clean end of tube to depth of valve socket with steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket in same manner.
- C. Apply proper soldering flux in an even coat to inside of valve socket and outside of tube.
- D. Open gate and globe valves to full open position.
- E. Remove the cap and disc holder of swing check valves having composition discs.
- F. Insert tube into valve socket, making sure the end rests against the shoulder inside valve. Rotate tube or valve slightly to ensure even distribution of the flux.
- G. Apply heat evenly to outside of valve around joint until solder will melt upon contact. Feed solder until it completely fills the joint around tube. Avoid hot spots or overheating valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush.

3.5 THREADED CONNECTIONS

- A. Note the internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.
- B. Align threads at point of assembly.
- C. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).
- D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.6 FLANGED CONNECTIONS

- A. Align flange surfaces parallel.
- B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.
- C. For dead-end service, butterfly valves require flanges both upstream and downstream for proper shutoff and retention.

3.7 FIELD QUALITY CONTROL

- A. Tests: After piping systems have been tested and put into service, but before final adjusting and balancing, inspect valves for leaks. Adjust or replace packing to stop leaks; replace valves if leak persists.

3.8 ADJUSTING AND CLEANING

- A. Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare valves to receive finish painting or insulation.

3.9 VALVE PRESSURE / TEMPERATURE CLASSIFICATION SCHEDULES

A. VALVES, 2-INCH AND SMALLER

<u>SERVICE</u>	<u>GATE</u>	<u>GLOBE</u>	<u>BALL</u>	<u>CHECK</u>
Chilled Water	--	150	600	150
Domestic Hot and Cold Water	--	150	600	150
Hot Water Heating	--	150	600	150

B. VALVES, 2 1/2-INCH AND LARGER

<u>SERVICE</u>	<u>GATE</u>	<u>GLOBE</u>	<u>BUTTERFLY</u>	<u>CHECK</u>
Chilled Water	--	150	200	150
Domestic Hot and Cold Water	--	150	200	150
Hot Water Heating	--	150	200	150

3.10 VALVE SCHEDULE

A. Gate Valves - 2 Inch and Smaller:

<u>MANUFACTURER</u>	<u>THREADED NRS</u>	<u>THREADED RS</u>	<u>SOLDER NRS</u>	<u>SOLDER RS</u>
Crane	438	428	1701S	1700S
Grinnell	3000	3010	3000SJ	3010SJ
Hammond	IB645	IB640	IB647	IB635
Jenkins	370	47	1240	1242
Lunkenheimer	2129	2127	2133	2132
Milwaukee	105	148	115	1149
Powell	507	500	1822	1821
Stockham	B-103	B-100	B-104	B-108

B. Gate Valves – 2 Inch and Smaller:

<u>MANUFACTURER</u>	<u>THREADED NRS</u>	<u>THREADED RS</u>	<u>SOLDER NRS</u>	<u>SOLDER RS</u>
Crane	x	431UB	x	x
Grinnell	3050	3060	x	x
Hammond	IB637	IB629	x	IB648
Jenkins	x	47U	x	x
Lunkenheimer	3153	3151	3154	3155

Milwaukee	x	1151	x	1169
Powell	2712	2714	x	1842
Stockham	B-130	B-120	x	B-124

1. x means not available.

C. Gate Valves – 2 ½ Inch and Larger:

<u>MANUFACTURER</u>	<u>OS&Y RS</u>	<u>NRS</u>
Crane	465-1/2	461
Grinnell	6020A	6060A
Hammond	IR1140	IR1138
Jenkins	651A	326
Lunkenheimer	1430	1428
Milwaukee	F2885	F2882
Stockham	G623	G612
Powell	1793	1787

D. Ball Valves

<u>MANUFACTURER</u>	<u>THREADED ENDS</u>	<u>SOLDER ENDS</u>
Jamesbury	356	x
Stockham	S-216 BR1RT	S-216 BR-R-S
Apollo	7014-04	

1. x means not available.
2. For grooved end connections, use Victaulic Style 721.

E. Plug Valves – 2 Inch and Smaller:

1. Lunkenheimer: 454.

F. Plug Valves – 2 ½ Inch and Larger:

1. Powell: 2201.

G. Globe Valves – 2 Inch and Smaller:

<u>MANUFACTURER</u>	CLASS 150 <u>THREADED</u>	CLASS 150 <u>SOLDER</u>	CLASS 150 <u>THREADED</u>
Crane	1	1310	17TF
Grinnell	3210	3210SJ	3240
Hammond	IB440	IB423	IB413T
Jenkins	746	1200	106-A-2
Lunkenheimer	2140	2146	407
Milwaukee	502	1502	590
Powell	650	1823	150
Stockham	B-16	B-14T	B-22

H. Globe Valves – 2 ½ Inch and Larger:

<u>MANUFACTURER</u>	<u>STRAIGHT BODY</u>	<u>ANGLE BODY</u>
Crane	351	353
Grinnell	6200A	x
Hammond	IR116	IR118
Jenkins	613	x
Lunkenheimer	1123	1124
Milwaukee	F2981	F2986
Powell	241	243
Stockham	G-512	G-515

I. Butterfly Valves 2 ½ Inch and Larger:

1. Grooved Ends: Victaulic Series 300 and 704 – fire system only.
2. The following are model numbers for lug-type, with aluminum-bronze disc:

<u>MANUFACTURER</u>	<u>LEVER</u>	<u>GEAR</u>
Center Line	Series 200	Series 200

3. Grooved Ends: Victaulic Series 300A, 700A, and 703A. Fire systems only.

J. Swing Check Valves – 2 Inch and Smaller:

<u>MANUFACTURER</u>	CLASS 150 THREADED <u>ENDS</u>	CLASS 150 SOLDER <u>ENDS</u>	CLASS 150 THREADED <u>ENDS</u>
Crane	37	1342	137
Grinnell	3300	3300SJ	3320
Hammond	IB940	IB941	IB946
Jenkins	92-A	1222	92-A
Lunkenheimer	2144	2145	230-70
Milwaukee	509	1509	510
Powell	578	1825	596
Stockham	B-319	B-309	B-321

K. Check Valves – 2.5 Inches and Larger to be full body wafer check DI, body, EPDM full body liner, 316 S.S. shaft and aluminum bronze plates.

L. Wafer Check Valves:

1. Center Line: CLC Series 800

M. Lift Check Valves 2 Inch and Smaller:

<u>MANUFACTURER</u>	<u>HORIZONTAL</u>	<u>ANGLE</u>
Hammond	x	IB954
Jenkins	655-A	x
Lunkenheimer	233	x

1. x means not available.

END OF SECTION

23 0100-9

SECTION 23 0170
ELECTRICAL MOTORS

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 this Section.

1.2 SUMMARY

- A. This Section includes basic requirements for electrical motors. It includes field-installed motors, but does not include motors that are factory installed as part of equipment and appliances.
- B. Related Sections include the following:
 - 1. Division 23 Sections for application of motors and reference to specific motor requirements for motor-driven equipment.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 70, "National Electrical Code."
- B. NRTL Listing: Provide NRTL listed motors.
 - 1. Term "Listed": As defined in "National Electrical Code," Article 100.
 - 2. Listing Agency Qualifications; "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7,
- C. Comply with NEMA MG 1, "Motors and Generators."
- D. Comply with UL 1004, "Motors, Electric."

1.4 SUBMITTALS

- A. Product Data: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.
- B. Factory Test Reports: For specified tests.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

PART 2 - PRODUCTS

2.1 BASIC MOTOR REQUIREMENTS

- A. Basic requirements apply to mechanical equipment motors unless otherwise indicated.
- B. Frequency Rating: 60 Hz.
- C. Voltage Rating: Determined by voltage of circuit to which motor is connected for the following motor voltage ratings (utilization voltages);
 - 1. 120V Circuit: 115V-motor rating.
 - 2. 208V Circuit: 200 V-motor rating.

3. 240V Circuit: 230 V-motor rating.
4. 480V Circuit: 460 V-motor rating.

- D. Service factors: According to NEMA MG 1, unless otherwise indicated.
- E. Capacity and Torque Characteristics: Sufficient to start and operate connected loads at designated speeds in indicated environment, and with indicated operating sequence, without exceeding nameplate ratings. Provide motors rated for continuous duty at 100 percent of rated capacity.
- F. Temperature Rise: Based on 40 deg C ambient unless otherwise indicated.
 1. Enclosure: Open drip-proof, unless otherwise indicated.

2.2 POLYPHASE MOTORS

- A. General: Squirrel-cage induction-type conforming to the following requirements unless otherwise indicated.
- B. NEMA Design Characteristic: Design B, unless otherwise indicated.
- C. Energy Efficient Motors: 100% load efficiency equal to or greater than that stated in current edition of NEMA MG 1, table 12-10 for that type and rating of motor.
- D. Variable Speed Motors for Use With Solid-State Drives: Energy efficient, squirrel-cage induction class F INSULATION, 1,600 volts spike capacity, design B units with ratings, characteristics, and features coordinated with and approved by drive manufacturer.
- E. Internal Thermal Overload Protection For Motors: For motors so indicated, protection automatically opens control circuit arranged for external connection. Protection operates when winding temperature exceeds safe value calibrated to the temperature rating of the motor insulation.
- F. Bearings: Double-shielded, pre-lubricated ball bearings suitable for radial and thrust loading of the application.

2.3 SINGLE-PHASE MOTORS

- A. General: Conform to the following requirements unless otherwise indicated.
- B. Energy Efficient Motors: One of the following types as selected to suit the starting torque and other requirements of the specific motor application.
 1. Permanent Split Capacitor.
 2. Split-Phase Start, Capacitor-Run.
 3. Capacitor-Start, Capacitor-Run.
- C. Shaded-Pole Motors: Use only for motors smaller than 1/20 hp.
- D. Internal Thermal Overload Protection for Motors: For motors so indicated, protection automatically opens the power supply circuit to the motor, or a control circuit arranged for external connection. Protection operates when winding temperature exceeds a safe value calibrated to the temperature rating of the motor insulation. Provide device that automatically resets when motor temperature returns to normal range unless otherwise indicated.
- E. Bearings, belt connected motors and other motors with high radial forces on motor shaft shall be ball bearing type. Sealed, pre-lubricated sleeve bearings may be used for other single phase motors.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: The following requirements apply to field-installed motors.
- B. Install motors in accordance with manufacturer's published instructions and the following:
 - 1. Direct Connected Motors: Mount securely in accurate alignment.
 - 2. Belt Drive Motors: Use adjustable motor mounting bases. Align pulleys and install belts. Use belts identified by the manufacturer and tension belts in accordance with manufacturer recommendations.

END OF SECTION

SECTION 23 0250
MECHANICAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes piping, ductwork, and equipment insulation.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 23 Section "Supports and Anchors" for pipe insulation shields and protection saddles.
 - 2. Division 23 Section "Ductwork".

1.3 DEFINITIONS

- A. Hot Surfaces: Normal operating temperatures of 100 deg F or higher.
- B. Cold Surfaces: Normal operating temperatures of 75 deg F or lower.
- C. Thermal Resistivity: "R-values" represent the reciprocal of thermal conductivity (k-value). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between two exposed faces required to cause one Btu to flow through one square foot of material, in one hour, at a given mean temperature.
- D. Density: Is expressed in lbs/cubic feet (pcf).

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of mechanical insulation identifying k-value, thickness, and accessories.
- C. Samples of each type of insulation and jacket. Identify each sample describing product and intended use. Submit the following sizes of sample materials:
 - 1. Board and Block insulation: 12-inch square section.
 - 2. Pre-Formed Pipe Insulation: 12 inches long, 2-inch NPS.
- D. Material certificates, signed by the manufacturer, certifying that materials comply with specified requirements where laboratory test reports cannot be obtained.
- E. Material test reports prepared by a qualified independent testing laboratory. Certify insulation meets specified requirements.

1.5 QUALITY ASSURANCE

- A. Fire Performance Characteristics: Conform to the following characteristics for insulation including facings, cements, and adhesives when tested according to ASTM E 84, by UL or other testing or inspecting

organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.

1. Interior Insulation: Flame spread rating of 25 or less and a smoke developed rating of 50 or less.
2. Exterior Insulation: Flame spread rating of 75 or less and a smoke developed rating of 150 or less.

1.6 SEQUENCING AND SCHEDULING

- A. Schedule insulation application after testing of piping and duct systems.
- B. Schedule insulation application after installation and testing of electrical heat trace tape.

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:
 1. Glass Fiber:
 - a. CertainTeed Corporation.
 - b. Knauf Fiberglass GmbH.
 - c. Schuller International, Inc.
 - d. Owens-Corning Fiberglas Corporation.
 2. Cellular Glass:
 - a. Pittsburg Corning Corporation.
 3. Flexible Elastomeric Cellular:
 - a. Armstrong World Industries, Inc.
 - b. Hatstead Industrial Products.
 - c. IMCOA.
 - d. Rubatex Corporation.
 4. Calcium Silicate:
 - a. Schuller International, Inc.
 - b. Owens-Corning Corporation.
 5. Acoustical Liner:
 - a. "ToughGuard with Enhanced Surface" by CertainTeed Corporation.
 - b. "Permacote Linacoustic" by Johns Manville.
 - c. "Aeroflex Plus" by Owens-Corning.

2.2 GLASS FIBER

- A. Material: Inorganic glass fibers, bonded with a thermosetting resin.
- B. Jacket: All-purpose, factory-applied, laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil having self-sealing lap.
- C. Board: ASTM C 612, Class 2, semi-rigid jacketed board.
 1. Thermal Conductivity: 0.26 average maximum, at 75 deg F mean temperature.
 2. Density: 12 pcf average maximum.
- D. Blanket: ASTM C 553, Type II, Class F-1, jacketed flexible blankets.
 1. Thermal Conductivity: 0.32 average maximum, at 75 deg F mean temperature.
- E. Preformed Pipe Insulation: ASTM C 547, Class 1, rigid pipe insulation, jacketed.
 1. Thermal Conductivity: 0.26 average maximum at 75 deg F mean temperature.
 2. Density: 10 average maximum.

- F. Adhesive: Produced under the UL Classification and Follow-up service.
 - 1. Type: Non-flammable, solvent-based.
 - 2. Service Temperature Range: Minus 20 to 180 deg F.
- G. Vapor Barrier Coating: Waterproof coating recommended by insulation manufacturer for outside service.

2.3 CELLULAR GLASS

- A. Material: Inorganic, foamed or cellulated glass, annealed, rigid, hermetically sealed cells, incombustible.
- B. Facing: ASTM C 921, Type 1, factory-applied, laminated foil, flame-retardant, vinyl facing.
- C. Form: The following as indicated:
 - 1. Blocks: ASTM C 552, Type 1.
 - 2. Boards; ASTM C 552, Type IV.
 - 3. Preformed Pipe: ASTM C 552, Type II, Class 2 (jacketed).
 - 4. Special Shapes: ASTM C 552, Type III, in shapes and thickness as indicated.
- D. Thermal Conductivity: 0.38 average maximum at 75 deg F mean temperature.
- E. Minimum Density: 7 pcf.
- F. Maximum Density: 9.5 pcf.

2.4 FLEXIBLE ELASTOMERIC CELLULAR

- A. Material: Flexible expanded closed-cell structure with smooth skin on both sides.
 - 1. Tubular Materials: ASTM C 534, Type 1.
 - 2. Sheet Materials: ASTM C 534, Type II.
- B. Thermal Conductivity: 0.30 average maximum at 75 deg F.
- C. Coating: Water based latex enamel coating recommended by insulation manufacturer.

2.5 INSULATING CEMENTS

- A. Mineral Fiber: ASTM C 195.
 - 1. Thermal Conductivity: 1.0 average maximum at 500 deg F mean temperature.
 - 2. Compressive Strength: 10 psi at 5 percent deformation.
- B. Expanded or Exfoliated Vermiculite: ASTM C 196.
 - 1. Thermal Conductivity: 1.10 average maximum at 500 deg F mean temperature.
 - 2. Compressive Strength: 5 psi at 5 percent deformation.
- C. Mineral Fiber, Hydraulic-Setting Insulating and Finishing Cement: ASTM C 449.
 - 1. Thermal Conductivity: 1.2 average maximum at 400 deg F mean temperature.
 - 2. Compressive Strength: 100 psi at 5 percent deformation.

2.6 ADHESIVES

- A. Flexible Elastomeric Cellular Insulation Adhesive: Solvent-based, contact adhesive recommended by insulation manufacturer.
- B. Lagging Adhesive: MIL-A-3316C, non-flammable adhesive in the following Classes and Grades:

1. Class 1, Grade A for bonding glass cloth and tape to unfaced glass fiber insulation, sealing edges of glass fiber insulation, and bonding lagging cloth to unfaced glass fiber insulation.
2. Class 2, Grade A for bonding glass fiber insulation to metal surfaces.

2.7 JACKETS

- A. General: ASTM C 921, Type 1, except as otherwise indicated.
- B. Foil and Paper Jacket: Laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.
 1. Water Vapor Permeance: 0.02 perm maximum, when tested according to ASTM E 96.
 2. Puncture Resistance: 50 beach units minimum, when tested according to ASTM D 781.
- C. Aluminum Jacket: ASTM B 209, 3003 Alloy, H-14 temper, factory cut and rolled to indicated sizes.
- D. PVC Jacket: Bright high-gloss white coloring, 25 Flame Spread, 50 Smoke Developed, indoor/outdoor grade.
 1. Water Vapor Permeance: 0.19 perm maximum, when tested according to ASTM E 96.
 2. Puncture Resistance: 78 beach units minimum, when tested according to ASTM D 781.

2.8 ACCESSORIES AND ATTACHMENTS

- A. Glass Cloth and Tape: Woven glass fiber fabrics, plain weave, presized a minimum of 8 ounces per sq. yd.
 1. Tape Width: 4 inches.
 2. Cloth Standard: MIL-C-20079H, Type I.
 3. Tape Standard: MIL-C-20079H, Type II.
- B. Bands: 3M-inch wide, in one of the following materials compatible with jacket.
 1. Stainless Steel: Type 304, 0.020 inch thick.
 2. Galvanized Steel: 0.005 inch thick.
 3. Aluminum: 0.007 inch thick.
 4. Brass: 0.01 inch thick.
 5. Nickel-Copper Alloy: 0.005 inch thick.
- C. Wire: 14-gage nickel copper alloy, 16-gage, soft-annealed stainless steel, or 16-gage, soft-annealed galvanized steel.
- D. Corner Angles: 28-gage. 1-inch by 1-inch aluminum, adhered to 2-inch by 2-inch kraft paper.
- E. Anchor Pins: Capable of supporting 20 pounds each. Provide anchor pins and speed washers of sizes and diameters as recommended by the manufacturer for insulation type and thickness.

2.9 SEALING COMPOUNDS

- A. Vapor Barrier Compound: Water-based, fire-resistive composition.
 1. Water Vapor Permeance: 0.08 perm maximum.
 2. Temperature Range: Minus 20 to 180 deg F.
- B. Weatherproof Sealant: Flexible-elastomer-based, vapor-barrier sealant designed to seal metal joints.
 1. Water Vapor Permeance: 0.02 perm maximum.
 2. Temperature Range: Minus 50 to 250 deg F.
 3. Color: Aluminum.

2.10 INTERNAL DUCT LINER

- A. General: Comply with NFPA Standard 90A and TIMA Standard AHC-101.

- B. Materials: ASTM C 1071, Type II, with coated surface exposed to airstream to prevent erosion of glass fibers. Liner shall be suitable for velocities up to 5,000 ft/min.
1. Thickness: one (1") inch, unless otherwise indicated.
 2. Density: 1.5 pcf.
 3. Coating: Air side shall have an acrylic or neoprene coating treated with anti-microbial agent proven to resist microbial growth as determined by ASTM G 21.
 4. Acoustics: Duct liner shall have a minimum noise reduction coefficient of 0.70 based on "type A mounting" and tested in accordance with ASTM C 423.
 5. Thermal Performance: "K-Factor" equal to 0.28 or better, at a mean temperature of 75 deg F.
 6. Fire Hazard Classification: Flame spread rating of not more than 25 without evidence of continued progressive combustion and a smoke developed rating of no higher than 50, when tested in accordance with ASTM C 411.
 7. Liner Adhesive: Comply with NFPA Standard 90A and ASTM C 916.
 8. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct. Provide fasteners that do not damage the liner when applied as recommended by the manufacturer, that do not cause leakage in the duct, and will indefinitely sustain a 50-pound tensile dead load test perpendicular to the duct wall.
 - a. Fastener Pin Length: As required for thickness of insulation, and without projecting more than 1/8 inch into the air stream.
 - b. Adhesive For Attachment of Mechanical Fasteners: Comply with the "Fire Hazard Classification" of duct liner system.

2.11 FIRE-RATED INSULATION SYSTEMS

- A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is UL tested and certified to provide a 2-hour fire rating.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean, dry, and remove foreign materials such as rust, scale, and dirt.
- B. Mix insulating cements with clean potable water. Mix insulating cements contacting stainless-steel surfaces with de-mineralized water.
1. Follow cement manufacturer's printed instructions for mixing and portions.

3.2 INSTALLATION, GENERAL

- A. Refer to schedules at the end of this Section for materials, forms, jackets, and thickness required for each mechanical system.
- B. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either the wet or dry state.
- C. Install vapor barriers on insulated pipes, ducts, and equipment having surface operating temperatures below 60 deg F.
- D. Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions.
- E. Install insulation with smooth, straight, and even surfaces.

- F. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor hairier.
- G. Seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.
- H. Seal Ends: Except for flexible elastomeric insulation, taper ends at 45 degree angle and seal with lagging adhesive. Cut ends of flexible elastomeric cellular insulation square and seal with adhesive.
 - 1. Apply adhesives and coatings at manufacturer's recommended coverage-per-gallon rate.
- J. Keep insulation materials dry during application and finishing.
- K. Items Not Insulated: Unless otherwise indicated do not apply insulation to the following systems, materials, and equipment:
 - 1. Low pressure (0-2 inches) exposed round spiral ducts..
 - 2. Metal ducts with internal acoustical duct liner.
 - 3. Factory-insulated flexible ducts.
 - 4. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
 - 5. Flexible connectors for ducts and pipes.
 - 6. Vibration control devices.
 - 7. Testing laboratory labels and stamps.
 - 8. Nameplates and data plates.
 - 9. Access panels and doors in air distribution systems.
 - 10. Fire protection piping systems.
 - 11. Sanitary drainage and vent piping.
 - 12. Below grade piping.
 - 13. Chrome-plated pipes and fittings, except for plumbing fixtures for the disabled.
 - 14. Piping specialties including air chambers, unions, meters and gages.

3.3 PIPE INSULATION INSTALLATION - GENERAL

- A. Tightly butt longitudinal seams and end joints. Bond with adhesive.
- B. Stagger joints on double layers of insulation.
- C. Apply insulation continuously over fittings, valves, and specialties, except as otherwise indicated.
- D. Apply insulation with a minimum number of joints.
- E. Apply insulation with integral jackets as follows:
 - 1. Pull jacket tight and smooth.
 - 2. Cover circumferential joints with butt strips, at least 3-inches wide, and of same material as insulation jacket. Secure with adhesive and outward clinching staples along both edges of butt strip and space 4 inches on center.
 - 3. Longitudinal Seams: Overlap seams at least 1-1/2 inches. Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches on center.
 - 4. Vapor Barrier Coatings: Where vapor barriers are indicated, apply on seams and joints, over staples, and at ends butt to flanges, unions, valves, and fittings.
 - 5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor barrier coating.
 - 6. Repair damaged insulation jackets, except metal jackets, by applying jacket material around damaged jacket; adhere, staple, and seal. Extend patch at least 2 inches in both directions beyond damaged insulation jacket and around the entire circumference of the pipe.

- F. Roof Penetrations: Apply insulation for interior applications to a point even with the top of the roof flashing. Seal with vapor barrier coating. Apply insulation for exterior applications butted tightly to interior insulation ends. Extend metal jacket for exterior insulation outside roof flashing at least 2 inches below top of roof flashing. Seal metal jacket to roof flashing with vapor barrier coating.
- G. Exterior Wall Penetrations: For penetrations of below grade exterior walls, extend metal jacket for exterior insulation through penetration to a point 2 inches from interior surface of wall inside the building. Seal ends of metal jacket with vapor barrier coating. Secure metal jacket ends with metal band. At point where insulation metal jacket contacts mechanical sleeve seal, insert cellular glass preformed pipe insulation to allow sleeve seal tightening against metal jacket. Tighten and seal sleeve to Jacket to form a watertight seal.
- H. Interior Walls and Partitions Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions. Apply an aluminum jacket with factory-applied moisture barrier over insulation. Extend 2 inches from both surfaces of wall or partition. Secure aluminum jacket with metal bands at both ends. Seal ends of jacket with vapor barrier coating. Seal around penetration with joint sealer. Refer to Division 7 Section "Joint Sealants."
- I. Fire-Rated Walls and Partitions Penetrations: Terminate insulation at penetrations through fire-rated walls and partitions. Seal insulation ends with vapor barrier coating. Seal around penetration with firestopping or fire-resistant joint sealer. Refer to Division 7 for firestopping and fire-resistant joint sealers.
- J. Floor Penetrations: Terminate insulation underside of floor assembly and at floor support at top of floor.
- K. Flanges, Fittings, and Valves - Interior Exposed and Concealed: Coat pipe insulation ends with vapor barrier coating. Apply premolded, precut, or field-fabricated segments of insulation around flanges, unions, valves, and fittings. Make joints tight. Bond with adhesive.
 - 1. Use same material and thickness as adjacent pipe insulation.
 - 2. Overlap nesting insulation by 2 inches or 1-pipe diameter, which ever is greater,
 - 3. Apply materials with adhesive, fill voids with mineral fiber insulating cement. Secure with wire or tape.
 - 4. Insulate elbows and tees smaller than 3-inches pipe size with premolded insulation.
 - 5. insulate elbows and tees 3 inches and larger with premolded insulation or insulation material segments. Use at least 3 segments for each elbow.
 - 6. Cover insulation, except for metal jacketed insulation, with PVC fitting covers and seal circumferential joints with butt strips.
 - 7. Cover insulation, except for metal jacketed insulation, with 2 layers of lagging adhesive to a minimum thickness of 1/16 inch. Install glass cloth between layers. Overlap adjacent insulation by 2 inches in both directions from joint with glass cloth and lagging adhesive.
- L. Hangers and Anchors: Apply insulation continuously through hangers and around anchor attachments, install saddles, shields, and inserts as specified in Division 23 Section "Supports and Anchors." For cold surface piping, extend insulation on anchor legs a minimum of 12 inches and taper and seal insulation ends.
 - 1. Inserts and Shields: Cover hanger inserts and shields with jacket material matching adjacent pipe insulation.

3.4 BELOW GROUND PIPE INSULATION INSTALLATION

- A. General: The following are additional requirements for insulation applied to piping installed below ground.
- B. Coat bore surfaces of insulation materials with insulating cement of type recommended by insulation manufacturer. Apply enough cement to fill surface cells. Do not use adhesives for this coating.
- C. Secure insulation with a minimum of 2 stainless-steel bands for each section of insulation.
- D. Secure insulation with a minimum of 2 reinforced tape bands for each section of insulation.

- E. Terminate insulation at anchor blocks.
- F. Apply insulation continuously through sleeves and manholes, except as specified above for exterior wall penetrations.
- G. Finishing: Apply 3 coats of asphaltic mastic to a finish thickness of 3/16 inch over insulation materials. Apply 10 x 10 mesh glass cloth between coats. Overlap edges of glass cloth by 2 inches.

3.5 GLASS FIBER PIPE INSULATION INSTALLATION

- A. Bond insulation to pipe with lagging adhesive.
- B. Seal exposed ends with lagging adhesive.
- C. Seal seams and joints with vapor barrier compound.

3.6 CELLULAR GLASS PIPE INSULATION INSTALLATION

- A. Cellular Glass Insulation: Join sections of cellular glass insulation with vapor barrier compound. Secure insulation with manufacturer's recommended adhesive. Seal joints with manufacturer's recommended joint sealer.
 - 1. Multiple Layer Installations: Stagger joints of multi-layer installations. Secure inner layer with glass fiber reinforced tape. Secure outer layers with 2 metal bands for each insulation section.
 - 2. Finishing: Apply manufacturer's recommended weather barrier mastic.
 - 3. Finishing: Apply metal jacket over manufacturer's recommended vapor barrier mastic.

3.7 FLEXIBLE ELASTOMERIC CELLULAR PIPE INSULATION INSTALLATION

- A. Slip insulation on the pipe before making connections wherever possible. Seal joints with adhesive. Where the slip-on technique is not possible, cut one side longitudinally and apply to the pipe. Seal seams and joints with adhesive.
- B. Valves, Fittings, and Flanges: Cut insulation segments from pipe or sheet insulation. Bond to valve, fitting, and flange and seal joints with adhesive.
 - 1. Miter cut materials to cover soldered elbows and tees.
 - 2. Fabricate sleeve fitting covers from flexible elastomeric cellular insulation for screwed valves, fittings, and specialties. Miter cut materials. Overlap adjoining pipe insulation.

3.8 EQUIPMENT INSULATION INSTALLATION, GENERAL

- A. Install board and block materials with a minimum dimension of 12 inches and a maximum dimension of 48 inches.
- B. Groove and score insulation materials as required to fit as closely as possible to the equipment and to fit contours of equipment. Stagger end joints.
- C. Insulation Thickness Greater than 2 Inches: install insulation in multiple layers with staggered joints.
- D. Bevel insulation edges for cylindrical surfaces for tight joint
- E. Secure sections of insulation in place with wire or bands spaced at 9-inch centers, except for flexible elastomeric cellular insulation.

- F. Protect exposed comers with comer angles under wires and bands.
- G. Manholes, Handholes, and Information Plates: Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
- H. Removable Insulation: Install insulation on components that require periodic inspecting, cleaning, and repairing for easy removal and replacement without damage to adjacent insulation.
 - 1. Pumps: Where insulation is indicated, fabricate galvanized steel boxes lined with insulation. Fit boxes around pumps and coincide joints in box with the splits in the pump casings. Fabricate joints with outward bolted flanges.
- J. Finishing: Except for flexible elastomeric cellular insulation, apply 2 coats of vapor barrier compound to a minimum thickness of 1/16 inch. Install a layer of glass cloth embedded between layers.

3.9 GLASS FIBER EQUIPMENT INSULATION INSTALLATION

- A. Secure Insulation with anchor pins and speed washers.
- B. Space anchors at maximum intervals of 18 inches in both directions and not more than 3 inches from edges and joints.
- C. Apply a smoothing coat of insulating and finishing cement to finished insulation.

3.10 CELLULAR GLASS EQUIPMENT INSULATION INSTALLATION

- A. Join sections of insulation with vapor barrier compound.
- B. Secure insulation with manufacturer's recommended adhesive. Seal joints with manufacturer's recommended joint sealer.
- C. Secure inner layer of multiple layer installations with glass fiber reinforced tape. Secure outer layers with 2 metal bands for each insulation section.

3.11 FLEXIBLE ELASTOMERIC CELLULAR EQUIPMENT INSULATION INSTALLATION

- A. Install sheets of the largest manageable size.
- B. Apply full coverage of adhesive to the surfaces of the equipment and to the insulation.
- C. Butt insulation joints firmly together and apply adhesive to insulation edges at Joints.

3.12 DUCT INSULATION

- A. Blanket Insulation: Install tight and smooth. Secure to ducts having long sides or diameters as follows:
 - 1. Smaller Than 24 Inches: Bonding adhesive applied in 6-inch-wide transverse strips on 12-inch centers.
 - 2. 24 inches and Larger: Anchor pins spaced 12 inches apart each way. Apply bonding adhesive to prevent sagging of the insulation.
 - 3. Overlap joints 3 inches.
 - 4. Seal joints, breaks, and punctures with vapor barrier compound.

3.13 INTERNAL LINER IN RECTANGULAR DUCTS

- A. Adhere a single layer of (one) 1-inch thick, (2-inch thick for external ducts) duct liner with 90 percent coverage of adhesive at liner contact surface area. Multiple layers of insulation to achieve indicated thickness is prohibited.

- B. Apply a coat of adhesive to liner facing in direction of airflow not receiving metal nosing.
- C. Butt transverse joints without gaps and coat joint with adhesive.
- D. Fold and compress liner in corners of rectangular ducts or cut and fit to assure butted edge overlapping.
- E. Longitudinal joints in rectangular ducts shall not occur except at corners of ducts, unless the size of the duct and standard liner product dimensions make longitudinal joints necessary. Apply an adhesive coating on longitudinal seams.
- F. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely around perimeter; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
- G. Secure transversely oriented liner edges facing the air stream with metal nosings that are either channel or "Z" profile or are integrally formed from the duct wall at the following locations:
 - 1. Fan discharge.
 - 2. Intervals of lined duct preceding unlined duct.
 - 3. Upstream edges of transverse joints in ducts.

3.14 JACKETS

- A. Foil and Paper Jackets (FP): Install jackets drawn tight. Install lap or butt strips at joints with material same as jacket. Secure with adhesive. Install jackets with 1-1/2-inch laps at longitudinal joints and 3-inch-wide butt strips at end joints.
 - 1. Seal openings, punctures, and breaks in vapor barrier Jackets and exposed insulation with vapor barrier compound.
- B. Interior Exposed Insulation: Install continuous glass cloth jackets.
- C. Exterior Exposed Insulation: Install continuous aluminum jackets and seal all joints and seams with waterproof sealant.
- D. Install metal jacket with 2-inch overlap at longitudinal and butt joints. Overlap longitudinal joints to shed water. Seal butt joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel draw bands 12 inches on center and at butt joints.
- E. Install glass cloth jacket directly over insulation. On insulation with a factory applied jacket, install the glass cloth jacket over the factory applied jacket. Install jacket drawn smooth and tight with a 2-inch overlap at joints. Embed glass cloth between (2) 1/16-inch-thick coats of lagging adhesive. Completely encapsulate the insulation with the jacket, leaving no exposed raw insulation.

3.15 FINISHES

- A. Paint finished insulation as specified in Division 9 Section "Painting."
- B. Flexible Elastomeric Cellular insulation: After adhesive has fully cured, apply 2 coats of protective coating to exposed insulation.

3.16 APPLICATIONS

- A. General: Materials and thickness are specified in schedules at the end of this Section.
- B. Interior Piping Systems: Unless otherwise indicated, insulate the following:

1. Domestic cold water.
 2. Storm water drainage. Insulate only roof drain bodies and horizontal rainwater leaders.
 3. AHU Condensate and EWC drainage.
 4. Domestic hot water supply and recirculation.
 5. Sanitary drains for fixtures accessible to the disabled.
 6. Sanitary drain lines that contain condensate from HVAC system.
 7. Hydronic Hot Water Heating supply and return piping.
- C. Exterior Piping Systems: Unless otherwise indicated, insulate the following:
1. Domestic cold water.
- D. Equipment: Unless otherwise indicated, insulate the following:
1. Domestic Hot Water equipment, tanks, and water heaters.
 2. Hydronic Hot Water Heating heaters, pumps and tanks.
 3. Refrigerated drinking water equipment.
- E. Duct Systems (Externally Insulated): Unless otherwise indicated, insulate the following (do not insulate internally lined ducts):
1. Supply and Outside Air ductwork.
 2. Outside Air plenums.
 3. Kitchen Exhaust Hood ductwork.
- F. Duct Systems (Internally Lined): Unless otherwise indicated, internally line the following:
1. Rectangular supply air ductwork downstream of VAV terminals and dehumidification unit.
 2. Transfer air ductwork.
 3. Return air sound-boots and intakes.

3.17 PIPE INSULATION SCHEDULES

- A. General: Abbreviations used in the following schedules include:
1. Field-Applied Jackets: P – PVC, K - Foil and Paper, A - Aluminum, SS - Stainless Steel, N - None.
 2. Pipe Sizes: NFS - Nominal Pipe Size.
- B. Interior; Domestic Cold Water, HVAC Unit Condensate, EWC Drainage and Storm Water; All Sizes: One-half (1/2") inch thick; glass fiber, cellular glass, or flexible elastomeric insulation. Vapor barrier is required. Field-applied jacket is not required.

DOMESTIC HOT WATER SUPPLY AND RECIRCULATION

<u>PIPE SIZES (NPS)</u>	<u>MATERIALS</u>	<u>THICKNESS IN INCHES</u>	<u>VAPOR BARRIER REQ'D</u>	<u>FIELD- APPLIED JACKET</u>
ALL	GLASS FIBER	1/2	NO	NONE
	CELLULAR GLASS	1/2	NO	NONE
	FLEXIBLE	1/2	NO	NONE
	ELASTOMERIC			

SANITARY DRAINS AND TRAPS EXPOSED AT FIXTURES FOR DISABLED

<u>PIPE SIZES (NPS)</u>	<u>MATERIALS</u>	<u>THICKNESS IN INCHES</u>	<u>VAPOR BARRIER REQ'D</u>	<u>FIELD- APPLIED JACKET</u>
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ALL	FLEXIBLE ELASTOMERIC	1/2	NO	(D)
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HYDRONIC HOT WATER HEATING PIPE SIZES (NPS)		THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
<u>MATERIALS</u>				
1/2 TO 1-1/4	GLASS FIBER	1	NO	NONE
	CELLULAR GLASS	1	NO	NONE
1-1/2 TO 4	GLASS FIBER	1-1/2	NO	NONE
	CELLULAR GLASS	1-1/2	NO	NONE
6 TO 12	GLASS FIBER	2	NO	NONE
	CELLULAR GLASS	2	NO	NONE

3.18 EQUIPMENT INSULATION SCHEDULES

DOMESTIC HOT WATER EQUIPMENT, TANKS, AND PUMPS				
<u>MATERIAL</u>	<u>FORM</u>	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
GLASS FIBER	BLOCK	2	NO	(A)
CELLULAR GLASS	BLOCK	2	NO	(A)

HYDRONIC HEATING WATER EQUIPMENT, TANK AND PUMPS				
<u>MATERIAL</u>	<u>FORM</u>	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
GLASS FIBER	BLOCK OR BOARD	2	NO	(A)
CELLULAR GLASS	BLOCK	2	NO	(A)

3.19 DUCT SYSTEMS INSULATION SCHEDULE

LOW PRESSURE (0-2 INCHES) ROUND
SUPPLY AIR DUCTWORK
RETURN AIR DUCTWORK (UNLESS OTHERWISE INDICATED)

<u>MATERIAL</u>	<u>FORM</u>	THICKNESS IN INCHES	VAPOR BARRIER REQ'D	FIELD- APPLIED JACKET
GLASS FIBER	BLANKET	2	YES	NONE

FIRST 15 FEET OF RETURN AIR MAIN TRUNK STARTING FROM HVAC UNIT
RECTANGULAR SUPPLY AIR DUCTWORK DOWNSTREAM OF VAV TERMINALS AND
DEHUMIDIFICATION UNIT
TRANSFER AIR DUCTWORK
RETURN AIR SOUND-BOOTS AND INTAKES

<u>MATERIAL</u>	<u>FORM</u>	THICKNESS IN <u>INCHES</u>	COATING FACING AIRSTREAM <u>REQ'D</u>	FIELD- APPLIED <u>JACKET</u>
GLASS FIBER	LINER	1	YES	NONE

MEDIUM PRESSURE (2-4 INCHES) RECTANGULAR AND ROUND DUCTWORK
DOUBLE WALL CONSTRUCTION WITH ONE INCH LINER.

END OF SECTION

SECTION 23 0554

FLUES AND VENTS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 GAS VENTS

- A. Double-wall gas vents, UL listed and labeled, complying with NFPA 211, Type B. Inner pipe of sheet aluminum, outer pipe of galvanized-steel sheet.
- B. Accessories: Tees, elbows, increasers, draft hood connectors, metal cap with bird barrier, adjustable roof flashing, storm collar, support assembly, thimbles, firestopping spacers, and fasteners; fabricated of similar materials and designs as vent-pipe straight sections.

2.2 STEEL, POSITIVE-PRESSURE, DOUBLE-WALL VENTS

- A. Description: Double-wall metal stacks complying with NFPA 211, suitable for use with building heating equipment burning gas, solid, or liquid fuels. Inner pipe of stainless steel, outer pipe of aluminum-coated steel.
- B. Accessories: Tees, elbows, increasers, draft hood connectors, termination, adjustable roof flashing, storm collar, support assembly, thimbles, firestopping spacers, and fasteners; fabricated of similar materials and designs as vent-pipe straight sections.

2.3 FABRICATED METAL BREECHINGS

- A. Breechings: Galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; minimum metal thickness corresponding to duct sizes in SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."
- B. Barometric Dampers: Adjustable, self-actuating draft dampers, where indicated, full size of breeching.
- C. Cleanout Doors: Same weight as breeching, bolted and gasketed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install vents according to stipulated minimum clearances from combustibles.
- B. Seal between sections of positive-pressure vents using only sealants recommended by manufacturer.
- C. Support vents at intervals to support the weight of the vent and all accessories, without exceeding loading of appliances.

END OF SECTION

SECTION 23 0731

ROOFTOP AIR CONDITIONERS – 6 TONS AND SMALLER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Comply with the requirements on the drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections.
- B. Comply with all other Division 23 sections as applicable. Refer to other Divisions for coordination of work with other trades as required.

1.2 SUMMARY

- A. This Section includes the following rooftop air conditioners:
 - 1. Cooling and heating units 6 tons and smaller.

1.3 SUBMITTALS

- A. Product Data: Include manufacturer's technical data for each model indicated, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, accessories and installation instructions.
- B. 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. Vibration isolators selected.
 - 2. Detail mounting, and securing. If applicable, indicate coordinating requirements with roof membrane system, including flashing of roof curb to roof structure.
 - 3. Wiring Diagrams: Power, signal, and control wiring.
- C. Operation and Maintenance Data: For rooftop air conditioners operation and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of rooftop air conditioners and are based on the specific system indicated.
- 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. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
- D. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- E. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- F. Comply with NFPA 54 for gas-fired furnace section.
- G. ARI Certification: Units shall be ARI certified and listed.
- H. ARI Compliance for Units with Capacities Less Than 135,000 Btuh: Rate rooftop air-conditioner capacity according to ARI 210/240, "Unitary Air-Conditioning and Air-Source Heat Pump Equipment."
 - 1. Sound Power Level Ratings: Comply with ARI 270, "Sound Rating of Outdoor Unitary Equipment."

1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
 - 1. 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.
 - 2. Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.
- C. Coordinate size, location, and installation of rooftop air-conditioner manufacturer's roof curbs and equipment supports with roof installer.
 - 1. Coordinate installation of restrained vibration isolation roof-curb rails.

1.6 WARRANTY

- A. Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of rooftop air conditioners that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Compressors: Manufacturer's standard, but not less than 5 years from date of Substantial Completion.
 - 2. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.
 - 3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than 3 years from date of Substantial Completion.
 - 4. Warranty Period for Control Boards: Manufacturer's standard, but not less than 3 years from date of Substantial Completion.

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. Fan Belts: One set for each belt-drive fan.
 - 2. Filters: One set of filters for each unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. York
- B. Description: Factory assembled and tested; designed for exterior installation; consisting of compressor, indoor and outside refrigerant coils, indoor fan and outside coil fan, refrigeration and temperature controls, filters, and dampers.
- C. Casing: Galvanized-steel construction with enamel paint finish on all externally exposed surfaces. Removable panels or access doors shall provide tool-less access to internal parts. Access panels/doors shall have neoprene gaskets around the entire opening. Access panels exposed to differential temperature shall have double panel construction with insulation installed in between. Cabinet shall have a minimum of 1/2-inch thick flexible fiberglass insulation coated on the airside and knockouts for electrical and piping connections. Aluminum foil-faced fiberglass insulation shall be used in the gas heat compartment. Unit shall have a factory-installed condensate drain pan made of a non-corrosive material with a minimum 3/4-inch connection extending to the exterior. Unit shall be provided with factory installed lifting lugs.
- D. Indoor Fan: Forward curved, centrifugal, direct drive or belt drive motor. Bearings shall be sealed permanently lubricated ball bearing type. Fan shall be made of steel with a factory applied corrosion-resistant finish and shall be dynamically factory balanced.
- E. Outside Coil Fan: Propeller type, direct drive with a vertical discharge. Grille shall not bear any weight of the condenser fan motor. Fan shall have aluminum blades mounted to corrosion-resistant steel spiders and be dynamically factory balanced.
- F. Refrigerant Coils: Aluminum-plate fins mechanically bonded to seamless copper tube with all joints brazed. Coils shall be mounted in steel casing with equalizing-type vertical distributor.
- G. Compressor: Hermetic scroll compressor with integral rubber vibration isolators, internal over-current and over-temperature protection, and internal pressure relief. Crankcase heater shall be factory installed.
- H. Refrigeration System:
 - 1. Compressor.
 - 2. Outside coil and fan.
 - 3. Indoor coil and fan.
 - 4. Expansion valve with replaceable thermostatic element.
 - 5. Refrigerant filter/dryer.
 - 6. High-pressure switch.

7. Low-pressure switch.
 8. Thermostat for coil freeze-up protection during low-ambient temperature operation or loss of air.
 9. Low-ambient switch.
 10. Brass service valves installed in suction and liquid lines.
 11. Charge of refrigerant.
- I. Filters: 2-inch thick, fiberglass, pleated throwaway filters in filter rack.
- J. Heat Exchanger: Aluminized-steel construction for natural gas fired burners with the following controls:
1. Redundant single or dual gas valve with manual shutoff.
 2. Direct-spark pilot ignition.
 3. Electronic flame proving sensor.
 4. Induced-draft blower.
 5. High-temperature limit switch.
 6. Flame rollout switch.
- K. Outside-Air Damper: Linked damper blades, for 0 to 25 percent outside air, with manual slide and hood.
- L. Economizer (Where indicated on the drawings): Return- and outside-air dampers with neoprene seals, and hood. Complete economizer should be factory installed.
1. Damper Motor: Fully modulating (0-100%) spring return with adjustable minimum position.
 2. Control: Electronic-control system shall be capable of control by either outside-air temperature, mixed-air and outside-air temperature, outside-air enthalpy, mixed-air temperature and selects between outside-air and return-air enthalpy or global control to adjust mixing dampers.
 3. Relief Damper: Barometric with bird screen and hood.
- M. Power Connection: Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in circuit breaker.
- N. Unit Controls: Solid-state control board and components contain at least the following features:
1. Default control to ensure proper operation after power interruption.
 2. Unit diagnostics and diagnostic code storage.
 3. Field-adjustable control parameters.
 4. Dehumidification control with dehumidistat (Where indicated on the drawings).
 5. Economizer control (Where indicated on the drawings).
 6. Gas valve delay between first- and second-stage firing.
 7. Indoor-air quality control with carbon dioxide sensor (Where indicated on the drawings).
 8. Night setback mode (Where indicated on the drawings).
 9. Return-air temperature limit.
 10. Smoke alarm with smoke detector installed in return air.
 11. Low-refrigerant pressure control.
 12. Digital display of outside temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.
- O. DDC (Where indicated on the drawings): Install stand-alone control module providing link between unit controls and DDC system. Control module shall be compatible with temperature-control system specified in Division 23 Section "Direct Digital Control System."

- P. Thermostat: Programmable, electronic; with heating setback and cooling setup with seven-day programming; and the following:
1. Touch sensitive keyboard.
 2. Automatic switching.
 3. Deg F readout.
 4. LED indicators.
 5. Hour/day programming.
 6. Manual override capability.
 7. Time and operational mode readout.
 8. Status indicator.
 9. Battery backup.
 10. Subbase with manual system switch (on-heat-auto-cool) and fan switch (auto-on).
 11. Fan-proving switch to lock out unit if fan fails.
 12. Dirty-filter switch.
- Q. Optional Accessories:
1. Service Outlets: Two, 115-V, ground-fault, circuit-interrupter type.
 2. Hail guards, painted to match casing
- R. Roof Curb (Where indicated on the drawings): Furnish and install a steel roof mounting frame for bottom discharge and return air duct connection, with corrosion-protection coating, gasketing, and factory-installed wood nailer; complying with NRCA standards; minimum height of 14 inches. MC to coordinate curb requirements with PEMB provider. Provide manufacturer's standard shop-fabricated units, modified as necessary to comply with requirements.
- S. All units to have breakers located inside unit-no external wiring. No pitch pans allowed.
- T. All units must have a self test mode.

2.2 MOTORS

- A. Compressor motors shall be cooled by refrigerant gas passing through motor windings and shall have line break thermal and current overload protection.
- B. Evaporator-fan motor shall have permanently lubricated bearings and inherent automatic-reset thermal overload protection.
- C. Total enclosed condenser fan motor shall have permanently lubricated bearings, and inherent automatic-reset thermal overload protection.
- D. Induced draft motor shall have permanently lubricated sealed bearings and inherent automatic reset thermal overload protection.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level, plumb, and as recommended by the unit manufacturer maintaining manufacturer's recommended clearances

- B. Curb Support (Where indicated on drawings): Install roof curb on roof structure, level and secure. Install and secure rooftop air conditioners on curbs and coordinate roof penetrations and flashing with roof construction. Secure units to curb support with anchor bolts.
- C. Unit Support (Where indicated on drawings): Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure units to structural support with anchor bolts.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
 - 1. Gas Piping: Comply with applicable requirements in Division 23 Section "Fuel Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.
- C. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 - 1. Install ducts to termination in roof curb.
 - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
 - 3. Connect supply ducts to rooftop unit with flexible duct connectors.
- D. Electrical System Connections: Comply with applicable requirements in Division 26 Sections for power wiring, switches, and motor controls.
- E. Ground equipment according to requirements in Division 26 Sections.
- F. 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.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field quality-control tests and inspections:
 - 1. After installing rooftop air conditioners and after electrical circuitry has been energized, test units for compliance with requirements.
 - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

- C. Remove malfunctioning units, replace with new units, and retest as specified above.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 - 1. Inspect for visible damage to unit casing.
 - 2. Inspect for visible damage to furnace combustion chamber.
 - 3. Inspect for visible damage to compressor, air-cooled outside coil, and fans.
 - 4. Inspect internal insulation.
 - 5. Verify that labels are clearly visible.
 - 6. Verify that clearances have been provided for servicing.
 - 7. Verify that controls are connected and operable.
 - 8. Verify that filters are installed.
 - 9. Clean outside coil and inspect for construction debris.
 - 10. Clean furnace flue and inspect for construction debris.
 - 11. Connect and purge gas line.
 - 12. Adjust vibration isolators.
 - 13. Inspect operation of barometric dampers.
 - 14. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
 - 15. Adjust fan belts to proper alignment and tension.
 - 16. Start unit according to manufacturer's written instructions.
 - a. Start refrigeration system in summer only.
 - b. Complete startup sheets and attach copy with Contractor's startup report.
 - 17. Inspect and record performance of interlocks and protective devices; verify sequences.
 - 18. Operate unit for an initial period as recommended or required by manufacturer.
 - 19. Measure and adjust gas pressure on manifold.
 - 20. Calibrate thermostats.
 - 21. Adjust and inspect high-temperature limits.
 - 22. Inspect outside-air dampers for proper stroke and interlock with return-air dampers.
 - 23. Start refrigeration system and check for proper operation.
 - 24. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
 - 25. Measure and adjust the minimum and maximum airflows.
 - 26. Simulate maximum cooling demand and inspect the following:
 - a. Compressor refrigerant suction and hot-gas pressures.
 - b. Short circuiting of air through outside coil or from outside coil to outside-air intake.
 - 27. Verify operation of remote panel, including electronic spark operation and failure modes. Inspect the following:
 - a. High-limit heat exchanger.
 - b. Warm-up for morning cycle.
 - c. Freezestat operation.
 - d. Economizer to limited outside-air changeover.
 - e. Alarms.

28. After startup and performance testing, change filters, vacuum heat exchanger and cooling and outside coils, adjust belt tension, and inspect operation of power vents.

3.5 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rooftop air conditioners.

END OF SECTION

SECTION 23 0732

ROOFTOP AIR CONDITIONING UNIT – 7.5 TONS TO 20 TONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Comply with the requirements on the drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections.
- B. Comply with all other Division 23 sections as applicable. Refer to other Divisions for coordination of work with other trades as required.

1.2 SUMMARY

- A. This Section includes the following rooftop air conditioners:

- 1. Cooling and heating units 7-1/2 to 20 tons.

1.3 SUBMITTALS

- A. Product Data: Include manufacturer's technical data for each model indicated, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, accessories and installation instructions.
- B. 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. Prepare the following:
 - 1. Vibration isolators selected.
 - 2. Detail mounting, and securing. If applicable, indicate coordinating requirements with roof membrane system, including flashing of roof curb to roof structure.
 - 3. Wiring Diagrams: Power, signal, and control wiring.
- C. Operation and Maintenance Data: For rooftop air conditioners to include in emergency, operation, and maintenance manuals.
- D. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of rooftop air conditioners and are based on the specific system indicated.
- 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. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
- D. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- E. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
- F. Comply with NFPA 54 for gas-fired furnace section.
- G. ARI Certification: Units shall be ARI certified and listed.
- H. ARI Compliance for Units with Capacities Less Than 135,000 Btuh: Rate rooftop air-conditioner capacity according to ARI 210/240, "Unitary Air-Conditioning and Air-Source Heat Pump Equipment."
 - 1. Sound Power Level Ratings: Comply with ARI 270, "Sound Rating of Outdoor Unitary Equipment."
- I. ARI Compliance for Units with Capacities 135,000 Btuh and More: Rate rooftop air-conditioner capacity according to ARI 340/360, "Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment."
 - 1. Sound Power Level Ratings: Comply with ARI 270, "Sound Rating of Outdoor Unitary Equipment."

1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
 - 1. 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.
 - 2. Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.
- C. Coordinate size, location, and installation of rooftop air-conditioner manufacturer's roof curbs and equipment supports with roof installer.
 - 1. Coordinate installation of restrained vibration isolation roof-curb rails.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of rooftop air conditioners that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Compressors: Manufacturer's standard, but not less than 5 years from date of Substantial Completion.
 - 2. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.

3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than 3 years from date of Substantial Completion.
4. Warranty Period for Control Boards: Manufacturer's standard, but not less than 3 years from date of Substantial Completion.

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. Fan Belts: One set for each belt-drive fan.
 2. Filters: One set of filters for each unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 1. York
- B. Description: Factory assembled and tested; designed for exterior installation; consisting of compressor, indoor and outside refrigerant coils, indoor fan and outside coil fan, refrigeration and temperature controls, filters, and dampers.
- C. Casing: Galvanized-steel construction with enamel paint finish on all externally exposed surfaces. Removable panels or access doors shall provide tool-less access to internal parts. Access panels/doors shall have neoprene gaskets around the entire opening. Access panels exposed to differential temperature shall have double panel construction with insulation installed in between. Cabinet shall have a minimum of 1/2-inch thick flexible fiberglass insulation coated on the airside and knockouts for electrical and piping connections. Aluminum foil-faced fiberglass insulation shall be used in the gas heat compartment. Unit shall have a factory-installed condensate drain pan made of a non-corrosive material with a minimum 3/4-inch connection extending to the exterior. Unit shall be provided with factory installed lifting lugs.
- D. Indoor Fan: Forward curved, centrifugal, belt driven with fixed motor sheaves, grease-lubricated ball bearings, and motor. Fan shall be made of steel with a factory applied corrosion-resistant finish and shall be dynamically factory balanced.
- E. Outside Coil Fan: Propeller type, direct drive by permanently lubricated motor, with a vertical discharge. Grille shall not bear any weight of the condenser fan motor. Fan shall have aluminum blades mounted to corrosion-resistant steel spiders and be dynamically factory balanced.
- F. Refrigerant Coils: Aluminum-plate fins mechanically bonded to seamless copper tube with all joints brazed. Coils shall be mounted in steel casing with equalizing-type vertical distributor.
- G. Compressor(s): Number as scheduled, hermetic scroll compressor(s) with integral rubber vibration isolators, internal over-current and over-temperature protection, and internal pressure relief. Crankcase heater shall be factory installed.
- H. Refrigeration System:

1. Compressor(s).
 2. Outside coil and fan.
 3. Indoor coil and fan.
 4. Expansion valve with replaceable thermostatic element.
 5. Refrigerant dryer.
 6. High-pressure switch.
 7. Low-pressure switch.
 8. Thermostat for coil freeze-up protection during low-ambient temperature operation or loss of air.
 9. Low-ambient switch.
 10. Brass service valves installed in discharge and liquid lines.
 11. Charge of refrigerant.
 12. Refrigerant Circuits: Interlaced refrigerant-coil circuiting with circuit for each compressor.
 13. Capacity Control: Hot-gas bypass valve and piping on one compressor.
 14. Compressor Motor Overload Protection: Manual reset.
 15. Anti-recycling Timing Device: Prevents compressor restart for five minutes after shutdown.
 16. Oil-Pressure Switch: Designed to shut down compressors on low oil pressure.
- I. Filters: 2-inch thick, fiberglass, pleated throwaway filters in filter rack.
- J. Heat Exchanger: Aluminized-steel construction for natural gas fired burners with the following controls:
1. Redundant single or dual gas valve with manual shutoff.
 2. Direct-spark pilot ignition.
 3. Electronic flame proving sensor.
 4. Induced-draft blower.
 5. High-temperature limit switch.
 6. Flame rollout switch.
- K. Outside-Air Damper: Linked damper blades, for 0 to 100 percent outside air, with fully modulating controls and hood.
- L. Economizer (Where indicated on the drawings): Return- and outside-air dampers with neoprene seals, and hood. Complete economizer should be factory installed.
1. Damper Motor: Fully modulating (0-100%) spring return with adjustable minimum position.
 2. Control: Electronic-control system shall be capable of control by either outside-air temperature, mixed-air and outside-air temperature, outside-air enthalpy, mixed-air temperature and selects between outside-air and return-air enthalpy or global control to adjust mixing dampers.
 3. Relief Damper: Barometric with bird screen and hood.
- M. Power Connection: Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in circuit breaker.
- N. Unit Controls: Solid-state control board and components contain at least the following features:
1. Default control to ensure proper operation after power interruption.
 2. Unit diagnostics and diagnostic code storage.
 3. Field-adjustable control parameters.
 4. Dehumidification control with dehumidistat (Where indicated on the drawings).
 5. Economizer control (Where indicated on the drawings).

6. Gas valve delay between first- and second-stage firing.
 7. Indoor-air quality control with carbon dioxide sensor (Where indicated on the drawings).
 8. Night setback mode (Where indicated on the drawings).
 9. Low-ambient control, allowing operation down to 0 deg F (Where indicated on the drawings).
 10. Return-air temperature limit.
 11. Smoke alarm with smoke detector installed in return air.
 12. Low-refrigerant pressure control.
 13. Digital display of outside temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.
 14. Variable-Air-Volume Control: Variable-frequency drive controls supply-air discharge temperature (Where indicated on the drawings).
- O. DDC (Where indicated on the drawings): Install stand-alone control module providing link between unit controls and DDC system. Control module shall be compatible with temperature-control system specified in Division 23 Section "Direct Digital Control System."
- P. Thermostat: Programmable, electronic; with heating setback and cooling setup with seven-day programming; and the following:
1. Touch sensitive keyboard.
 2. Automatic switching.
 3. Deg F readout.
 4. LED indicators.
 5. Hour/day programming.
 6. Manual override capability.
 7. Time and operational mode readout.
 8. Status indicator.
 9. Battery backup.
 10. Subbase with manual system switch (on-heat-auto-cool) and fan switch (auto-on).
 11. Fan-proving switch to lock out unit if fan fails.
 12. Dirty-filter switch.
- Q. Optional Accessories:
1. Service Outlets: Two, 115-V, ground-fault, circuit-interrupter type.
 2. Condensate drain trap.
 3. Dirty-filter switch.
 4. Hail guards, painted to match casing
 5. Power exhaust fan (Where indicated on the drawings).
- R. Roof Curb (Where indicated on the drawings): Furnish and install a steel roof mounting frame for bottom discharge and return air duct connection, with corrosion-protection coating, gasketing, and factory-installed wood nailer; complying with NRCA standards; minimum height of 14 inches. MC to coordinate curb requirements with PEMB provider. Provide manufacturer's standard shop-fabricated units, modified as necessary to comply with requirements.

2.2 MOTORS

- A. Compressor motors shall be cooled by refrigerant gas passing through motor windings and shall have line break thermal and current overload protection.
- B. Evaporator-fan motor shall have permanently lubricated bearings and inherent automatic-reset thermal overload protection.

- C. Total enclosed condenser fan motor shall have permanently lubricated bearings, and inherent automatic-reset thermal overload protection.
- D. Induced draft motor shall have permanently lubricated sealed bearings and inherent automatic reset thermal overload protection.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level, plumb, and as recommended by the unit manufacturer maintaining manufacturer's recommended clearances
- B. Curb Support (Where indicated on drawings): Install roof curb on roof structure, level and secure. Install and secure rooftop air conditioners on curbs and coordinate roof penetrations and flashing with roof construction. Secure units to curb support with anchor bolts.
- C. Unit Support (Where indicated on drawings): Install unit level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure units to structural support with anchor bolts.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
 - 1. Gas Piping: Comply with applicable requirements in Division 23 Section "Fuel Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.
- C. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
 - 1. Install ducts to termination in roof curb.
 - 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
 - 3. Connect supply ducts to rooftop unit with flexible duct connectors.
- D. Electrical System Connections: Comply with applicable requirements in Division 26 Sections for power wiring, switches, and motor controls.
- E. Ground equipment according to Division 26 Section "Grounding and Bonding."
- F. 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.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field quality-control tests and inspections:
 - 1. After installing rooftop air conditioners and after electrical circuitry has been energized, test units for compliance with requirements.
 - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove malfunctioning units, replace with new units, and retest as specified above.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 - 1. Inspect for visible damage to unit casing.
 - 2. Inspect for visible damage to furnace combustion chamber.
 - 3. Inspect for visible damage to compressor, air-cooled outside coil, and fans.
 - 4. Inspect internal insulation.
 - 5. Verify that labels are clearly visible.
 - 6. Verify that clearances have been provided for servicing.
 - 7. Verify that controls are connected and operable.
 - 8. Verify that filters are installed.
 - 9. Clean outside coil and inspect for construction debris.
 - 10. Clean furnace flue and inspect for construction debris.
 - 11. Connect and purge gas line.
 - 12. Adjust vibration isolators.
 - 13. Inspect operation of barometric dampers.
 - 14. Lubricate bearings on fan.
 - 15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
 - 16. Adjust fan belts to proper alignment and tension.
 - 17. Start unit according to manufacturer's written instructions.
 - a. Start refrigeration system in summer only.
 - b. Complete startup sheets and attach copy with Contractor's startup report.
 - 18. Inspect and record performance of interlocks and protective devices; verify sequences.
 - 19. Operate unit for an initial period as recommended or required by manufacturer.
 - 20. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency. Adjust pilot to stable flame.
 - a. Measure gas pressure on manifold.
 - b. Measure combustion-air temperature at inlet to combustion chamber.
 - c. Measure flue-gas temperature at furnace discharge.

- d. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
 - e. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
- 21. Calibrate thermostats.
- 22. Adjust and inspect high-temperature limits.
- 23. Inspect outside-air dampers for proper stroke and interlock with return-air dampers.
- 24. Start refrigeration system and measure and record the following:
 - a. Coil leaving-air, dry- and wet-bulb temperatures.
 - b. Coil entering-air, dry- and wet-bulb temperatures.
 - c. Outside-air, dry-bulb temperature.
 - d. Outside-air-coil, discharge-air, dry-bulb temperature.
- 25. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
- 26. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
 - a. Supply-air volume.
 - b. Return-air volume.
 - c. Relief-air volume.
 - d. Outside-air intake volume.
- 27. Simulate maximum cooling demand and inspect the following:
 - a. Compressor refrigerant suction and hot-gas pressures.
 - b. Short circuiting of air through outside coil or from outside coil to outside-air intake.
- 28. Verify operation of remote panel, including pilot-light operation and failure modes. Inspect the following:
 - a. High-limit heat exchanger.
 - b. Warm-up for morning cycle.
 - c. Freezestat operation.
 - d. Economizer to limited outside-air changeover.
 - e. Alarms.
- 29. After startup and performance testing, change filters, vacuum heat exchanger and cooling and outside coils, lubricate bearings, adjust belt tension, and inspect operation of power vents.

3.5 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rooftop air conditioners.

END OF SECTION

SECTION 23 0838

POWER VENTILATORS

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 this Section.
- B. Requirements of the following Division 23 Sections apply to this section:
 - 1. "Basic Mechanical Materials and Methods."

1.2 SUMMARY

- A. This Section includes the following types of power ventilators:
 - 1. Roof mounted exhaust fans.
 - 2. In-line duct mounted cabinet-type exhaust fans.
- B. Products furnished but not installed under this Section include roof curbs for roof-mounted exhaust fans.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:
 - 1. Product data for selected models, including specialties, accessories, and the following:
 - a. Certified fan performance curves with system operating conditions indicated.
 - b. Certified fan sound power ratings.
 - c. Motor ratings and electrical characteristics plus motor and fan accessories.
 - d. Materials gages and finishes, including color charts.
 - e. Dampers, including housings, linkages, and operators.
 - 2. Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.
 - 3. Coordination drawings, in accordance with Division 23 Section "Basic Mechanical Requirements," for roof penetration requirements and for reflected ceiling plans drawn accurately to scale and coordinating penetrations and units mounted above ceiling. Show the following:
 - a. Roof framing and support members relative to duct penetrations.
 - 4. Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer-installed wiring and field-installed wiring.
 - 5. Product certificates, signed by manufacturers of air-handling units, certifying that their products comply with specified requirements.
 - 6. Maintenance data for air-handling units, for inclusion in Operating and Maintenance Manual specified in Division 1 and Division 23 Section "Basic Mechanical Requirements."

1.4 QUALITY ASSURANCE

- A. UL Compliance: Fans shall be designed, manufactured, and tested in accordance with UL 705 "Power Ventilators."
- B. UL Compliance: Fans and components shall be UL listed and labeled.
- C. Nationally Recognized Testing Laboratory and NEMA Compliance (NRTL): Fans and components shall be NRTL listed and labeled. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

- D. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- E. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

1.5 DELIVERY, STORAGE AND HANDLING

- A. Lift and support units with the manufacturer's designated lifting or supporting points.
- B. Disassemble and reassemble units as required for movement into the final location following manufacturer's written instructions.
- C. Deliver fan units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

1.6 SEQUENCING AND SCHEDULING

- A. Coordinate the installation of roof curbs, equipment supports, and roof penetrations specified in Division 7.
- B. Coordinate the size and location of structural steel support members.

1.7 EXTRA MATERIALS

- A. Furnish one additional complete set of belts for each belt-driven fan.

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. Centrifugal Roof Ventilators:
 - a. ACME.
 - b. Cook Co.
 - c. Greenheck.
 - d. Twin City.

2.2 SOURCE QUALITY CONTROL

- A. Testing Requirements: The following factory tests are required:
 - 1. Sound Power Level Ratings: Comply with AMCA Standard 301 "Method for Calculating Fan Sound Ratings From Laboratory Test Data." Test fans in accordance with AMCA Standard 300 "Test Code for Sound Rating." Fans shall be licensed to bear the AMCA Certified Sound Ratings Seal.
 - 2. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA Standard 210/ASHRAE Standard 51 - Laboratory Methods of Testing Fans for Rating.

2.3 FANS, GENERAL

- A. General: Provide fans that are factory fabricated and assembled, factory tested, and factory finished with indicated capacities and characteristics.

- B. Fans and Shafts: Statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower.
 - 1. Fan Shaft: Turned, ground, and polished steel designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fan's class.
- C. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.
 - 1. Service Factor: 1.4.
- D. Belts: Oil-resistant, non-sparking, and non-static.
- E. Motors and Fan Wheel Pulleys: Adjustable pitch. Select pulley so that pitch adjustment is at the middle of the adjustment range at fan design conditions.
 - 1. Belt Guards: Provide steel belt guards for motors mounted on the outside of the fan cabinet.
- F. Shaft Bearings: Provide type indicated, having a median life "Rating Life" (AFBMA (L(50))) of 200,000, calculated in accordance with AFBMA Standard 9 for ball bearings and AFBMA Standard 11 for roller bearings.
- G. Factory Finish: The following finishes are required:
 - 1. Manufacturer's standard finish or as noted on the schedule.

2.4 CENTRIFUGAL ROOF VENTILATORS

- A. General Description: Belt-driven or direct-drive as indicated, centrifugal consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.
- B. Housing: Heavy-gage, removable, spun-aluminum, dome top and outlet baffle; square, one-piece, hinged aluminum base with venturi inlet cone.
 - 1. Up-blast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.
- C. Fan Wheel: Aluminum hub and wheel with backward-inclined blades.
- D. Belt-Driven Drive Assembly: Resiliently mounted to the housing, with the following features:
 - 1. Pulleys: Cast-iron, adjustable-pitch.
 - 2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - 3. Fan Shaft: Turned, ground, and polished steel drive shaft keyed to wheel hub.
 - 4. Fan and motor isolated from exhaust air stream.
- E. Accessories: The following items are required as indicated:
 - 1. Disconnect Switch: Nonfusible type, with thermal overload protection mounted inside fan housing, factory-wired through an internal aluminum conduit.
 - 2. Bird Screens: Removable 1/2-inch mesh, 16-gage, aluminum or brass wire.
 - 3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base, factory set to close when fan stops.
 - 4. Roof Curbs: Prefabricated, heavy-gage, galvanized steel; mitered and welded corners; 2-inch-thick, rigid, fiberglass insulation adhered to inside walls; built-in cant and mounting flange for flat roof decks; and 2-inch wood nailer. Size as required to suit roof opening and fan base. Verify roof slope to provide level equipment mounting.
 - a. Overall Height: 14 inches.

2.5 MOTORS

- A. Torque Characteristics: Sufficient to accelerate the driven loads satisfactorily.

- B. Motor Sizes: Minimum sizes and electrical characteristics as indicated. If not indicated, large enough so that the driven load will not require the motor to operate in the service factor range.
- C. Temperature Rating: 50 deg C maximum temperature rise at 40 deg C ambient for continuous duty at full load (Class A Insulation).
- D. Service Factor: 1.15 for polyphase motors and 1.35 for single-phase motors.
- E. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty. Design B. Provide permanent-split capacitor classification motors for shaft-mounted fans and capacitor start classification for belted fans.
 - 1. Bases: Adjustable.
 - 2. Bearings: The following features are required:
 - a. Ball or roller bearings with inner and outer shaft seals.
 - b. Grease lubricated.
 - c. Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.
 - 3. Enclosure Type: The following features are required:
 - a. Open drip-proof motors where satisfactorily housed or remotely located during operation.
 - b. Guarded drip-proof motors where exposed to contact by employees or building occupants.
 - 4. Overload protection: Built-in, automatic reset, thermal overload protection.
 - 5. Noise rating; Quiet.
 - 6. Efficiency: Energy-efficient motors shall have a minimum efficiency as scheduled in accordance with IEEE Standard 112, Test Method B. If efficiency not specified, motors shall have a higher efficiency than "average standard industry motors" in accordance with IEEE Standard 112. Test Method B.
 - 7. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, and special features
- F. Starters, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, roof curbs, equipment supports, and other conditions affecting performance of fans.
- B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install fans level and plumb, in accordance with manufacturer's written instructions. Support units as described below, using the vibration control devices indicated.
 - 1. Secure roof-mounted fans to roof curbs with cadmium-plated hardware.
 - 2. MC to coordinate curb requirements with PEMB provider. Provide manufacturer's standard shop-fabricated units, modified as necessary to comply with requirements.
- B. Arrange installation of units to provide access space around fans for service and maintenance.

3.3 CONNECTIONS

- A. Duct installations and connections are specified in other Division 23 sections. Make final duct connections with flexible connections.
- B. Electrical Connections: The following requirements apply:

1. Electrical power wiring is specified in Division 26.
2. Temperature control wiring and interlock wiring are specified in Division 23 Section "DDC Controls".
3. Grounding: Connect unit components to ground in accordance with the National Electrical Code.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Inspection: Arrange and pay for a factory- authorized service representative to perform the following:
1. Inspect the field assembly of components and installation of fans including ductwork and electrical connections.
 2. Prepare a written report on findings and recommended corrective actions.

3.5 ADJUSTING, CLEANING, AND PROTECTING

- A. Adjust damper linkages for proper damper operation.
- B. Clean unit cabinet interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel and cabinet.

3.6 COMMISSIONING

- A. Final Checks Before Start-Up: Perform the following operations and checks before start-up:
1. Remove shipping blocking and bracing.
 2. Verify unit is secure on mountings and supporting devices and that connections for: ductwork, and electrical are complete. Verify proper thermal overload protection is installed in motors, starters, and disconnects.
 3. Perform cleaning and adjusting specified in this Section.
 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearings operations. Reconnect fan drive system, align belts, and install belt guards.
 5. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
 6. Verify manual and automatic controls and that fire and smoke dampers in connected ductwork systems are in the full-open position.
 7. Disable automatic controls operators.
- B. Starting procedures for fans:
1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
 - a. Replace fan and motor pulleys as required to achieve design conditions.
 2. Measure and record motor electrical values for voltage and amperage.
- C. Shut unit down and reconnect automatic controls operators.
- D. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for procedures for air-handling-system testing, adjusting, and balancing.

END OF SECTION

SECTION 23 0891

DUCTWORK

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 this Section.
- B. Requirements of the following Division 23 Sections apply to this Section:
 - 1. "Basic Mechanical Materials and Methods."

1.2 SUMMARY

- A. This Section includes:
 - 1. Medium-Pressure round ductwork.
 - 2. Low-Pressure rectangular and round ductwork.
 - 3. Flexible ducts.
- B. Related Sections: The following sections contain requirements that relate to this Section:
 - 1. Division 7 Section "Joint Sealers" for fire-resistant sealants for use around duct penetrations and fire damper installations in fire rated floors, partitions, and walls.
 - 2. Division 8 Section "Access Panels and Doors" for wall- and ceiling-mounted access panels and doors for access to concealed ducts.
 - 3. Division 23 Section "Mechanical Insulation" for external duct and plenum insulation,
 - 4. Division 23 Section "Duct Accessories" for flexible duct materials, dampers, duct-mounted access panels and doors, and turning vanes.
 - 5. Division 23 Section "Air Outlets and Inlets."
 - 6. Division 23 Section "DDC System" for automatic volume control dampers and operators.
 - 7. Division 23 Section "Testing, Adjusting, and Balancing."

1.3 DEFINITIONS

- A. Medium-pressure round ducts: All ductwork from the rooftop units to the variable air volume terminals.
- B. Low-pressure ductwork: All other ducts including ductwork downstream of the variable air volume terminals.
- C. Sealing Requirements Definitions: For the purposes of duct systems sealing requirements specified in this Section, the following definitions apply:
 - 1. Seams: A seam is defined as joining of two longitudinally (in the direction of airflow) oriented edges of duct surface material occurring between two joints. All other duct surface connections made on the perimeter are deemed to be joints.
 - 2. Joints: Joints include girth joints; branch and sub-branch intersections; so-called duct collar tap-ins; fitting subsections; louver and air terminal connections to ducts; access door and access panel frames and jambs; duct, plenum, and casing abutments to building structures,

1.4 SYSTEM PERFORMANCE REQUIREMENTS

- A. The duct system design, as indicated, has been used to select and size air moving and distribution equipment and other components of the air system. Changes or alterations to the layout or configuration of the duct system must be specifically accepted by the Engineer, in writing. Accompany requests for layout

modifications with calculations showing that the proposed revised layout will provide the original design results without increasing the system total pressure.

1.5 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data including details of construction relative to materials, dimensions of individual components, profiles, and finishes for the following items:
 - 1. External Insulation (on outside of ducts).
 - 2. Sealing Materials.
 - 3. Fire-Stopping Materials.
 - 4. Flexible duct.
- C. Shop drawings from duct fabrication shop, drawn to a scale not smaller than 1/4 inch equals 1 foot (1/4"=1'-0"), on drawing sheets same size as the Contract Drawings, detailing:
 - 1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.
 - 2. Duct layout, indicating pressure classifications and sizes in plan view. For exhaust ducts systems, indicate the classification of the materials handled as defined in this Section.
 - 3. Fittings.
 - 4. Reinforcing details and spacing.
 - 5. Seam and joint construction details.
 - 6. Penetrations through fire-rated and other partitions.
 - 7. Terminal unit, coil, and humidifier installations.
 - 8. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.
- D. Coordination drawings for ductwork installation in accordance with Division 23 Section "Basic Mechanical Requirements." In addition to the requirements specified in "Basic Mechanical Requirements" show the following:
 - 1. Coordination with ceiling suspension members.
 - 2. Spatial coordination with other systems installed in the same space with the duct systems.
 - 3. Coordination of ceiling and wall-mounted access doors and panels required to provide access to dampers and other operating devices.
 - 4. Coordination with ceiling-mounted lighting fixtures, supply air outlets, return/exhaust/transfer air inlets and all other devices.
- E. Welding certificates including welding procedures specifications, welding procedures qualifications test records, and welders' qualifications test records complying with requirements specified in "Quality Assurance" below.
- F. Record drawings including duct systems routing, fittings details, reinforcing, support, and installed accessories and devices, in accordance with Division 23 Section "Basic Mechanical Requirements" and Division 1.
- G. Maintenance data for volume control devices, fire dampers, and smoke dampers, in accordance with Division 23 Section "Basic Mechanical Requirements" and Division 1.

1.6 QUALITY ASSURANCE

- A. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel" for hangers and supports and AWS D9.1 "Sheet Metal Welding Code."

- B. Qualify each welder in accordance with AWS qualification tests for welding processes involved. Certify that their qualification is current.
- C. NFPA Compliance: Comply with the following NFPA Standards:
 - 1. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," except as indicated otherwise.
 - 2. NFPA 96, "Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors for Commercial Cooking Equipment," Chapter 3, "Duct System," for kitchen hood duct systems, except as indicated otherwise.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sealant and fire-stopping materials to site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
- B. Store and handle sealant fire-stopping materials in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.
- C. Deliver and store stainless steel sheets with mill-applied adhesive protective paper, maintained through fabrication and installation.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

- A. Sheet Metal, General: Provide sheet metal in thickness indicated, packaged, and marked as specified in ASTM A 700.
- B. Galvanized Sheet Steel: Lock-forming quality, ASTM A 527, Coating Designation G 90. Provide mill phosphatized finish for exposed surfaces of ducts exposed to view.
- C. Carbon Steel Sheets: ASTM A 366. cold-rolled sheets, commercial quality, with oiled, exposed matte finish.
- D. Aluminum Sheets: ASTM B 209, Alloy 3003, Temper H14, sheet form: with standard, one-side bright finish where ducts are exposed to view, and mill finish for concealed ducts.
- E. Reinforcement Shapes and Plates: Unless otherwise indicated, provide galvanized steel reinforcing where installed on galvanized sheet metal ducts. For aluminum ducts provide reinforcing of compatible materials.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less: 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 SEALING MATERIALS

- A. Joint and Seam Sealants, General: The term sealant used here is not limited to materials of adhesive or mastic nature, but also includes tapes and combinations of open weave fabric strips and mastics.
- B. Joint and Seam Tape: 2 inches wide, glass-fiber-fabric reinforced.
- C. Tape Sealing System: Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with the tape to form a hard, durable, airtight seal.

- D. Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant complying with FS TT-S-001657, Type 1; formulated with a minimum of 75 percent solids.
- E. Flanged Joint Mastics: One-part, acid-curing, silicone elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS. Class 25, Use 0.

2.4 FIRE-STOPPING

- A. Refer to Division 7 Section "Joint Sealers" for firestopping.

2.5 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, powder actuated fasteners, or structural steel fasteners appropriate for building materials. Do not use powder actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4 inches thick.
- B. Hangers: Galvanized sheet steel, or round, uncoated steel, threaded rod.
 - 1. Hangers Installed In Corrosive Atmospheres: Electro-galvanized, all-thread rod or hot-dipped-galvanized rods with threads painted after installation.
 - 2. Straps and Rod Sizes: Conform with Table 4-1 in SMACNA HVAC Duct Construction Standards, 1985 Edition, for sheet steel width and gage and steel rod diameters.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports: Steel shapes conforming to ASTM A 36.
 - 1. Where galvanized steel ducts are installed, provide hot-dipped-galvanized steel shapes and plates.
 - 2. For stainless steel ducts, provide stainless steel support materials.
 - 3. For aluminum ducts, provide aluminum support materials, except where materials are electrolytically separated from ductwork.

2.6 RECTANGULAR DUCT FABRICATION

- A. General: Except as otherwise indicated, fabricate rectangular ducts with galvanized sheet steel, in accordance with SMACNA "HVAC Duct Construction Standards," Tables 1-3 through 1-19, including their associated details. Conform to the requirements in the referenced standard for metal thickness, reinforcing types and intervals, tie rod applications, and joint types and intervals.
 - 1. Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
 - 2. Provide materials that are free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.
- B. Static Pressure Classifications: Except where otherwise indicated, construct duct systems to the following pressure classifications:
 - 1. Medium-pressure supply air ductwork from rooftop unit to variable air volume terminals: four (4") inches water gage.
 - 2. Supply air ductwork from variable air volume terminal units to air distribution devices: two (2") inches water gage.
 - 3. All other Supply air ducts: two (2") inches water gage.
 - 4. Return air ducts: two (2") inches water gage, negative pressure.
 - 5. General Exhaust ducts: two (2") inches water gage, negative pressure.

- C. Crossbreaking or Cross Beading: Crossbreak or bead duct sides that are 19 inches and larger and are 20 gage or less, with more than 10 sq. ft. of unbraced panel area, as indicated in SMACNA "HVAC Duct Construction Standard," Figure 1-4, unless they are lined or are externally insulated.

2.7 RECTANGULAR DUCT FITTINGS

- A. Fabricate elbows, transitions, offsets, branch connections, and other duct construction in accordance with SMACNA "HVAC Metal Duct Construction Standard," 1985 Edition, Figures 2-1 through 2-10.

2.8 ROUND DUCT FABRICATION

- A. General: "Basic Round Diameter*" as used in this article is the diameter of the size of round duct that has an open area equal to the area of a given sized rectangular duct. Except where interrupted by fittings, provide round ducts in lengths not less than 12 feet.
- B. Low-Pressure supply air: Fabricate round supply ducts with spiral lockseam construction, except where diameters exceed 72 inches, and as indicated below. Fabricate ducts having diameters greater than 72 inches with longitudinal butt-welded seams. Comply with SMACNA "HVAC Duct Construction Standards," Table 3-2 for galvanized steel gages.
 - 1. Low-Pressure supply air runouts from duct mains to air distribution devices, and for exhaust ductwork, for pressure classifications: two (2") inches water gage and less, construction shall be longitudinal seam construction.
- C. Medium-Pressure supply air: Fabricate double-wall insulated ducts with an outer shell, insulation, and an inner liner as specified below. Dimensions indicated on internally insulated ducts are nominal inside dimensions. Provide Medium-Pressure, double metal wall with one (1") thick insulation, round supply air ductwork similar to United's K-27.
 - 1. Thermal Conductivity: 0.27 Btu/sq.ft./deg F/inch thickness at 75 deg F mean temperature.
 - 2. Outer Shell: Base outer shell gage on actual outer shell dimensions. Provide outer shell lengths 2 inches longer than inner shell and insulation, and in gages specified above for single-wall duct.
 - 3. Insulation: Unless otherwise indicated, provide one (1") inch thick fiber-glass insulation. Provide insulation ends where internally insulated duct connects to single-wall duct or non-insulated components. The insulation end shall terminate the insulation and reduce the outer shell diameter to the inner liner diameter.
 - 4. Perforated Inner Liner: Construct round and flat oval inner liners with perforated sheet metal of the gages listed below. Provide 3/32-inch-diameter perforations, with an overall open area of 23 percent. For flat oval ducts, the diameter indicated below is the "basic round diameter."
 - a. 3 to 8 inches: 28 gage with standard spiral construction.
 - b. 9 to 42 inches: 28 gage with single-rib spiral construction.
 - c. 44 to 60 inches: 26 gage with single-rib spiral construction.
 - d. 62 to 88 inches: 22 gage with standard spiral construction.
 - 5. Maintain concentricity of liner to outer shell by mechanical means. Retain insulation from dislocation by mechanical means.

2.9 ROUND SUPPLY AND RETURN/EXHAUST FITTINGS FABRICATION

- A. 90-Degree Tees and Laterals and Conical Tees: Fabricate to conform to SMACNA "HVAC Duct Construction Standards," 1985 Edition, Figures 3-4 and 3-5 and with metal thickness specified for longitudinal seam straight duct.
- B. Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from the body onto branch tap entrance.

- C. Elbows: Fabricate in die-formed, gored, pleated, or mitered construction. Fabricate the bend radius of die-formed, gored, and pleated elbows 1.5 times the elbow diameter. Unless elbow construction type is indicated, provide elbows meeting the following requirements:
1. Mitered Elbows: Fabricate mitered elbows with welded construction in gages specified below.
 - a. Mitered Elbows Radius and Number of Pieces: Unless otherwise indicated, construct elbow to comply with SMACNA "HVAC Duct Construction Standards," Table 3-1.
 - b. Round Mitered Elbows: Solid welded and with metal thickness listed below for pressure classes from minus 2 inches to plus 2 inches:
 - 1) 3 to 26 inches: 24 gage.
 - 2) 27 to 36 inches: 22 gage.
 - 3) 37 to 50 inches: 20 gage.
 - 4) 52 to 60 inches: 18 gage.
 - 5) 62 to 84 inches: 16 gage.
 - c. Round Mitered Elbows: Solid welded and with metal thickness listed below for pressure classes from 2 inches to 10 inches:
 - 1) 3 to 14 inches: 24 gage.
 - 2) 15 to 26 inches: 22 gage.
 - 3) 27 to 50 inches: 20 gage.
 - 4) 52 to 60 inches: 18 gage.
 - 5) 62 to 84 inches: 16 gage.
 - d. Flat Oval Mitered Elbows: Solid welded and with the same metal thickness as longitudinal seam flat oval duct.
 - e. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems, or exhaust systems for material handling classes A and B; and only where space restrictions do not permit the use of 1.5 bend radius elbows. Fabricate with a single-thickness turning vanes.
 2. Round Elbows - 8 Inches and Smaller: Die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend angle configurations or 1/2-inch-diameter (e.g. 3-1/2- and 4-1/2-inch) elbows with gored construction.
 3. Round Elbows - 9 Through 14 Inches: Gored or pleated elbows for 30, 45, 60, and 90 degrees, except where space restrictions require a mitered elbow. Fabricate nonstandard bend angle configurations or 1/2-inch-diameter (e.g. 9-1/2- and 10-1/2-inch) elbows with gored construction.
 4. Round Elbows - Larger Than 14 Inches and All Flat Oval Elbows: Gored elbows, except where space restrictions require a mitered elbow.
 5. Die-Formed Elbows for Sizes Through 8 Inches and All Pressures: 20 gage with 2-piece welded construction.
 6. Round Gored Elbows Gages: Same as for non-elbow fittings specified above.

2.10 FLEXIBLE DUCTS

- A. General: Comply with UL 181, Class 1.
- B. Flexible Ducts - Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-1/2-inch-thick, glass fiber insulation around a continuous inner liner.
1. Reinforcement: Steel-wire helix encapsulated in the inner liner.
 2. Outer Jacket: Glass-reinforced, silver mylar with a continuous hanging tab, integral fiber glass tape, and nylon hanging cord.
 3. Inner Liner: Polyethylene film.

2.11 DUCT LINER

- A. Fibrous-Glass Liner: Comply with NFPA 90A and with NAIMA AH124.
1. Available Manufacturers:

- a. CertainTeed Corp.; Insulation Group.
 - b. Johns Mansville International, Inc.
 - c. Knauf Fiber Glass GmbH.
 - d. Owens Corning.
2. Materials: ASTM C 1071; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers.
- a. Thickness: 1 inch.
 - b. Thermal Conductivity (k-value): 0.26 at 75 deg F mean temperature.
 - c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION, GENERAL

- A. Install ducts with the fewest possible joints.
- B. Use fabricated fittings for all changes in directions, changes in size and shape, and connections.
- C. Install couplings tight to duct wall surface with projections into duct at connections kept to a minimum.
- D. Locate ducts, except as otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs. Install duct systems in shortest route that does not obstruct useable space or block access for servicing building and its equipment.
- E. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- F. Provide clearance of 1 inch where furring is shown for enclosure or concealment of ducts, plus allowance for insulation thickness, if any.
- G. Install insulated ducts with 1-inch clearance outside of insulation.
- H. Conceal ducts from view in finished and occupied spaces by locating in mechanical shafts, hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown.
- I. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.
- J. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- K. Non-Fire-Rated Partition Penetrations: Where ducts pass interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2 inches.

3.2 SEAM AND JOINT SEALING

- A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.
 - 1. For pressure classes lower than 2-inch wg, seal transverse joints. Seal ducts before external insulation is applied.

- B. Pressure Classifications Greater Than 3 Inches Water Gage: All transverse joints, longitudinal seams, and duct penetrations.
- C. Pressure Classification 2 and 3 Inches Water Gage: All transverse joints and longitudinal seams.
 - 1. Pressure Classification Less than 2 Inches Water Gage: Transverse joints only.
- D. Seal externally insulated ducts prior to insulation installation.

3.3 HANGING AND SUPPORTING

- A. Install rigid round and rectangular metal ducts with support systems indicated in SMACNA "HVAC Duct Construction Standards," Tables 4-1 through 4-3 and Figures 4-1 through 4-8.
- B. Support horizontal ducts within 2 feet of each elbow and within 4 feet of each branch intersection.
- C. Support vertical ducts at a maximum interval of 16 feet and at each floor.
- D. Upper attachments to structures shall have an allowable load not exceeding 1/4 of the failure (proof test) load but are not limited to the specific methods indicated.
- E. Install concrete insert prior to placing concrete.
- F. Install powder actuated concrete fasteners after concrete is placed and completely cured.

3.4 CONNECTIONS

- A. Equipment Connections: Connect equipment with flexible connectors in accordance with Division 23 Section "Duct Accessories."
- B. Branch Connections: Comply with SMACNA "HVAC Duct Construction Standards." Figures 2-7 and 2-8.
- C. Outlet and Inlet Connections: Comply with SMACNA "HVAC Duct Construction Standards," Figures 2-16 through 2-18.
- D. Terminal Units Connections: Comply with SMACNA "HVAC Duct Construction Standards," Figure 2-19.

3.5 FIELD QUALITY CONTROL

- A. The Contractor will sub-contract with an independent testing agency to perform, record, and report leakage tests.
- B. Remake leaking joints as required and apply sealants to achieve specified maximum allowable leakage.
- C. Disassemble, reassemble, and seal segments of the systems as required to accommodate leakage testing, and as required for compliance with test requirements.
- D. Conduct tests, in the presence of the Engineer, at static pressures equal to the maximum design pressure of the system or the section being tested. If pressure classifications are not indicated, test entire system at the maximum system design pressure. Do not pressurize systems above the maximum design operating pressure. Give seven (7) days advanced notice prior to testing.

- E. Determine leakage from entire system or section of the system by relating leakage to the surface area of the test section.
- F. Maximum Allowable Leakage: As described in ASHRAE 1989 Handbook, "Fundamentals" Volume, Chapter 32, Table 6 and Figure 10. Comply with requirements for leakage classification 3 for round ducts, leakage classification 12 for rectangular ducts in pressure classifications less than and equal to 2 inches water gage (both positive and negative pressures), and leakage classification 6 for pressure classifications greater than 2 inches water gage and less than and equal to 10 inches water gage.
- G. Leakage Test: Perform volumetric measurements and adjust air systems as described in ASHRAE 1987 "HVAC Systems and Applications" Volume, Chapter 57 and ASHRAE 1989 "Fundamentals" Volume, Chapter 13, and Division 23 Section "TESTING, ADJUSTING, AND BALANCING."

3.6 ADJUSTING AND CLEANING

- A. Adjust volume control devices as required by the testing and balancing procedures to achieve required air flow. Refer to Division 23 Section "TESTING, ADJUSTING, AND BALANCING" for requirements and procedures for adjusting and balancing air systems.
- B. Vacuum ducts systems prior to final acceptance to remove dust and debris.

END OF SECTION

SECTION 23 0910

DUCTWORK 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. Backdraft dampers.
 - 2. Manual volume control dampers.
 - 3. Instrument Test Holes.
 - 4. Fire and smoke dampers.
 - 5. Turning vanes.
 - 6. Duct-mounted access doors and panels.
 - 7. Flexible connectors.
 - 8. Accessories hardware.
 - 9. Louvers.
 - 10. Roof Hoods.
 - 11. Prefabricated Roof Curbs.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 23 Section "Air Outlets and Inlets" for diffusers, registers, and grilles.
 - 2. Division 23 Section "Air Terminals" for constant and variable air volume units.
 - 3. Division 23 Section "Direct Digital Controls" for electric and pneumatic dampers actuators.
 - 4. Division 26 Section "Fire Alarm Systems" for duct-mounted fire and smoke detectors.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data including details for materials, dimensions of individual components, profiles, and finishes for the following items:
 - 1. Backdraft dampers.
 - 2. Manual volume control dampers.
 - 3. Instrument Test Holes.
 - 4. Fire and smoke dampers.
 - 5. Duct-mounted access panels and doors.
 - 6. Duct silencers.
 - 7. Louvers.
 - 8. Roof Hoods.
 - 9. Prefabricated Roof Curbs.
- C. Shop drawings from manufacturer detailing assemblies. Include dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection. Detail the following:
 - 1. Special fittings and volume control damper installation (both manual and automatic) details.
 - 2. Fire and smoke damper installations, including sleeves and duct-mounted access door and panel installations.

- D. Product Certification: Submit certified test data on dynamic insertion loss: self-noise power levels; and airflow performance data, static pressure loss, and dimensions and weights.

1.4 QUALITY ASSURANCE

- A. NFPA Compliance: Comply with the following NFPA Standards:
 - 1. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
 - 2. NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."

1.5 EXTRA MATERIALS

- A. Furnish extra materials matching products installed as described below, packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Owner.
 - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2-PRODUCTS

2.1 BACKDRAFT DAMPERS

- A. Description: Suitable for horizontal or vertical installation.
- B. Frame: 18-gage galvanized steel, with welded corners.
- C. Blades: 0.050-inch-thick 6063T extruded aluminum.
- D. Blade Seals: Neoprene.
- E. Blade Axles: Galvanized steel.
- F. Tie Bars and Brackets: Galvanized steel.
- G. Return Spring: Adjustable tension.
- H. Wing-Nut Operator: Galvanized steel, with 1/4-inch galvanized-steel rod.

2.2 MANUAL VOLUME CONTROL DAMPERS

- A. General: Provide factory-fabricated volume-control dampers, complete with required hardware and accessories. Stiffen damper blades to provide stability underoperating conditions. Provide locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class. Provide end bearings or other seals for ducts with pressure classifications of 3 inches or higher. Extend axles full length of damper blades. Provide bearings at both ends of operating shaft.
- B. Standard Volume Control Dampers: Multiple or single blade, parallel or opposed blade design as indicated, standard leakage rating, with linkage outside of air stream, and suitable for horizontal or vertical applications.
- C. Damper Control Hardware: Zinc-plated, die-cast core with a heavy-gage dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Provide center hole to suit damper operating rod size. Provide elevated platform for insulated duct mounting.

2.3 INSTRUMENT TEST HOLES

- A. General: Equal to Ventlok 699-2 with screw on cap to be installed on each section of an air handler and on all mixing boxes, outside air ducts, return air ducts and at points in the air system that changes occur in temperature.
- B. Size of holes and length shall be coordinated with Test and Balance and Temperature Controls Contractors.

2.4 FIRE DAMPERS

- A. General: UL labeled according to UL Standard 555 "Standard for Fire Dampers." Refer to drawings for location.
- B. Fire Rating: 1-1/2 hours unless otherwise indicated.
- C. Frame: Type A or Type B; fabricated with roll-formed, 21-gage, galvanized-steel; with mitered and interlocking comers.
- D. Mounting Sleeve: Factory-installed or field-installed galvanized steel.
 - 1. Minimum Thickness: 0.056-inch (16-gage) or 0.138-inch (10-gage) thick as indicated, and length to suit application.
 - 2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of the wall or floor, and thickness of damper frame meets sleeve requirements.
- E. Mounting Orientation: Vertical or horizontal as indicated.
- F. Blades: Roll-formed, interlocking, 21-gage galvanized steel. In place of interlocking blades, provide full-length, 21-gage, galvanized-steel blade connectors.
- G. Horizontal Dampers: Include a blade lock and stainless steel negator closure spring.
- H. Fusible Link: Replaceable, 165 deg F rated.

2.5 SMOKE DAMPERS

- A. General: UL-labeled according to UL Standard 555S, "Standard for Leakage Rated Dampers for Use in Smoke Control Systems." Combination fire and smoke dampers shall also be UL-labeled for 1-1/2 hour rating according to UL Standard 555 "Standard for Fire Dampers." Refer to drawings for locations.
- B. Fusible Link: Replaceable, 165 deg F rated.
- C. Frame and Blades: 16-gage galvanized steel.
- D. Mounting Sleeve: Factory-installed, 18-gage galvanized steel, length to suit wall or floor application.

2.6 TURNING VANES

- A. Fabricate turning vanes according to SMACNA HVAC Duct Construction Standards, Figures 2-2 through 2-7.
- B. Manufactured Turning Vanes: Fabricate of two (2") inch radius curved blades set at one and a half (1-1/2") inches on center, support with bars perpendicular to blades set at two (2") inches on center, and set into side strips suitable for mounting in ducts.

2.7 DUCT-MOUNTED ACCESS DOORS AND PANELS

- A. General: Provide construction and air tightness suitable for duct pressure class.
- B. Frame: Galvanized sheet steel. Provide with bend-over tabs and foam gaskets.
- C. Door: Double-wall, galvanized sheet metal construction with insulation fill and thickness, number of hinges and locks as indicated for duct pressure class. Provide vision panel where indicated. Provide 1-inch by 1-inch butt hinge or piano hinge and cam latches.
- D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber seals.
- E. Insulation: 1-inch thick fiberglass or polystyrene foam board.

2.8 FLEXIBLE CONNECTORS

- A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL Standard 181, Class 1.
- B. Standard Metal-Edged Connectors: Factory-fabricated with a strip of fabric 3-1/2 inches wide attached to 2 strips of 2-3/4 inches wide, 24-gage, galvanized sheet steel or 0.032-gage aluminum sheets. Select metal compatible with connected duct system. Fold and crimp metal edge strips onto fabric as illustrated in SMACNA HVAC Duct Standard, 1st Edition, Figure 2-19.
- C. Conventional, Indoor System Flexible Connectors Fabric: Glass fabric double coated with polychloroprene.
 - 1. Minimum Weight: 26 oz. per sq yd.
 - 2. Tensile Strength: 480 lb per inch in the warp and 360 lb per inch in the filling.

2.9 ACCESSORIES HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket and a flat mounting gasket. Size to allow insertion of pitot tube and other testing instruments and provide in length to suit duct insulation thickness.
- B. Flexible Duct Clamps: Stainless steel band with cadmium-plated hex screw to tighten band with a worm-gear action. Provide in sizes from 3 to 18 inches to suit duct size.
- C. Adhesives: High strength, quick setting, neoprene based, waterproof and resistant to gasoline and grease.

2.10 LOUVERS

- A. General: Except as otherwise indicated, provide manufacturer's standard louvers where shown; of size, shape, capacity, and type indicated; constructed of materials and components as indicated and as required for complete installation.
- B. Performance: Provide louvers that have free area and pressure drop equivalent to that indicated as listed in the manufacturer's current data. Louvers must be designed to be weatherproof.
- C. Substrate Compatibility: Provide louvers with frame and sill styles that are compatible with adjacent substrate and that are specifically manufactured to fit into construction openings with accurate fit and adequate support for weatherproof installation. Refer to architectural drawings and specifications for types of substrate which will contain each type of louver.
- D. Materials: Construct of aluminum extrusions, ASTM B 221, alloy 6063-T52. Weld units or use stainless steel fasteners.

- E. Louver Screens: On the inside face of exterior louvers, provide 1/2" square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.
- F. Manufacturer: Subject to compliance with requirements, provide louvers of one of the following:
 - 1. Airline Products Co.
 - 2. Airolite Co.
 - 3. American Warming and Ventilating Inc.
 - 4. Arrow United Industries, Inc.
 - 5. Construction Specialties, Inc.
 - 6. Dowco Corp.
 - 7. Industrial Louvers, Inc.
 - 8. Louvers & Dampers, Inc.
 - 9. Penn Ventilator Co., Inc.
 - 10. Ruskin Mfg. Co.
 - 11. Vent Products Co., Inc.
- G. Exposed Finish: Apply the following coating in thickness indicated. Furnish appropriate air-drying spray finish in matching color for touch up.
 - 1. Fluoropolymer 2-Coat Coating System: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight with a total minimum dry film thickness of 0.9 mil (0.023 mm) and 30 percent reflective gloss when tested according to ASTM D 523.
 - a. Durability: Provide coating field tested under normal range of weather conditions for a minimum of 20 years without significant peel, blister, flake, chip, crack, or check in finish; without chalking in excess of a chalk rating of 8 according to ASTM D 4214; and without fading in excess of 5 Hunter units.
 - b. Color: Match Architect's samples.

2.11 ROOF HOODS

- A. General: Provide roof-mounted Outside Air Intake, Exhaust/Relief Air Vents, hooded type, roof-curb mounted, of size, type, and capacity as scheduled, and as specified herein.
- B. Type: Stationary, natural draft type. Provide weatherproof housings to match power ventilators in materials and finish. Provide square or rectangular base to suit roof curb.
- C. Construction: Construct of galvanized steel or aluminum as indicated or scheduled. Provide protective coating if scheduled.
- D. Bird Screens: Provide removable bird screens, 1/2" square mesh, 16-ga. aluminum or brass wire.
- E. Relief Dampers: For exhaust and pressure relief applications, provide gravity-actuated louvered shutters in curb bases.
- F. Motor-operated Dampers: Where indicated, provide motor-operated louvered dampers with linkage in curb base.

2.12 PREFABRICATED ROOF CURB (Furnished and installed by metal building manufacturer)

- A. General: MC to coordinate curb requirements with PEMB provider. Provide manufacturer's standard shop-fabricated units, modified as necessary to comply with requirements.
- B. Construction: Fabricate structural framing for units of structural quality sheet steel (ASTM A 570, Grade 40), formed to profiles indicated, or if not indicated, to manufacturer's standard profiles for coordination with roofing, insulation, and deck construction. Include 45 degree cant strips and deck flanges with offsets to accommodate roof insulation. Weld comers and seams to form watertight units.

- C. Sloping Roof Decks: For deck slopes of 1/4" per foot and more, fabricate support units to form level top edge.
- D. Gage and Height: Fabricate units of minimum 14 gage metal and to height above roof surface as required for application.
- E. Insulation: Insulate units inside structural support wall with rigid glass fiber insulation board of approximately 3-lb. density and 1-1/2" minimum thickness, except as otherwise indicated.
- F. Manufacturer: Subject to compliance with requirements, provide prefabricated roof curbs of one of the following:
 - 1. Same manufacturer as exhaust fans or roof hoods.
 - 2. Custom Curb, Inc.
 - 3. Pate Co.
 - 4. Thycurb Div.; Thybar Corp.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of duct accessories. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Install duct accessories according to manufacturer's installation instructions and applicable portions of details of construction as shown in SMACNA standards.
- B. Install volume control dampers in lined duct with methods to avoid damage to liner and to avoid erosion of duct liner.
- C. Provide test holes with access ports at fan inlet and outlet and elsewhere as required by TAB and controls manufacturer. Coordinate these requirements prior to insulating ductwork. Coordinate locations with double wall duct fabrication.
- D. Install fire and smoke dampers according to the manufacturer's UL-approved printed instructions.
- E. Install fusible links in fire dampers.
- F. Label access doors according to Division 23 Section "Mechanical Identification."
- G. Coordinate roof hood and roof curb work with work of roofing, walls, and ceilings, as necessary for proper interfacing.

3.3 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Adjust fire and smoke dampers for proper action.
- C. Final positioning of manual dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

END OF SECTION

23 0910-6

SECTION 23 0932

AIR OUTLETS AND INLETS

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 air outlets and inlets work is indicated by drawings and schedules, and by requirements of this Section.
- B. Types of outlets and inlets required for project include the following:
 - 1. Ceiling air diffusers.
 - 2. Wall registers and grilles.
- C. Refer to other Division-23 sections for ductwork and duct accessories required in conjunction with air outlets and inlets; not work of this section.
- D. Refer to other Division-23 sections for balancing of air outlets and inlets; not work of this section.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualification: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
 - 2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".
 - 3. ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual".
 - 4. ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.
 - 5. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters".
 - 6. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
 - 7. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:
 - 1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
 - 2. Data sheet for each type of air outlet and inlet, and accessory furnished: indicating construction, finish, and mounting details.
 - 3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses; throw and drop; and noise criteria ratings. Indicate selections on data.
- B. Samples: Two (2) samples of each type to be furnished with specified finishes.

- C. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.
- D. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 1.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.
- B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 CEILING AIR DIFFUSERS:

- A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown: of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.
- D. Manufacturer: Subject to compliance with requirements, provide diffusers of one of the following:
 - 1. METAL-AIRE.
 - 2. NAILOR INDUSTRIES.
 - 3. PRICE.
 - 4. TITUS.

2.2 WALL REGISTERS AND GRILLES:

- A. General: Except as otherwise indicated, provide manufacturer's standard wall registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide wall registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer's current data.
- C. Wall Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall construction which will contain each type of wall register and grille.

- D. Manufacturer Subject to compliance with requirements, provide registers and grilles of one of the following:
1. METAL-AIRE.
 2. NAILOR INDUSTRIES.
 3. PRICE.
 4. TITUS.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

- A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended function.
- B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.
- C. Locate ceiling air diffusers, registers, and grilles, as indicated on architectural drawings "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling module.

3.3 SPARE PARTS:

- A. Furnish to Owner, with receipt, 3 operating keys for each type of air outlet and inlet that require them.

END OF SECTION

SECTION 23 0990

TESTING, ADJUSTING, AND BALANCING

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 SUMMARY:

- A. This Section specifies the requirements and procedures for mechanical systems' testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid (air and water) quantities of the mechanical systems as required to meet design specifications, recording and reporting the results.
- B. Test, Adjust, and Balance the following mechanical systems:
 - 1. Supply air systems, all pressure ranges.
 - 2. Return air and Outside air systems;
 - 3. Exhaust air systems.
 - 4. Domestic water recirculation system.
 - 5. Verify temperature controls system operation.
 - 6. Reporting of results of activities and procedures specified in this section.

1.3 DEFINITIONS:

- A. Systems Testing, Adjusting, and Balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:
 - 1. Balance of air and water distribution.
 - 2. Adjustment of total system to provide design quantities.
 - 3. Electrical measurement.
 - 4. Verification of performance of all equipment and automatic controls.
- B. Test: To determine quantitative performance of equipment.
- C. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.
- D. Report forms: Test data sheets arranged for collecting test data in logical order for submission, review and acceptance. These reports should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.
- E. Terminal: The point where the controlled fluid enters or leaves the distribution system. These are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers and hoods.
- F. Main: Duct or pipe containing the system's major or entire fluid flow.
 - 1. Submain: Duct or pipe containing part of the systems capacity and serving two or more branch mains.
- G. Branch main: Duct or pipe serving two or more terminals.
- H. Branch: Duct or pipe serving a single terminal.

1.4 SUBMITTALS:

- A. Agency Data:
 - 1. Within 30 days from Contractor's Notice to Proceed, submit proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified in "Quality Assurance" Article.
- B. Procedures and Agenda: Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this project.
- C. Maintenance Data: Submit maintenance and operating data that include how to test, adjust and balance the building systems. Include this information in maintenance data specified in Division 1 and Section 15010.
- D. Certified Reports: Submit two copies of testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards are; an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:
 - 1. Draft reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.
 - 2. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports.
 - 3. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:
 - a. General Information and Summary
 - b. Air Systems
 - c. Hydronic Systems
 - d. Temperature Control Systems
 - e. Special Systems
 - 4. Report Contents: Provide the following minimum information, forms and data:
 - a. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the seal, name, address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.
 - b. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by NEBB, for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.
- E. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of one-month prior to starting the TAB work.

1.5 QUALITY ASSURANCE:

- A. Test and Balance Agency Qualifications:
 - 1. Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to; test, adjust, and balance the building mechanical systems identified above, to produce the design objectives. Services shall include

checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, recording and reporting the results.

2. The independent testing, adjusting, and balancing agency certified by the National Environmental Balancing Bureau (NEBB) in those testing and balancing disciplines required for this project, and having at least one Professional Engineer registered in the State in which the services are to be performed and certified by NEBB as a Test and Balance Engineer.

B. Codes and Standards:

1. NEBB: "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
2. ASHRAE: ASHRAE Handbook, 1984 Systems Volume, Chapter 37, Testing, Adjusting, and Balancing.

- C. Pre-Balancing Conference: Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Engineer and representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

1.6 PROJECT CONDITIONS:

- A. Systems Operation: Systems shall be fully operational prior to beginning procedures.

1.7 SEQUENCING AND SCHEDULING:

- A. Test, adjust, and balance the air systems before hydronic systems.
- B. Test, adjust and balance air conditioning (cooling) systems during summer season and heating systems during the winter season, including at least a period of operation at outside conditions within 5 deg. F wet bulb temperature of maximum summer design condition, and within 10 deg. F dry bulb temperature of minimum winter design condition. Take final temperature readings during seasonal operation.

1.8 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING:

- A. Before operating the system, perform these steps:
1. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.
 2. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return, and exhaust) and temperature controls diagrams.
 3. Compare design to installed equipment and field installations.
 4. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.

5. Check filters for cleanliness.
6. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.
7. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.
8. Determine best locations in main and branch ductwork for most accurate duct traverses.
9. Place outlet dampers in the full open position.
10. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.
11. Lubricate all motors and bearings.
12. Check fan belt tension.
13. Check fan rotation.

3.3 PRELIMINARY DOMESTIC HOT WATER RECIRCULATING SYSTEM BALANCING:

- A. Before operating the system perform these steps:
 1. Open recirculating balancing valves to full open position.
 2. Remove and clean all strainers.
 3. Check circulating pump rotation.

3.4 MEASUREMENTS:

- A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.
- B. Provide instruments meeting the specifications of the referenced standards.
- C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.
- D. Apply instruments as recommended by the manufacturer.
- E. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.
- F. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.
- G. Take all readings with the eye at the level of the indicated value to prevent parallax.
- H. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.
- I. Take measurements in the system where best suited to the task.

3.5 PERFORMING TESTING, ADJUSTING, AND BALANCING:

- A. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.
- B. Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.
- C. Patch insulation, ductwork, and housings, using materials identical to those removed.

- D. Seal ducts and piping, and test for and repair leaks.
- E. Seal insulation to re-establish integrity of the vapor barrier.
- F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.
- G. Final balanced conditions as measured shall be within -10% to +10% of design conditions.
- H. Domestic hot water system balance shall require adjusting calibrated ball valves to approximately equal flow to ensure circulation in all piping loops when there is no hot water usage.
- I. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

3.6 TESTING FOR SOUND AND VIBRATION:

- A. Test mechanical systems for sound and vibration problems. Adjust mechanical systems so they operate as quiet as possible from minimum capacity to maximum capacity. Adjust mechanical system that cause too much vibration or that may be out of rotational balance.

3.7 RECORD AND REPORT DATA:

- A. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, on standard NEBB report forms. Minimum information shall include:
 - 1. Name and address of project, name and address of Contractor, dates of all tests, name and telephone number of test engineer.
 - 2. Grilles, registers and diffusers:
 - Fan System and/or zone number
 - Room number
 - Size of inlet or outlet
 - Manufacturer's effective data
 - Required flow and velocity
 - Initial flow and velocity
 - Final flow and velocity
 - 3. Fans:
 - System and fan number
 - Fan manufacturer, serial number, and model number
 - Motor manufacturer, HP, voltage, phase, RPM, type and service factor, amperage nameplate rating.
 - Scheduled data on drawings or specifications
 - Final air flow
 - Final RPM
 - Final total static pressure
 - Final suction static pressure
 - Final motor amperage
 - Final motor BHP
 - 4. Domestic Hot Water System:
 - Flow at circulating pump
 - Flow at each calibrated balance valve

5. Pumps:
 - System and pump number
 - Manufacturer, size, and model
 - Motor manufacturer, HP, voltage, phase, RPM, type and amperage nameplate rating
 - Scheduled data on drawings or specifications
 - Discharge and suction pressures
 - Flow
 - Amperage
 - BHP

- B. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced to within specified acceptable tolerances.

3.8 DEMONSTRATION:

- A. Training:
 1. Train the Owner's maintenance personnel on troubleshooting procedures and testing, adjusting, and balancing procedures. Review with the Owner's personnel, the information contained in the Operating and Maintenance Data specified in other Division 23 sections.
 2. Schedule training with Owner through the Engineer with at least seven (7) days prior notice.

END OF SECTION

SECTION 26 0500

BASIC ELECTRICAL MATERIALS AND METHODS

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. Electrical equipment coordination and installation.
 - 2. Common electrical installation requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 COORDINATION

- A. 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 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.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. 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 8 Section "Access Doors and Frames."
- D. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. 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.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."
- B. 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.

3.3 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 7 Section "Through-Penetration Firestop Systems."

3.4 FIELD QUALITY CONTROL

- A. Inspect installed sleeve and sleeve-seal installations and associated firestopping for damage and faulty work.

END OF SECTION

SECTION 26 0519
CONDUCTORS AND CABLES

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. 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.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

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.

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. Alcan Products Corporation; Alcan Cable Division.
 - 2. American Insulated Wire Corp.; a Leviton Company.

3. General Cable Corporation.
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.

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 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. 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.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.

- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- I. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- J. Class 2 Control Circuits: Power-limited cable, concealed in building finishes.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Identify and color-code conductors according to local custom.

3.4 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.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

- B. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 7 Section "Through-Penetration Firestop Systems."

3.6 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 7 Section "Through-Penetration Firestop Systems."

END OF SECTION

SECTION 26 0526
GROUNDING AND BONDING

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 methods and materials for grounding systems and equipment.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. 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.

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 UL 467 for grounding and bonding materials and equipment.

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.

2. Stranded Conductors: ASTM B 8.

2.2 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.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad 3/4 inch diameter by 10 foot length.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 3/0 AWG minimum.
 1. Bury at least 24 inches below grade.
- C. 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, minimum, from wall 6 inches above finished floor, unless otherwise indicated.
- D. 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 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.

- B. 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-2-by-12-inch grounding bus.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
- C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 2 Section "Underground Ducts and Utility Structures," and shall be at least 12 inches 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.
- D. 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.
- E. 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.
- F. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. Bond grounding conductor to reinforcing steel in at least four locations. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

3.4 FIELD QUALITY CONTROL

- A. Perform the following 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 service disconnect enclosure grounding terminal.
 - 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.
- B. Report measured ground resistances that exceed the following values:
 1. 10 ohms.
- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 0533

RACEWAYS AND BOXES

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 raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.5 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.
 - 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 5. Electri-Flex Co.
 - 6. Manhattan/CDT/Cole-Flex.
 - 7. Maverick Tube Corporation.
 - 8. O-Z Gedney; a unit of General Signal.
 - 9. Wheatland Tube Company.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. Aluminum Rigid Conduit: ANSI C80.5.
- D. IMC: ANSI C80.6.
- E. EMT: ANSI C80.3.
- F. FMC: Zinc-coated steel.
- G. LFMC: Flexible steel conduit with PVC jacket.
- H. 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.
 - 1. Fittings for EMT: Steel set-screw or compression type.
- I. Joint Compound for Rigid Steel Conduit 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 NONMETALLIC 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. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 3. Arnco Corporation.
 - 4. CANTEX Inc.
 - 5. CertainTeed Corp.; Pipe & Plastics Group.
 - 6. Condux International, Inc.
 - 7. ElecSYS, Inc.
 - 8. Electri-Flex Co.
 - 9. Lamson & Sessions; Carlon Electrical Products.

10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

- B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- C. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

2.3 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:
- B. following:
 1. Cooper B-Line, Inc.
 2. Hoffman.
 3. Square D; Schneider Electric.
- C. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.
- D. Fittings and Accessories: 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.
- E. Wireway Covers: Screw-cover type.
- F. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Prime coating, ready for field painting.
 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. Walker Systems, Inc.; Wiremold Company (The).
 - c. Wiremold Company (The); Electrical Sales Division.

2.5 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. Erickson Electrical Equipment Company.

4. Hoffman.
 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
 6. O-Z/Gedney; a unit of General Signal.
 7. RACO; a Hubbell Company.
 8. Robroy Industries, Inc.; Enclosure Division.
 9. Scott Fetzer Co.; Adalet Division.
 10. Spring City Electrical Manufacturing Company.
 11. Thomas & Betts Corporation.
 12. Walker Systems, Inc.; Wiremold Company (The).
 13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- D. Floor Boxes: As specified on drawings.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Hinged-Cover Enclosures: 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.
- G. Cabinets:
1. 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.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
1. Exposed Conduit: Rigid steel conduit.
 2. Concealed Conduit, Aboveground: EMT.
 3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- 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: Rigid steel conduit.
 3. Concealed in Ceilings and Interior Walls and Partitions: EMT
 4. Connection to Vibrating Equipment (Including Transformers and Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 3R in outdoor locations.

- C. Minimum Raceway Size: 1/2-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.
- E. Do not install aluminum conduits in contact with concrete.

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. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- E. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- G. 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.
- H. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- I. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- J. 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. Where otherwise required by NFPA 70.
- K. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.

- L. Recessed Boxes in Masonry Walls: Saw-cut opening for box in cell of masonry block, and install box flush with surface of wall.
- M. Set floor boxes level and flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
 - 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earthwork" for pipe less than 6 inches in nominal diameter.
 - 2. Install backfill as specified in Division 31 Section "Earthwork."
 - 3. Install manufactured rigid steel conduit elbows for stub-ups at 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 of concrete.

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 7 Section "Through-Penetration Firestop Systems."

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.

END OF SECTION

SECTION 26 0553

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes electrical identification materials and devices required to comply with ANSI C2, NFPA 70, OSHA standards, and authorities having jurisdiction.
- B. Related Documents:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with ANSI A13.1 and NFPA 70 for color-coding.

PART 2 - PRODUCTS

2.1 RACEWAY AND CABLE LABELS

- A. Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
 - 1. Color: Black letters on orange field.
 - 2. Legend: Indicates voltage and service.
- B. Adhesive Labels: Pre-printed, flexible, self-adhesive vinyl with legend over-laminated with a clear, weather- and chemical-resistant coating.
- C. Pre-tensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the line it identifies and arranged to stay in place by pre-tensioned gripping action when placed in position.
- D. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide (0.08 mm thick by 25 to 51 mm wide).
- E. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with pre-printed numbers and letters.

- F. Plasticized Card-Stock Tags: Vinyl cloth with pre-printed and field-printed legends. Orange background, unless otherwise indicated, with eyelet for fastener.

2.2 NAMEPLATES AND SIGNS

- A. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.
- B. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, 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.
- C. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

2.3 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength: 50 lb (22.3 kg) minimum.
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: According to color-coding.
- B. Paint: Formulated for the type of surface and intended use.
 - 1. Primer for Galvanized Metal: Single-component acrylic vehicle formulated for galvanized surfaces.
 - 2. Primer for Concrete Masonry Units: Heavy-duty-resin block filler.
 - 3. Primer for Concrete: Clear, alkali-resistant, binder-type sealer.
 - 4. Enamel: Silicone-alkyd or alkyd urethane as recommended by primer manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.
- C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before applying.

- E. Install painted identification according to manufacturer's written instructions and as follows:
1. Clean surfaces of dust, loose material, and oily films before painting.
 2. Prime surfaces using type of primer specified for surface.
 3. Apply one intermediate and one finish coat of enamel.
- F. Color Banding Raceways and Exposed Cables: Band exposed and accessible raceways of the systems listed below:
1. Bands: Pre-tensioned, wraparound plastic sleeves; colored adhesive tape; or a combination of both. Make each color band 2 inches (51 mm) wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
 2. Band Locations: 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.
 3. Apply the following colors to the systems listed below:
 - a. Fire Alarm System: Red.
 - b. Fire-Suppression Supervisory and Control System: Red and yellow.
 - c. Combined Fire Alarm and Security System: Red and blue.
 - d. Security System: Blue and yellow.
 - e. Mechanical and Electrical Supervisory System: Green and blue.
 - f. Telecommunication System: Green and yellow.
- G. Caution Labels for Indoor Boxes and Enclosures for Power and Lighting: Install pressure-sensitive, self-adhesive labels identifying system voltage with black letters on orange background. Install on exterior of door or cover.
- H. Color-Coding of Secondary Phase Conductors: Use the following colors for service, feeder and branch-circuit phase conductors:
1. 208/120-V Conductors:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 2. 480/277-V Conductors:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 3. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:
 - a. Colored, pressure-sensitive plastic tape in half-lapped turns for a 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. Use 1-inch- (25-mm-) wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
- I. Apply identification to conductors as follows:

1. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
 2. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.
- J. Apply warning, caution, and instruction signs as follows:
1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
 2. Emergency Operation: Install engraved laminated signs with white legend on red background with minimum 3/8-inch- (9-mm-) high lettering for emergency instructions on power transfer and other emergency operations.
- K. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high lettering on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high. Use white lettering on black field. Apply labels for each unit of the following categories of equipment using mechanical fasteners:
1. Panelboards, electrical cabinets, and enclosures.
 2. Emergency system boxes and enclosures.
 3. Disconnect switches.
 4. Enclosed circuit breakers.
 5. Motor starters.
 6. Contactors.
 7. Control devices.
 8. Transformers.
 9. Clock/program master equipment.
 10. Fire alarm master station or control panel.
 11. Security-monitoring master station or control panel.

END OF SECTION

SECTION 26 0923
LIGHTING CONTROL DEVICES

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 lighting control devices:
 - 1. Time switches.
 - 2. Outdoor photoelectric switches.
 - 3. Multi-pole contactors.
- B. Related Sections include the following:
 - 1. Division 26 Section "Wiring Devices" for wall-box dimmers and manual light switches.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

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.

1.5 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 TIME SWITCHES

- A. Available Manufacturers:
 - 1. Fisher Pierce.
 - 2. Leviton Mfg. Company Inc.
 - 3. Lightolier Controls; a Genlyte Company.
 - 4. Lithonia Lighting.
 - 5. Square D.
 - 6. TORK.
- B. Digital Time Switches: Electronic, solid-state programmable units with alphanumeric display complying with UL 917.
 - 1. Contact Configuration: As required or indicated.
 - 2. Contact Rating: 20-A ballast load, 277/480-V ac.
 - 3. Program: Single channel, 2 on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays.
 - 4. Circuitry: Allow connection of a photoelectric relay as substitute for on and off function of a program.
 - 5. Astronomical Time: All channels.
 - 6. Battery Backup: For schedules and time clock.

2.3 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Available Manufacturers:
 - 1. Fisher Pierce.
 - 2. Lithonia Lighting.
 - 3. Square D.
 - 4. TORK.
- B. Description: Solid state, with DPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, microprocessor input, and complying with UL 773A.
 - 1. Light-Level Monitoring Range: 1.5 to 10 fc (16 to 108 lx), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.

2. Time Delay: 15-second minimum, to prevent false operation.
3. Surge Protection: Metal-oxide varistor type, complying with IEEE C62.41 for Category A1 locations.
4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the North sky exposure.

2.4 MULTIPOLE CONTACTORS

A. Available Manufacturers:

1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
3. Cutler-Hammer; Eaton Corporation.
4. Fisher Pierce.
5. GE Industrial Systems; Total Lighting Control.
6. Hubbell Lighting Inc.
7. Lithonia Lighting.
8. TORK.
9. Watt Stopper (The).

B. Description: Electrically operated and mechanically held, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Control-Coil Voltage: Match control power source.

2.5 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG, complying with Division 26 Section "Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multi-conductor cable with stranded copper conductors not smaller than No. 18 AWG, complying with Division 26 Section "Conductors and Cables."
- C. Class 1 Control Cable: Multi-conductor cable with stranded copper conductors not smaller than No. 14 AWG, complying with Division 26 Section "Conductors and Cables."

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Conductors and Cables." Minimum conduit size shall be 1/2 inch (13 mm).
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.

- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- E. 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.

3.2 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Electrical Identification."
- B. Label time switches and contactors with a unique designation.

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - 2. Operational Test: Verify actuation of each sensor and adjust time delays.
- B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION

SECTION 26 2200
LOW-VOLTAGE TRANSFORMERS

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 types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
 - 1. Distribution transformers.
 - 2. Buck-boost transformers.

1.3 SUBMITTALS

- A. 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.
- B. 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.
- C. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each transformer type through one source 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 IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is

not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

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. Eaton Electrical Inc.; Cutler-Hammer Products.
 - 2. Square D; Schneider Electric.

2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- 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. Cores: One leg per phase.
- C. Enclosure: Ventilated, NEMA 250, Type 2.
- D. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
- E. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

2.4 BUCK-BOOST TRANSFORMERS

- A. Description: Self-cooled, two-winding dry type, rated for continuous duty and with wiring terminals suitable for connection as autotransformer. Transformers shall comply with NEMA ST 1 and shall be listed and labeled as complying with UL 506 or UL 1561.
- B. Enclosure: Ventilated, NEMA 250, Type 2.

2.5 IDENTIFICATION DEVICES

- A. Nameplates: Engraved, laminated-plastic or metal nameplate for each transformer, mounted with corrosion-resistant screws.

2.6 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.91.

PART 3 - EXECUTION

3.1 EXAMINATION

- 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 26 Section "Grounding and Bonding" 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 INSTALLATION

3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding."
- B. Connect wiring according to Division 26 Section "Conductors and Cables."

3.4 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. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.
- C. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.5 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION

SECTION 26 2416

PANELBOARDS

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. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.
 - 3. Transient voltage suppression panelboards.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. RFI: Radio-frequency interference.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.

1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard 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 panelboards and overcurrent protective devices.
 - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

- C. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- D. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- 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 NEMA PB 1.
- E. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Ambient Temperature: Not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.

1.7 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

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. Keys: Six spares for each type of panelboard cabinet lock.

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. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
 - a. Eaton Corporation; Cutler-Hammer Products.
 - b. Square D.

2.2 MANUFACTURED UNITS

- A. Fabricate and test panelboards according to IEEE 344.
- B. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.
 - 1. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 2. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
 - 3. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
- C. Phase and Ground Buses:
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- D. Conductor Connectors: Suitable for use with conductor material.
 - 1. Main and Neutral Lugs: Mechanical type.
 - 2. Ground Lugs and Bus Configured Terminators: Mechanical type.
 - 3. Feed-Through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
- E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.3 PANELBOARD SHORT-CIRCUIT RATING

- A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

- B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.5 TRANSIENT VOLTAGE SUPPRESSION PANELBOARDS

- A. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- B. Main Overcurrent Devices: Thermal-magnetic circuit breaker.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.
- D. Bus: Copper phase and neutral buses; 200 percent capacity neutral bus and lugs.
- E. Transient Voltage Suppression Device: IEEE C62.41, integrally mounted, plug-in-style, solid-state, parallel-connected, sine-wave tracking suppression and filtering modules.
 - 1. Minimum Single-Impulse Current Ratings:
 - a. Line to Neutral: 100,000 A.
 - b. Line to Ground: 100,00 A.
 - c. Neutral to Ground: 50,000 A.
 - 2. Protection modes shall be as follows:
 - a. Line to neutral.
 - b. Line to ground.
 - c. Neutral to ground.
 - 3. EMI/RFI Noise Attenuation Using 50-ohm Insertion Loss Test: 55 dB at 100 kHz.
 - 4. Maximum UL 1449 Clamping Levels: 400 V, line to neutral and line to ground on 120/208 V systems.
 - 5. Withstand Capabilities: 3000 Category C surges with less than 5 percent change in clamping voltage.
 - 6. Accessories:
 - a. Audible alarm activated on failure of any surge diversion module.

2.6 OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.
 - 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 shall have RMS sensing; field-replaceable rating plug; and with the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.

- B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
 - 1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - 2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
 - 3. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
 - 4. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Mount top of trim 74 inches above finished floor, unless otherwise indicated.
- C. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- D. Install overcurrent protective devices and controllers.
 - 1. Set field-adjustable switches and circuit-breaker trip ranges.
- E. Install filler plates in unused spaces.
- F. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components.
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding."
- B. Connect wiring according to Division 26 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
 - 1. Measure as directed during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.5 CLEANING

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

SECTION 26 2726

WIRING DEVICES

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. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Twist-locking receptacles.
 - 3. Wall-box motion sensors.
 - 4. Snap switches and wall-box dimmers.
 - 5. Pendant cord-connector devices.
 - 6. Cord and plug sets.
 - 7. Floor service outlets, service poles, and multioutlet assemblies.

1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 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 70.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Service/Power Poles: One for every 10, but no fewer than one.
 - 2. Floor Service Outlet Assemblies: One for every 5, but no fewer than one.

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:
 - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 5351 (single), 5352 (duplex).
 - b. Hubbell; HBL5351 (single), CR5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; GF20.
 - b. Pass & Seymour; 2084.

2.4 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; L520R.
 - b. Hubbell; HBL2310.
 - c. Leviton; 2310.
 - d. Pass & Seymour; L520-R.

2.5 PENDANT CORD-CONNECTOR DEVICES

- A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.
 - 1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
 - 2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.6 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 - 1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
 - 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.7 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
 - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
 - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
 - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).
- C. Key-Operated Switches, 120/277 V, 20 A:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper; 2221L.
 - b. Hubbell; HBL1221L.
 - c. Leviton; 1221-2L.
 - d. Pass & Seymour; PS20AC1-L.
 - 2. Description: Single pole, with factory-supplied key in lieu of switch handle.

2.8 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
- C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
 - 1. 600 W; dimmers shall require no derating when ganged with other devices.

2.9 OCCUPANCY SENSORS

- A. Ceiling Mount Sensors: Dual technology, with both passive-infrared- and micro phone acoustic detection, 120/277 V, adjustable time delay up to 30 minutes, 360-degree field of view, and a minimum coverage area of 450 sq. ft. Sensors shall be self-contained and accept class 1 wiring directly without the use of a power pack.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

- a. Sensor Switch; CMR-PDT.

2.10 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: 0.035-inch- thick, satin-finished stainless steel.
 - 3. Material for Unfinished Spaces: Galvanized steel.
 - 4. Wet-Location, Weatherproof While In Use Cover Plates: NEMA 250, complying with type 3R

2.11 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color. Color shall be as selected by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 - 1. Take steps to ensure 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.
- C. 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.
- D. 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 the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches 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.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Electrical Identification."

1. Receptacles: Identify panelboard and circuit number from which served. Use durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.

4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. 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. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION

SECTION 26 2813

FUSES

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. Cartridge fuses rated 600 V and less for use in switches, switchboards, and controllers.
 - 2. Spare-fuse cabinets.

1.3 SUBMITTALS

- A. Product Data: Include the following for each fuse type indicated:
 - 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
- B. 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.
 - 2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
- C. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Division 1 Section Operation and Maintenance Data, include the following:
 - a. Let-through current curves for fuses with current-limiting characteristics.
 - b. Time-current curves, coordination charts and tables, and related data.
 - c. 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 or more than 100 deg F, 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.

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. Cooper Bussman, Inc.
 2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.
 3. Ferraz Shawmut, Inc.
 4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

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- 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 in other sections, with 15 percent spare capacity minimum.
 2. Finish: Gray, baked enamel.
 3. Identification: "SPARE FUSES" in 1-1/2-inch- 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: Class RK1, time delay.
- C. Motor Branch Circuits: Class RK5, time delay.
- D. 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.

END OF SECTION

SECTION 26 2816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

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 the following individually mounted, enclosed switches and circuit breakers:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Molded-case circuit breakers.
 - 4. Molded-case switches.
 - 5. Enclosures.

1.3 DEFINITIONS

- A. GD: General duty.
- B. GFCI: Ground-fault circuit interrupter.
- C. HD: Heavy duty.
- D. RMS: Root mean square.
- E. SPDT: Single pole, double throw.

1.4 SUBMITTALS

- A. 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. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current rating.
 - 4. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.5 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.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.

1.7 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.

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. Spares: For the following:
 - a. Fuses for Fusible Switches: (3) for each amperage used.

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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work are limited to, manufacturers specified.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

- A. Manufacturers:
 - 1. Eaton Corporation; Cutler-Hammer Products.
 - 2. 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.
- 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.

2.3 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
 - 1. Outdoor Locations: NEMA 250, Type 3R.
 - 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 - 3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches for compliance with installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated.

3.3 IDENTIFICATION

- A. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate."

3.4 CLEANING

- A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

- B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION

SECTION 26 5100
INTERIOR LIGHTING

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. Interior lighting fixtures, lamps, and ballasts.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Lighting fixture supports.
- B. Related Sections include the following:
 - 1. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.
 - 2. Division 26 Section "Stage Lighting" for theatrical lighting fixtures and their controls.

1.3 DEFINITIONS

- A. BF: Ballast factor.
- B. CRI: Color-rendering index.
- C. CU: Coefficient of utilization.
- D. HID: High-intensity discharge.
- E. LER: Luminaire efficacy rating.
- F. Luminaire: Complete lighting fixture, including ballast housing if provided.
- G. RCR: Room cavity ratio.

1.4 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of lighting fixture including dimensions.
 - 2. Emergency lighting units including battery and charger.

3. 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 lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
 - a. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.
- B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
 - C. Qualification Data: For agencies providing photometric data for lighting fixtures.
 - D. Field quality-control test reports.
 - E. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
 - F. Warranties: Special warranties specified in this Section.

1.5 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. 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.

1.6 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including 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 Self-Powered Exit Sign 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 repair or replace ballasts that fail in materials or workmanship within specified warranty period.
1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.
 2. Warranty Period for Electromagnetic Ballasts: Three years from date of Substantial Completion.
- C. Special Warranty for T5 and T8 Fluorescent 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: Two years from date of Substantial Completion.

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. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
 3. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 LIGHTING FIXTURES 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 minimum unless different thickness is indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass, unless otherwise indicated.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

- A. Electronic Ballasts: Comply with ANSI C82.11; instant-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. Sound Rating: A.
 - 2. Total Harmonic Distortion Rating: Less than 20 percent.
 - 3. Transient Voltage Protection: IEEE C62.41, Category A or better.
- B. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.
 - 1. Ballast Manufacturer Certification: Indicated by label.
- C. Single Ballasts for Multiple Lighting Fixtures: Factory-wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

- A. Description: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
1. Lamp end-of-life detection and shutdown circuit.
 2. Automatic lamp starting after lamp replacement.
 3. Sound Rating: A.
 4. Total Harmonic Distortion Rating: Less than 20 percent.
 5. Transient Voltage Protection: IEEE C62.41, Category A or better.
 6. Operating Frequency: 20 kHz or higher.
 7. Lamp Current Crest Factor: 1.7 or less.
 8. BF: 0.95 or higher, unless otherwise indicated.
 9. Power Factor: 0.95 or higher.
 10. Ballast Case Temperature: 75 deg C, maximum.

2.5 BALLASTS FOR HID LAMPS

- A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features, unless otherwise indicated:
1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 2. Minimum Starting Temperature: Minus 22 deg F for single-lamp ballasts.
 3. Normal Ambient Operating Temperature: 104 deg F.
 4. Open-circuit operation that will not reduce average life.
 5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.
- B. High-Pressure Sodium Ballasts: Electromagnetic type, with solid-state igniter/starter. Igniter-starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.
1. Minimum Starting Temperature: Minus 40 deg F.
 2. Open-circuit operation shall not reduce average lamp life.

2.6 EXIT SIGNS

- A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
 2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

- d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
- e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.7 EMERGENCY LIGHTING UNITS

- A. Description: Self-contained units complying with UL 924.
 - 1. Battery: Sealed, maintenance-free, lead-acid type.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - 5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

2.8 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 rapid-start low-mercury lamps, rated 32 W maximum, nominal length of 48 inches, 2800 initial lumens (minimum), CRI 82 (minimum), color temperature 3500 K, and average rated life 20,000 hours, unless otherwise indicated.
- C. T5HO rapid-start, high-output low-mercury lamps, rated 54 W maximum, nominal length of 45.2 inches, 5000 initial lumens (minimum), CRI 85 (minimum), color temperature 3500 K, and average rated life of 20,000 hours, unless otherwise indicated.
- D. Compact Fluorescent Lamps: 4-Pin, low mercury, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at 3 hours operation per start.
 - 1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
 - 2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
 - 3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
 - 4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
 - 5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
 - 6. 55 W: T4, triple tube, rated 4300 initial lumens (minimum).

2.9 HID LAMPS

- A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 2100 K, and average rated life of 24,000 hours, minimum.
- B. Metal-Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature 4000 K.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.
 - 1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from lighting fixture corners.
 - 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
 - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
- C. Suspended Lighting Fixture Support:
 - 1. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 2. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
- D. Adjust aimable lighting fixtures to provide required light intensities.
- E. Connect wiring according to Division 26 Section "Conductors and Cables."

3.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- 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.

END OF SECTION

SECTION 26 5600
EXTERIOR LIGHTING

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 luminaires with lamps and ballasts.
 - 2. Luminaire-mounted photoelectric relays.
- B. Related Sections include the following:
 - 1. Division 26 Section "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.3 DEFINITIONS

- A. CRI: Color-rendering index.
- B. HID: High-intensity discharge.
- C. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 SUBMITTALS

- A. Product Data: For each luminaire, 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 manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
 - 6. Photoelectric relays.

7. 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.

- B. Qualification Data: For agencies providing photometric data for lighting fixtures.
- C. Operation and Maintenance Data: For luminaires to include in emergency, operation, and maintenance manuals.
- D. Warranty: Special warranty specified in this Section.

1.5 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. 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 IEEE C2, "National Electrical Safety Code."
- D. Comply with NFPA 70.

1.6 WARRANTY

- A. Special Warranty: 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, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
 1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
 2. Warranty Period for Lamps: Replace lamps and fuses that fail within 12 months from date of Substantial Completion.

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. Lamps: One of each type and rating installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In Exterior Lighting Device Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

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. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use.
- E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions. 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.
- F. Exposed Hardware Material: Stainless steel.
- G. 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.
- H. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- I. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping.

2.3 HID LAMPS

- A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 2100 K, and average rated life of 24,000 hours, minimum.
- B. Metal-Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature 4000 K.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.
- 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. Adjust luminaires that require field adjustment or aiming.

3.2 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.

END OF SECTION

**SECTION 31 3116
TERMITE CONTROL**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Chemical soil treatment.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Vapor barrier placement under concrete slab-on-grade.

1.03 REFERENCE STANDARDS

- A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; 2019.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.

PART 2 PRODUCTS

2.01 CHEMICAL SOIL TREATMENT

- A. Toxicant Chemical: EPA Title 7, United States Code, 136 through 136y approved; synthetically color dyed to permit visual identification of treated soil.
- B. Diluent: Recommended by toxicant manufacturer.
- C. Manufacturers:
 - 1. Bayer Environmental Science Corp
 - 2. FMC Professional Solutions:
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
- D. Mixes: Mix toxicant to manufacturer's instructions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.
- B. Verify final grading is complete.

3.02 APPLICATION - CHEMICAL TREATMENT

- A. Comply with requirements of U.S. EPA and applicable state and local codes.
- B. Spray apply toxicant in accordance with manufacturer's instructions.
- C. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.
- D. Re-treat disturbed treated soil with same toxicant as original treatment.
- E. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

END OF SECTION