



City of Port Aransas

Project Name:

LIFEGUARD HEADQUARTERS

Project Location:

303 Ninth St.

Port Aransas, TX 78373

PROJECT MANUAL

EDR Project No. 21004

February 25, 2026



EDR
architects

City of Port Aransas
LIFEGUARD HEADQUARTERS
Port Aransas, TX

PROJECT ARCHITECT

EDR Architects, PLLC.
P. O. Box 271613
Corpus Christi, Texas 78427
(361) 537-4400
Contact: Emily D. Rozypal, AIA

STRUCTURAL/WINDSTORM ENGINEER

REM Engineering
6800 Park Ten Blvd., Suite 239E
San Antonio, Texas 78213
(210) 320-1199
Contact: Robert Martinez, P.E.

MEP ENGINEER

NRG Engineering
5656 S. Staples, ste. 312
Corpus Christi, TX 78411
(361) 852-2727
Contact: John Rodriguez, P.E.

CIVIL ENGINEERING

Urban/DCCM Engineering
2725 Swantner Dr.
Corpus Christi, TX 78404
phone: 361.854.3101
Attn. Stephen Grunewald, P.E.

EDR Project No. 21004

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COPA LIFEGUARD HEADQUARTERS

Project Manual and Table of Contents

DOCUMENT TITLE	No. of Pages
Project Contacts	2
Project Manual Table of Contents	8

INTRODUCTORY INFORMATION	No. of Pages
00 0004 Project Information	4
00 0005 Instructions to Bidders and Wage Rates	12
00 0006 Bid Form	4
00 0007 Statement of Qualifications	2
00 0008 SOQ Questionnaire	4

CONTRACTING REQUIREMENTS	No. of Pages
00 0009 Payment Bond	2
00 0010 Performance Bond	2
00 0011 Insurance Requirements	4
00 0012 Contractor's Release and Waiver of Lien	2

DIVISION 01 – GENERAL REQUIREMENTS	No. of Pages
01 0100 Summary of Work	2
01 0270 Application for Payment	4
01 0300 Bid Alternates	2
01 0350 Modification Procedures	2
01 0400 Coordination	4
01 0450 Cutting and Patching	4
01 2000 Project Meetings	4
01 3000 Submittals	6
01 4000 Quality Control	4
01 4100 Testing Laboratory Services	4
01 4101 Air Barrier System	6
01 4110 Building Envelope Testing	18
01 4500 Windstorm Construction Requirements	2
01 5000 Construction Facilities and Temporary Controls	8
01 6000 Materials and Equipment	4
01 7000 Contract Closeout	6
01 7100 Clean Up	2
01 7400 Warranties	4
01 7700 Closeout Procedures	10
01 7810 Project Record Documents	4
01 7820 Operation and Maintenance Data	8

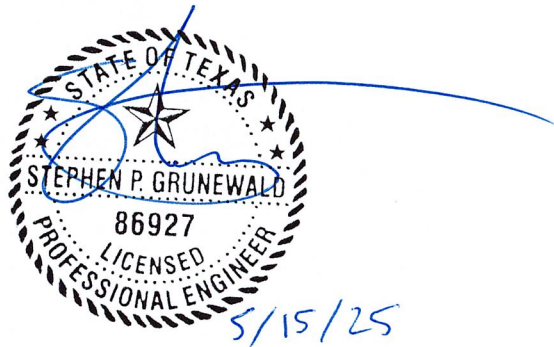
DIVISIONS 03 – 12, 31 ARCHITECTURAL	No. of Pages
03 0540 Sealed Concrete Floor Finishing	6
05 0500 Metal Fabrications	8
05 5213 Pipe and Tube Railings	8
06 1000 Rough Carpentry	4
06 2000 Finish Carpentry	4
07 2119 Foamed-in-Place Insulation	2
07 4113 Metal Roof Panels	10
07 4647 Fiber Cement Soffits	4
07 6200 Sheet Metal Flashing and Trim	20
07 9200 Joint Sealants	8
08 1116 Aluminum Doors and Frames	10
08 1213 Hollow Metal Frames	4
08 3100 Access Doors and Panels	4
08 7100 Door Hardware	2
09 2216 Non-structural Metal Framing	6
09 2900 Gypsum Board	12
09 9000 Painting and Coating	8
10 1400 Signage	4
10 4400 Fire Protection Specialties	4
10 5126 Plastic Lockers	4
10 7500 Flagpole and Flags	4
12 3661.19 Quartz Agglomerate Countertops	6
31 3116 Termite Control	2
GROUPED - CIVIL ENGINEERING - SPECIFICATIONS	No. of Pages
Civil Engineering Specifications with Sealed Index	93
GROUPED - STRUCTURAL ENGINEERING - SPECIFICATIONS	No. of Pages
Structural Engineering Specifications with Sealed Index	82
GROUPED - MEP ENGINEERING - SPECIFICATIONS	No. of Pages
MEP Engineering Specifications with Sealed Index	241
GROUPED – LANDSCAPE ARCHITECT - SPECIFICATIONS	No. of Pages
Landscape Architect Specifications with Sealed Index	24
REFER TO CONSTRUCTION DOCUMENTS FOR BLANACE OF ARCHITECTURAL, LANDSCAPE, CIVIL, MEP AND STRUCTURAL PLAN SPECIFICATIONS.	

END OF TABLE OF CONTENTS

CIVIL TECHNICAL SPECIFICATIONS
FOR

CITY OF PORT ARANSAS LIFE GUARD HEAD QUARTERS

303 NINTH STREET



OWNER:
EDR Architects, PLLC
City of Port Aransas
710 West Avenue - A
Port Aransas, Texas 78373

Job No. 6100.C3.02 (10293)
MAY 2025



2725 SWANTNER DRIVE
CORPUS CHRISTI, TEXAS 78404

Firm No. 145
TBPLS Firm No.: 10032400

TABLE OF CONTENTS

DIVISION 01 – GENERAL REQUIREMENTS

- 01 51 36.10 Water for Construction
- 01 89 30 Technical Special Provisions

DIVISION 03 – CONCRETE

- 03 10 01 Concrete Formwork
- 03 11 13 Concrete Structures
- 03 20 01 Concrete Reinforcement
- 03 30 02 Normal Weight Aggregate Concrete

DIVISION 31 – EARTHWORK

- 31 10 00 Clearing, Grubbing and Stripping
- 31 20 00 Site Excavation and Fill
- 31 22 13 Site Grading
- 31 23 00 Structural Excavation and Backfill
- 31 23 16.13 Pipe Trench Excavation and Backfill
- 31 23 23 Compacted Embankment
- 31 25 13 Storm Water Pollution Prevention Plan (less than 1 acre)
- 31 32 16 Laboratory Testing

DIVISION 32 – EXTERIOR IMPROVEMENTS

- 32 11 33.13 Portland Cement Concrete Pavement
- 32 16 13.13 Concrete Curb, Gutter, and Concrete Valley Gutter
- 32 16 23 Concrete Sidewalk and Concrete Driveways
- 32 31 13 Chain Link Fence (Heavy Duty)

DIVISION 33 – UTILITIES

- 33 05 05 Installation of Water Pipe
- 33 05 05.11 Installation of Sanitary Sewer Pipe (PVC-SDR26)
- 33 05 05.31 Hydrostatic Testing of Pressure System
- 33 05 19 Ductile-Iron Utility Pipe
- 33 05 31.16 Polyvinyl Chloride Pipe and Fittings for Water Lines (C-900 & C-905)
- 33 05 31.29 Polyvinyl Chloride Pipe and Fittings (SCH 40) for Duct
- 33 05 76 Sanitary Sewer Manholes (Fiberglass)
- 33 05 97.10 Existing Utilities
- 33 14 19 Gate Valves
- 33 14 19.13 Fire Hydrants
- 33 31 11 Polyvinyl Chloride Pipe and Fittings for Sewer Lines (SDR 26)

COPA LIFEGUARD HEADQUARTERS FACILITY

STRUCTURAL SPECIFICATIONS INDEX

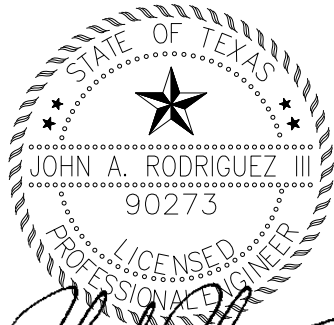
<u>Section</u>	<u>Title</u>
01 41 00	Testing Laboratory Services
03 10 00	Concrete Formwork
03 20 00	Concrete Reinforcement
03 30 00	Cast-In-Place Concrete
03 31 00	Epoxy Related Work
04 23 00	Reinforced Unit Masonry
05 12 00	Structural Steel
05 20 00	Steel Joists
05 31 00	Steel Roof Deck


Robert E. Martinez 5/15/25
THE SEAL APPEARING ON
THIS DOCUMENT WAS AUTHORIZED
BY ROBERT E. MARTINEZ, P.E. # 89387
T.B.P.E. FIRM NO. 6944

TABLE OF CONTENTS
MECHANICAL ELECTRICAL & PLUMBING SPECIFICATIONS
CITY OF PORT ARANSAS
NEW LIFEGUARD FACILITY

<u>SECTION</u>	<u>NAME</u>	<u>PAGES</u>
SECTION 22 05 00	BASIC MATERIALS AND METHODS	23
SECTION 22 07 00	INSIDE UTILITY TRENCH EXCAVATION, BACKFILL, AND COMPACTION	4
SECTION 22 08 00	OUTSIDE UTILITY TRENCH EXCAVATION, BACKFILL, AND COMPACTION	3
SECTION 22 14 00	HANGERS AND SUPPORTS	8
SECTION 22 19 00	SYSTEM IDENTIFICATION AND PIPE MARKING	3
SECTION 22 26 00	PIPING INSULATION	5
SECTION 22 41 00	PLUMBING PIPING & VALVES	20
SECTION 22 43 00	PLUMBING SPECIALTIES	6
SECTION 22 44 00	PLUMBING FIXTURES	5
SECTION 22 45 00	PLUMBING EQUIPMENT	6
SECTION 23 05 00	BASIC MATERIALS AND METHODS	23
SECTION 23 07 19	DX PIPING SYSTEM INSULATION	5
SECTION 23 14 00	SUPPORTS AND ANCHORS	7
SECTION 23 17 00	MOTORS AND MOTOR CONTROLLERS	6
SECTION 23 29 00	DUCT INSULATION	5
SECTION 23 53 00	REFRIGERANT PIPING	2
SECTION 23 58 54	DX FAN COIL UNIT	2
SECTION 23 67 10	AIR COOLED CONDENSING UNITS	3
SECTION 23 88 10	AIR DISTRIBUTION DEVICES	4
SECTION 23 88 85	AIR FILTERS	2
SECTION 23 89 00	METAL DUCTWORK	9
SECTION 23 91 00	DUCTWORK ACCESSORIES	7
SECTION 23 99 00	TESTING, ADJUSTING, & BALANCING	12
SECTION 26 01 00	ELECTRICAL GENERAL PROVISIONS	6
SECTION 26 06 00	GROUNDING	5
SECTION 26 07 50	ELECTRICAL IDENTIFICATION	4
SECTION 26 12 30	WIRE & CABLE	6
SECTION 26 13 60	RACEWAYS	8
SECTION 26 14 00	WIRING DEVICES	4
SECTION 26 24 16	PANELBOARDS	8

SECTION 26 43 13	SURGE PROTECTION DEVICES	4
SECTION 26 44 10	DISCONNECT SWITCHES	4
SECTION 26 51 00	LUMINAIRES	13
SECTION 26 74 00	TELEPHONE / DATA SYSTEM (ROUGH-IN)	2
SECTION 26 75 00	CABLE TELEVISION SYSTEM (ROUGH-IN)	2



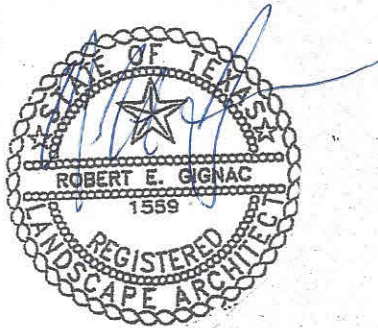
John A. Rodriguez III
05/15/2025



Sean Rodriguez
05/15/2025

COPA LIFE GAURD HEADQUARTERS FACILITY
IRRIGATION AND LANDSCAPE INDEX

<u>Section</u>	<u>Title</u>
32 84 23	Underground Sprinklers
32 90 01	Common Planting Requirements
32 91 13	Soil Preparation
32 92 23	Sodding
32 90 00	Plants



5/15/25

PROJECT INFORMATION

1.01 PROJECT IDENTIFICATION

- A. Project Name: **COPA LIFEGUARD HEADQUARTERS**
- B. Located at 303 Ninth St., Port Aransas, TX 78373.
- C. EDR Project Number: 21004.
- D. The Owner, hereinafter referred to as City of Port Aransas, located at 710 W. Avenue A, Port Aransas, Texas, 78373.

1.02 INVITATION TO PROSPECTIVE BIDDERS

- A. These documents constitute an invitation to Bid to General Contractors for the construction of the project described below.
- B. **MINORITY AND WOMEN'S BUSINESS ENTERPRISES:** The City of Port Aransas is committed to developing, establishing, maintaining, and enhancing minority involvement in all the city's procurement activities. The City's goal is to have at least a 20% M/WBE participation with all procurement processes. It is The City's wish to involve qualified minority/women-owned businesses to the greatest extent feasible in the Procurement of goods, equipment, services, and construction projects. The City, its contractors, their suppliers and subcontractors, and vendors of goods, equipment services, and professional services shall not discriminate on the basis of race, color, religion, national origin, handicap, or sex in the award and/or performance of contracts. However, competition and quality of work remains the ultimate "yardstick" in contractor, subcontractor, vendor, service, professional service, and supplier utilization. All vendors, suppliers, professionals, and contractors doing business or anticipating doing business with The City of Port Aransas shall support, encourage, and implement affirmative steps toward our common goal of Establishing equal opportunity for all citizens of Port Aransas.

1.03 PROJECT DESCRIPTION

Summary Project Description (Including, but not limited to): The Work scheduled to be performed includes select site demolition, New single-story Building, Masonry, Site Work, Accessible ramps, stairs, vehicular ramps, Guardrails, Handrails, Signage, Flagpole, Parking, Board Formed Retaining Walls, MEP, Utilities, Kitchen, Restrooms, etc.

- A. Substitutions: There shall be no Substitutions allowed.

1.04 PROJECT ARCHITECT

- A. The Architect, hereinafter referred to as EDR Architects, PLLC: Emily Rozypal, A.I.A.
 - 1. Address: PO Box 271613
 - 2. City, State, Zip: Corpus Christi, Texas 78427.
 - 3. Phone: (361) 537-4400.
 - 4. E-mail: erozypal@edrarchitects.com

1.05 PROCUREMENT TIMETABLE

- A. Mandatory Pre-Bid Conference: **Thursday, March 19, 2026, 10:00 a.m.** local time at Port Aransas City Hall located at 710 W. Avenue A, Port Aransas, TX 78373.
- B. Mandatory Pre-Bid Site Tour: Immediately following the Pre-Bid Conference: **Thursday, March 19, 2026** located at 303 Ninth St., Port Aransas, TX 78373.
- C. SUBSTITUTIONS: There shall be no substitutions/alternate bids allowed.
- D. Last Request for Information Due: **Thursday, March 26, 2026, 11:00 a.m.** local time.
Emailed to: erozypal@edrarchitects.com
- E. Contractor's Statement of Qualifications Due with Sealed Bid: **Tuesday, April 14, 2026, before 2:00 p.m.** local time.
- F. Bid Due Date: **Tuesday, April 14, 2026, before 2:00 p.m.** local time.
- G. Bid Opening: **Tuesday, April 14, 2026, 2:00 p.m.** local time.
- H. Tentative Award of Bid: within 7-10 Days of approval by the City Council at the next regular scheduled meeting.
- I. Notice to Proceed: within 7-10 days of Contract execution.
- J. Commence Work: within 7-10 days after written Notice to Proceed.
- K. Bids May Not Be Withdrawn Until: 90 days after due date.
- L. Required Substantial Completion Date: Not later than the number of calendar days indicated by the Bidder, as indicated in Bid Form.
- M. Liquidated Damages: The Bidder further agrees to pay as Liquidated Damages the sum of Five Hundred Dollars (\$500.00) for each calendar day that the work is incomplete after the expiration of the calendar days specified and any extended days allowed by the Owner's Representative in accordance with the Specifications not as a penalty, but as liquidated damages and added expense for supervision and delay in obtaining the use of the work.
- N. City of Port Aransas reserves the right to change the schedule or terminate the entire procurement process at any time.

1.06 PROCUREMENT DOCUMENTS

- A. Availability of Documents:
 - 1. Complete set of electronic PDF documents may be obtained by contacting EDR Architects, via email, at erozypal@edrarchitects.com. Documents may be reproduced at the expense of the user.
 - 2. On-line at www.cityofportaransas.org. Documents may be reproduced at the expense of the user.
 - 3. City Hall, located at 710 W. Avenue A, Port Aransas, TX 78373.

1.07 BID SECURITY/GUARANTY

- A. Bids shall be accompanied by a security deposit as follows:
 - 1. The Bid must be accompanied by a Bid guaranty that shall not be less than five percent (5%) of the amount of the Bid. At the option of the Bidder, guaranty may be a certified check, bank draft, negotiable U. S. Government Bonds (at par value)

or a Bid Bond in the form attached. The Bid Bond shall be secured by a guaranty or a surety company listed in the latest issue of U.S. Treasury Circular 570. The amount of such Bid Bond shall be within the maximum amount specified for such company in said Circular 570. No Bid will be considered unless it is accompanied by the required guaranty. A certified check or bank draft must be made payable to the order of the City of Port Aransas. Cash deposits will not be accepted. The Bid guaranty shall insure the execution of the Agreement and the furnishing of the surety bond or bonds by the successful Bidder, all as required by the Contract Documents. Certified check or bank drafts, or the amounts thereof, Bid Bonds, and negotiable U.S. Government Bonds of unsuccessful Bidders will be returned as soon as practical after the opening of the Bids.

1.08 CONTRACT DOCUMENT FORMAT

- A. Contract Documents between Owner and Contractor shall be the most current AIA Contract Document A-Series Format including, but not limited to:
 - a. AIA 101 – 2017 Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum.
 - b. AIA 201 – 2017 General Conditions of the Contract for Construction.

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INSTRUCTIONS TO BIDDERS

1.1 OWNER

- A. The "Owner", hereinafter referred to as City of Port Aransas.
 - 1. Address: 710 W. Avenue A,
 - 2. City, State, Zip: Port Aransas, Texas, 78373.

1.2 PROJECT ARCHITECT

- A. The "Architect", hereinafter referred to as EDR Architects, PLLC. Emily Rozypal, A.I.A.
 - 1. Address: PO Box 271613
 - 2. City, State, Zip: Corpus Christi, Texas 78427.
 - 3. Phone: (361) 537-4400.
 - 4. E-mail: erozypal@edrarchitects.com

1.3 OBTAINING DOCUMENTS AND ELECTRONIC (PDF) COPIES OF BID DOCUMENTS

- A. Bid Documents Availability (Documents may be reproduced at the expense of the user):
 - 1. Complete set of digital (PDF) documents may be obtained by contacting EDR Architects, via email, at erozypal@edrarchitects.com.
 - 2. On-line at www.cityofportaransas.org.
 - 3. City Hall, located at 710 W. Avenue A, Port Aransas, TX 78373.
- B. Bid Documents are made available only for the purpose of obtaining offers for this project. Their use does not grant a license for other purposes. Documents may be reproduced as needed; however; bidders are responsible for being fully aware of all the published documents.
- C. General Contract bidders are advised to include an amount in their bids for reproduction of documents to the extent that they deem appropriate for both bidding and construction.

1.4 ACCEPTANCE/REJECTION OF OFFER

- A. **REJECTION OF BIDS:** The Owner reserves the right to consider as unqualified to do the work of general construction any Bidder who does not habitually perform with his own forces the major portions of the work involved in construction of the Improvements embraced in this project.
- B. **AWARD:** The Contract will be awarded to the responsible Bidder submitting the lowest and/or best bid complying with the Contract Documents. The Owner reserves the right to accept or reject any or all bids if it is deemed to be in the best interest of the Owner. Further the Owner reserves the right to reject any bid because of irregularity or to waive such irregularity or such action as in the Owner's interest.

1.5 BIDDING DOCUMENTS

- A. Bidding documents include the Instructions to Bidders, the Notice to Bidders and proposed Contract Documents, including any Addenda issued prior to receipt of bids.

1.6 INSPECTION OF SITE

- A. Each Bidder is required to visit the site of the proposed work and fully acquaint himself with the existing conditions there relating to construction and labor, and should fully inform himself as to the facilities involved, the difficulties and restrictions attending the performance of the Contract. The Bidder shall thoroughly examine and familiarize himself with the Drawings, Technical Specifications, and all other Contract Documents. The Contractor by the execution of the Contract shall in no way be relieved of any obligation under it due to his failure to receive or examine any form or legal instrument or to visit the site and acquaint himself with the conditions there existing and the Owner will be justified in rejecting any claim based on facts regarding which he should have been on notice as a result thereof.

1.7 CLARIFICATIONS/ INTERPRETATIONS/ ADDENDA/ ALTERNATE BIDS/ SUBSTITUTIONS

- A. No oral interpretation will be made to any Bidder as to the meaning of the Contract Documents or any part thereof. Every request for such an interpretation shall be made in writing to the Architect, via email, to erozypal@edrarchitects.com. Every interpretation made to a Bidder will be in the form of an Addendum to the Contract Documents, and when issued, will be on file in the office of the Architect. In addition, all Addenda will be emailed to each person holding Contract Documents, but it shall be the Bidder's responsibility to make inquiry as to the Addenda issued. All such Addenda shall become part of the Contract and all bidders shall be bound by such Addenda, whether or not received by the Bidders. A pre-bid conference will be held.
- B. Last Request for Clarifications/Interpretations, etc. is Due: **Thursday, March 26, 2026 by 11:00 a.m.** local time. Emailed to: erozypal@edrarchitects.com.
- C. Substitutions: No substitutions allowed.

1.8 STATEMENT OF BIDDER'S QUALIFICATIONS

- A. Each Bidder shall submit for that purpose a statement of the Bidder's qualifications, his experience record in constructing the type of improvements in this project, and his organization and equipment available for the work contemplated; and when specifically requested by the Owner, a detailed financial statement. The Owner shall have the right to take such steps as he deems necessary to determine the ability of

the Bidder to perform his obligations under the Contract and the Bidder shall furnish the Owner such information and data for this purpose as it may request. The right is reserved to reject any bid where the investigation of the available evidence or information does not satisfy the Owner that the Bidder is qualified to carry out properly the terms of the Contract.

1.9 SUBMISSION OF BIDS/ BID PACKAGE

- A. The following items shall be submitted in the Bid Package:
 - 1. Bid Proposal
 - 2. Bid Guaranty
 - 3. Statement of Qualifications/SOQ Questionnaire
- B. The above listed items shall be enclosed in envelopes, outer and inner, both of which shall be sealed and clearly labeled with the words:

“SEALED BID –COPA LIFEGUARD HEADQUARTERS”

City of Port Aransas

Name of Bidder

Date and Time of Bid Opening

(date and time of bid opening is required in order to guard against premature opening of the Bid.)

- C. The Owner may consider as Irregular any Bid on which there is an alternate or departure from the Bid Form hereto attached, and at its option may reject the same.

1.10 WITHDRAWAL OF BIDS

- A. A Bid may be withdrawn on written request, via email, to erozypal@edrarchitects.com. Withdrawal of bid must be received prior to the time of Bid Opening. The Bid guaranty of any Bidder withdrawing his Bid in accordance with the foregoing Conditions will be returned promptly.

1.11 OPENING OF BIDS

- A. At the time and place fixed for the opening of Bids, the Owner will cause to be opened and publicly read aloud every Bid received within the time set for receiving Bids, irrespective of any irregularities therein. Bidders and other persons properly interested may be present, in person or by representative.

1.12 TERMINATION OF BID

- A. The submission of a bid by a Contractor or Supplier shall constitute an offer by the Contractor or Supplier to enter into contract with the Owner to provide the

work describe herein, such offer being binding until ninety (90) days after bid opening.

1.13 BID GUARANTY/BONDS REQUIRED

- A. **BID GUARANTY:** The Bid must be accompanied by a Bid guaranty that shall not be less than five percent (5%) of the amount of the Bid. At the option of the Bidder, guaranty may be a certified check, bank draft, negotiable U. S. Government Bonds (at par value) or a Bid Bond in the form attached. The Bid Bond shall be secured by a guaranty or a surety company listed in the latest issue of U.S. Treasury Circular 570. The amount of such Bid Bond shall be within the maximum amount specified for such company in said Circular 570. No Bid will be considered unless it is accompanied by the required guaranty. Certified check or bank draft must be made payable to the order of the City of Port Aransas. Cash deposits will not be accepted. The Bid guaranty shall insure the execution of the Agreement and the furnishing of the surety bond or bonds by the successful Bidder, all as required by the Contract Documents. Certified check or bank drafts, or the amounts thereof, Bid Bonds, and negotiable U.S. Government Bonds of unsuccessful Bidders will be returned as soon as practical after the opening of the Bids.
- B. **BONDS:** Having satisfied all conditions of award as set forth elsewhere in these documents, the successful Bidder shall, within the period specified, furnish surety bonds in a penal sum not less than the amount of the contract and for the payment of all persons, firms or corporations to whom the contractor may become legally indebted for labor, materials, tools, equipment, or services of any nature including the work. Such bonds shall be in the same form as that included in the Contract Documents and shall bear the same date as, or a date subsequent to that of the Agreement. The current power of attorney for the person who signs for any surety company shall be attached to such bonds. These bonds shall be signed by a guaranty or surety company listed in the latest issue of the U. S. Treasury Circular 570 and the penal sum be within the maximum specified for such company in said Circular 570.

1.14 WAGE RATES

- A. All Contractors and Sub-contractors employed upon the work shall be required to conform to the Labor Law of the State of Texas and the various Acts Amendatory and Supplementary thereto; and all other laws, ordinances and legal requirements applicable thereto. Not less than the general prevailing rate per diem wages must be paid to all laborers, workmen, and mechanics directly employed on the work covered by this contract. The Contractor must abide by the Wage and Hour Laws of the State of Texas, and must pay not less than the legally prescribed rate for Nueces County.

1.15 SALES TAX

- A. The Owner is exempt from payment of the State of Texas sales tax on the purchase of materials which are incorporated into this project. The Contractor will be required to provide a separated cost breakdown of all labor and materials to meet any requirements of the State of Texas Comptroller's office for classification of this contract as a "separated contract". The Owner will provide to the Contractor an exemption certificate for exemption of state and local sales taxes. The Contractor will be fully responsible for assurance of compliance with state sales tax laws. No additional payment will be made by the Owner if any Contractor, Supplier or Sub-contractor fails to meet compliance standards.

1.16 PRE-BID CONFERENCE

- A. See the Notice to Bidders for information on a Pre-Bid Conference for General Contractors and Subcontractors and Suppliers. All General Contractors, Sub-Contractors and Suppliers are required to attend and ask questions about the requirements of the Project. Attendance is mandatory.

1.17 VENUE

- A. The venue for filing any liens, litigation or other legal documents for this contract shall be Nueces County, Texas

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"General Decision Number: TX20260288 01/02/2026

Superseded General Decision Number: TX20250288

State: Texas

Construction Type: Building

Counties: Aransas, Nueces and San Patricio Counties in Texas.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Modification Number Publication Date
0 01/02/2026

BOIL0074-003 01/01/2025

	Rates	Fringes
BOILERMAKER.....	\$ 33.17	24.92

ELEC0278-002 08/25/2024

	Rates	Fringes
ELECTRICIAN.....	\$ 30.80	8.97

ENGI0178-005 06/01/2020

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
(1) Tower Crane.....	\$ 32.85	13.10
(2) Cranes with Pile Driving or Caisson Attachment and Hydraulic Crane 60 tons and above.....	\$ 28.75	10.60
(3) Hydraulic cranes 59 Tons and under.....	\$ 32.35	13.10

IRON0084-011 06/01/2024

	Rates	Fringes
IRONWORKER, ORNAMENTAL.....	\$ 28.26	8.13

SUTX2014-068 07/21/2014

	Rates	Fringes
BRICKLAYER.....	\$ 20.04	0.00
CARPENTER.....	\$ 15.21	0.00
CEMENT MASON/CONCRETE FINISHER...	\$ 15.33	0.00
INSULATOR - MECHANICAL (Duct, Pipe & Mechanical System Insulation).....	\$ 19.77	7.13
IRONWORKER, REINFORCING.....	\$ 12.27	0.00

IRONWORKER, STRUCTURAL.....\$ 22.16	5.26
LABORER: Common or General.....\$ 9.68	0.00
LABORER: Mason Tender - Brick...\$ 11.36	0.00
LABORER: Mason Tender - Cement/Concrete.....\$ 10.58	0.00
LABORER: Pipelayer.....\$ 12.49	2.13
LABORER: Roof Tearoff.....\$ 11.28	0.00
OPERATOR: Backhoe/Excavator/Trackhoe.....\$ 14.25	0.00
OPERATOR: Bobcat/Skid Steer/Skid Loader.....\$ 13.93	0.00
OPERATOR: Bulldozer.....\$ 18.29	1.31
OPERATOR: Drill.....\$ 16.22	0.34
OPERATOR: Forklift.....\$ 14.83	0.00
OPERATOR: Grader/Blade.....\$ 13.37	0.00
OPERATOR: Loader.....\$ 13.55	0.94
OPERATOR: Mechanic.....\$ 17.52	3.33
OPERATOR: Paver (Asphalt, Aggregate, and Concrete).....\$ 16.03	0.00
OPERATOR: Roller.....\$ 12.70	0.00
PAINTER (Brush, Roller, and Spray).....\$ 14.45	0.00
PIPEFITTER.....\$ 25.80	8.55
PLUMBER.....\$ 25.64	8.16
ROOFER.....\$ 13.75	0.00
SHEET METAL WORKER (HVAC Duct Installation Only).....\$ 22.73	7.52
SHEET METAL WORKER, Excludes HVAC Duct Installation.....\$ 21.13	6.53
TILE FINISHER.....\$ 11.22	0.00
TILE SETTER.....\$ 14.74	0.00
TRUCK DRIVER: Dump Truck.....\$ 12.39	1.18
TRUCK DRIVER: Flatbed Truck.....\$ 19.65	8.57
TRUCK DRIVER: Semi-Trailer Truck.....\$ 12.50	0.00
TRUCK DRIVER: Water Truck.....\$ 12.00	4.11

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been renewed or extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least \$13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for

this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE:

UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

- a) a survey underlying a wage determination
- b) an existing published wage determination
- c) an initial WHD letter setting forth a position on a wage determination matter
- d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION

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BID FORM

THE PROJECT AND THE PARTIES

1.01 TO:

- A. City of Port Aransas
City Secretary's office
710 W. Avenue A
Port Aransas, Texas, 78373

1.02 FOR:

- A. Project Name: **"SEALED BID – COPA LIFEGUARD HEADQUARTERS"**.
B. Project Address: 303 Ninth St., Port Aransas, TX 78373

1.03 BID DATE: _____

1.04 SUBMITTED BY: (Bidder to enter name and address)

A. Bidder's Full Name:

1. Bidder's Full Address:

2. City, State, Zip

1.05 OFFER

- A. Having examined the Place of The Work and all matters referred to in the Contract Documents prepared by the Architect for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Sum of:

B. _____
_____ dollars

(\$ _____), in lawful money of the United States of America.

C. This Project is Tax Exempt.

D. Overhead and Profit shall include (but not be limited to) the following: Supervision, Insurance, Bonds, Workman's Comp, Mark-up, Job-site and Office Overhead, Coordination, Submittals and any other related expenses.

E. 001 Bid Alternate:

_____ dollars

(\$ _____), in lawful money of the United States of America.

1.06 ACCEPTANCE

- A. This offer shall be open to acceptance and is irrevocable for ninety (90) days from the bid closing date.
- B. If this bid is accepted by the City of Port Aransas within the time period stated above, we will:
 - 1. Execute the Agreement within 7-10 days of receipt of Notice of Award.
 - 2. Furnish the required bonds within 7-10 days of receipt of Notice of Award.
 - 3. Commence work within 7-10 days after written Notice to Proceed of this bid.

1.07 CONTRACT TIME

- A. If this Bid is accepted, we will:
 - 1. Complete the Work within _____ calendar days.

1.08 LIQUIDATED DAMAGES

- A. The Bidder further agrees to pay as Liquidated Damages the sum of Five Hundred Dollars (\$500.00) for each calendar day that the work is incomplete after the expiration of the calendar days specified and any extended days allowed by the Owner's Representative in accordance with the Specifications not as a penalty, but as liquidated damages and added expense for supervision and delay in obtaining the use of the work.

1.09 CHANGES TO THE WORK

- A. When Architect establishes that the method of valuation for Changes in the Work will be net cost plus a percentage fee in accordance with General Conditions, our percentage fee will be:
 - 1. _____ percent overhead and profit on the net cost of our own Work;
 - 2. _____ percent on the cost of work done by any Subcontractor.
- A. On work deleted from the Contract, our credit to the City of Port Aransas shall be Architect-approved net cost plus _____ of the overhead and profit percentage noted above.

1.10 ADDENDA

- A. The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.
 - 1. Addendum # _____ Dated _____.
 - 2. Addendum # _____ Dated _____.
 - 3. Addendum # _____ Dated _____.
 - 4. Addendum # _____ Dated _____.
 - 5. Addendum # _____ Dated _____.

1.11 BID FORM SUPPLEMENTS

- A. We agree to submit the following Supplements to Bid Forms within 24 hours of request for Supplements, for additional bid information, if requested from Architect or Owner:
 - 1. Subcontractors List: Include the names of all Subcontractors and the portions of the Work they will perform. The City of Port Aransas reserves the right to reject any Subcontractor.

2. Cost Breakdown identifies the Bid Price/Sum segmented into portions as requested.
3. Document - Project Management Team Qualifications.

1.12 BID FORM SIGNATURE(S)

The Corporate Seal of

(Bidder - print the full name of your firm)

was hereunto affixed in the presence of:

(Authorized signing officer, Title)

(Seal)

(Authorized signing officer, Title)

END OF BID FORM

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STATEMENT OF QUALIFICATIONS

1.1 GENERAL

Submit a Statement of Qualifications (SOQ) as required herein. The SOQ shall provide a clear and thorough description of the Respondent's Capability as it relates to this Project. As used herein, "Capability" includes all indicators of a Respondent's ability to best meet the Owner's needs and objectives, including experience, performance record, personnel, subconsultants, resources, commitment and other qualifications and indicators.

All requirements and questions shall be addressed and all requested information shall be supplied. The Owner reserves the right to request additional information which may be needed to evaluate the Respondent's Capability.

1.2 SOQ FORMAT

Submit all materials in one bound document with dividers as needed. Include the following in the order listed.

Cover Sheet: Identify the Respondent and include the Project Identifier (as noted below). Other information may be included if desired.

Table of Contents: List all items included in the SOQ.

Cover Letter: Provide a signed cover letter (1-page limit) that briefly profiles the reasons why the Respondent's Capability is well suited to this Project.

SOQ Questionnaire: The SOQ Questionnaire included herein shall be completed by each firm participating in the response regardless of the relationship (i.e. joint-venture, partnership, association, etc.).

- Do not change the format, sequence or content. Provide answers directly below each Questionnaire item.
- Answers may be expanded where needed, but the resulting Questionnaire shall not exceed 15 pages.
- Font colors and styles may be changed, but fonts shall not be less than 11 point.
- The Respondent's firm name and/or logo may be added to the footers.

Display the following Project Identifier prominently on the Cover Sheet and Cover Letter.

"SEALED BID – COPA LIFEGUARD HEADQUARTERS"

City of Port Aransas

Name of Bidder

Contractor's Statement of Qualifications

Bid Due Date and Time

1.3 SOQ EVALUATION PROCESS

The Owner will evaluate the SOQ's in accordance with the Evaluation Criteria noted herein. Such evaluation will include review of the SOQ materials, as well as other indicators of Respondent Capability. The Owner's evaluation may include discussions, investigations, findings, compliance checks, references and information checks, and other potential indicators of the Respondent Capability.

END OF SECTION

SOQ QUESTIONNAIRE

RE: COPA LIFEGUARD HEADQUARTERS
SOQ QUESTIONNAIRE
Request for Competitive Sealed Proposals

Provide the following information in the sequence and format shown in this questionnaire. Supplemental materials providing additional information may be attached. A completed copy of this questionnaire shall be submitted by each firm participating in the response regardless of the relationship (i.e. prime contractor, joint-venture, partnership, association, etc.). All questions must be answered and the data given must be clear and comprehensive. This statement must be notarized. If necessary, questions may be answered on separate attached sheets. The Bidder may submit any additional information he desires.

A. FIRM INFORMATION

Name of Firm: _____

Address of Principal Office: _____

Form of Business Organization: _____

_____ Prime Contractor _____ Partner _____ Joint Venture _____ Other

Year Founded: _____

Primary Individual to Contact: _____

Telephone of Primary Contact: _____

Email Address of Primary Contact: _____

B. ORGANIZATION

1. How many years has your organization been in the construction business in its current capacity?

2. How many years has your organization been in business under its present name? Under what other names has your organization operated? Also, note any predecessor firms and the dates of their existence.

3. If your organization is a corporation, answer the following: Date of incorporation, State of incorporation, President's name, Vice-President's name(s), Secretary's name, Treasurer's name.

4. If your organization is a partnership, answer the following: Date of organization, type of partnership (if applicable), names of general partner(s).

5. If your organization is individually owned, answer the following: Date of organization, name of owner(s).

6. If the form of your organization is other than those listed above, describe it and name the principals.

C. EXPERIENCE AND CAPABILITY

1. Past Experience with Owner: List the projects constructed and completed by your organization for the City of Port Aransas, Texas. For each project provide the name, brief description, size, location and completion date. Include the name of Owner and Architect and their contact person with phone number.
2. Current Work: List the construction projects your organization has in progress, giving the names and location of project, contract amount, percent complete and scheduled completion date. Include name of Owner and Architect and their contact person with phone number.
3. Work During Last Five (5) Years: List important projects constructed and completed by your organization over the last five years. For each project provide the name, brief description, size location, cost, completion date. Include name of Owner and Architects and their contact person with phone number.
4. Work by Firm: List the categories of work that your organization normally performs with its own forces. On this Project, what work do you propose to do with your own forces, and what work do you propose to bid to subcontractors?
5. List your major equipment available for this contact.
6. Subcontractor List: List any subcontractors in which your organization has some ownership and list the categories of work those subcontractors normally perform.
7. Claims and Suits: (If the answer to any of the questions below is yes, please attach details.)
 - a. Are there any judgments, claims, arbitration proceedings or suits pending or outstanding against your organization or its officers? If so, please explain.
 - b. Has your organization filed any lawsuits or requested arbitration against an Owner or a design professional with regard to construction contracts within the last fifteen years? If so, provide a detailed explanation.
 - c. Has your organization had any lawsuits or arbitration proceedings filed against it by an Owner or a design professional within the last fifteen years? If so, provide a detailed explanation
8. Failure to Complete Contracts: Within the last fifteen years, has any officer or principal of your organization ever been an officer or principal of another organization when it failed to complete a construction contract? If so, provide a detailed explanation.

D. BONDING CAPABILITIES

1. Bank Reference: Provide bank name, address, contact person, and phone for bank reference.
2. Surety: Name of bonding company, name and address of agent. A bond for 100% of the construction cost will be required. Proof of ability to bond will be required prior to selection.
3. Other Financial Information: Will you provide a financial statement and other relevant financial information if requested by the Owner after receipt of SOQs? (Do not include such information with the SOQ).

E. OTHER ITEMS FOR CONSIDERATION

1. Personnel: Given the scope and schedule of the project, identify the specific Project Managers and Job Site Superintendents who would work on the project. Provide a resume and references with phone numbers for each individual.
2. Safety: Provide your company's safety experience modifier rate for each of the last three years and OSHA 200 Log.
3. Local Participation: What work do you expect to be performed by Local Firms? What is the estimated percentage of the total Construction Cost that will be provided by Local Firms?
4. HUB/MWBE Participation: What work do you expect to be performed by HUB/MWBE Firms? What is the estimated percentage of the total Construction Cost that will be provided by HUB/MWBE Firms?
5. Responsible Firm(s): Which Firm or Firms will be responsible for this contract if so awarded?

a. Firm Name: _____

Responsible as _____ Prime Contractor _____ Partner _____ Joint Venture
_____ Other

b. Firm Name: _____

Responsible as _____ Prime Contractor _____ Partner _____ Joint Venture
_____ Other

c. Firm Name: _____

Responsible as _____ Prime Contractor _____ Partner _____ Joint Venture
_____ Other

F. QUESTIONNAIRE SIGNATURE(S)

We have received Addenda numbers _____. All portions of this Statement of Qualifications are true and correct. The undersigned is authorized to sign for and legally bind the Respondent. The undersigned authorizes City of Port Aransas, the Architect and their representatives to contact any firm, organization, or person discussed in this Statement of Qualifications regarding the Respondent's performance, financial condition and other information regarding the Respondent's capability.

_____ (Affix Corporate Seal Signature of
Authorized Signing Officer if a Corporation)

Printed Name

Title Date

END OF SOQ

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COPA LIFEGUARD HEADQUARTERS
City of Port Aransas, TX

PAYMENT BOND

THE STATE OF TEXAS §

KNOW ALL MEN BY THESE PRESENTS:

COUNTY OF NUECES §

That we, _____, Contractor, as Principal, and _____, as Surety, are hereby held and firmly bound unto the **City of Port Aransas of Nueces County, TX** (hereafter called "Owner") in the full and just sum of _____ Dollars (\$ _____) for the payment of which the said Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

The conditions of this obligation are such that: WHEREAS the Principal entered into a certain Contract, which Contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein, with the Owner acting by, dated _____, **2026**, for the construction of the **COPA LIFEGUARD HEADQUARTERS**, in accord with the Drawings, Specifications and other Contract Documents pertaining thereto, prepared or compiled by EDR Architects, PLLC.

NOW, THEREFORE, if the Principal shall promptly make payment to all claimants as defined in Chapter 2253, Government Code, as amended, supplying labor and materials in the prosecution of the work provided for in said Contract, as well as any changes, extensions, deletions or modifications thereof which may be made by Owner, with or without notice to Surety, then this obligation shall be null and void, otherwise it shall remain in full force and effect.

PROVIDED that any additions, deletions, alterations or changes which may be made in the terms of the Contract or in the Drawings, Specifications or other Contract Documents, or in the work to be done thereunder, or the making by the Owner of any payment or pre-payment under the Contract, or the giving by the Owner of any extension of time for the performance of the Contract, or the granting of any other forbearance on the part of either the Owner or the Principal to the other shall not in any way release the Principal or the Surety, or either of them, their heirs, executors, administrators, successors or assigns, from their liability or the liability of any of them hereunder, notice to the Surety of any such addition, deletion, alteration, change, payment, pre-payment, extension or forbearance being hereby expressly waived.

PROVIDED FURTHER, that this bond is made and entered into solely for the protection of all claimants as defined in Chapter 2253, Government Code, as amended, supplying labor and material in the prosecution of the work provided for in said Contract, and each such 435975/SSH claimant shall have a direct right of action under the bond as provided in such Chapter 2253, Government Code, as amended.

EXECUTED on _____, **2026.**

PRINCIPAL

SURETY

Contractor

(Name)

By _____

Name: _____

Title: _____

Attorney-in-Fact: _____

Name: _____

ATTEST:

*Name: _____

*Title: _____

Address of Contractor:

Address of Surety:

*Typed or clearly printed

COPA LIFEGUARD HEADQUARTERS
City of Port Aransas, TX

PERFORMANCE BOND

THE STATE OF TEXAS §

KNOW ALL MEN BY THESE PRESENTS:

COUNTY OF NUECES §

That we, _____, Contractor, as Principal, and _____, as Surety, are hereby held and firmly bound unto the **City of Port Aransas of Nueces County, TX** (hereafter called "Owner") in the full and just sum of _____ Dollars (\$_____) for the payment of which the said Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITIONS OF THIS OBLIGATION are such that: WHEREAS the Principal entered into a certain Contract with The City of Port Aransas the Owner, dated _____, **2026**, for the construction of the **COPA LIFEGUARD HEADQUARTERS**, in accord With the Drawings, Specifications and other Contract Documents pertaining thereto, prepared or compiled by EDR Architects, PLLC.

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform the Contract in accord with the Drawings, Specifications, and other Contract Documents pertaining thereto, as well as any changes, extensions, deletions or modifications thereof which may be made by Owner, with or without notice to the Surety, and shall fully indemnify and save harmless the Owner from all costs and damage which Owner may suffer by reason of Principal's default or failure so to do, shall fully reimburse and repay Owner all outlay and expense which Owner may incur in making good any such default, then this obligation shall be null and void, otherwise it shall remain in full force and effect.

PROVIDED that any additions, deletions, alterations or changes which may be made in the terms of the Contract or in the Drawings, Specifications or other Contract Documents, or in the work to be done thereunder, or the making by the Owner of any payment or pre-payment under the Contract, or the giving by the Owner of any extension of time for the performance of the Contract, or the granting of any other forbearance on the part of either the Owner or the Principal to the other shall not in any way release the Principal or the Surety, or either of them, their heirs, executors, administrators, successors or assigns, from their liability or the liability of any of them hereunder, notice to the Surety of any such addition, deletion, alteration, change, payment, pre-payment, extension or forbearance being hereby expressly waived.

PROVIDED FURTHER, that if any legal action be filed upon this bond, venue shall lie in Nueces County, State of Texas and that said surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the work to be performed thereunder or the specifications accompanying the same shall in any wise affect its obligation on this bond, and it does hereby waive notice of any such change, extensions of time, alteration or addition to the terms of the contract or to the work or to the specifications.

EXECUTED on _____, **2026**.

PRINCIPAL

SURETY

Contractor

(Name)

By _____

Name: _____

Title: _____

Attorney-in-Fact: _____

Name: _____

ATTEST:

*Name: _____

*Title: _____

Address of Contractor:

Address of Surety:

*Typed or clearly printed

INSURANCE REQUIREMENTS

INSURANCE REQUIREMENTS:

Upon submittal of this request for proposal the submitting Contractor shall procure, pay for, and maintain at minimum the following insurance coverage's with the stated limits or greater. Said insurance shall be evidenced by delivery to the Owner of

1. Certificates of insurance executed by the insurers listing coverage's and limits, expiration dates and terms of policies and all endorsements, whether or not required by the Owner, and listing all carriers issuing said policies; and
2. Upon request a certified copy of each policy, including all endorsements.

The insurance requirements shall remain in effect throughout the term of this Contract and any additional extensions. In addition, the Owner reserves the right to request physical evidence of this coverage by requesting the policy declaration page, and/or an estopped from the agent and/or company verifying the coverage is and/or has been continually in effect.

The Contractor shall secure and maintain, at its sole cost and expense during the contract term and any subsequent extensions, the following insurance:

- a. **Commercial General Liability** - in the amount of five million dollars (\$5,000,000.00) aggregate/one million dollars (\$1,000,000.00) per occurrence. The General Aggregate limit shall either apply separately to the resulting contractor or shall be at least twice the required occurrence limit.
- b. **Comprehensive Automobile and Water Vehicle Liability** - covering any automotive equipment to be used in performance of the service, with a minimum limit in the amount of one million dollars (\$1,000,000.00) per occurrence combined single limit / Any Auto. Physical Damage Insurance covering owned or rented machinery, tools, equipment, office trailers, and vehicles.
- c. **Worker's Compensation** - Proposer shall provide a policy with employer's liability coverage with limits of not less than one million dollars (\$1,000,000.00) per occurrence for each accident or illness. The Worker's Compensation policy shall state that it cannot be cancelled or materially changed without first giving thirty (30) days prior notice thereof in writing to the Owner. Firms that have owner/operators that have filed a "Notice of Election to be Exempt" shall supply a signed copy of said notice. Any such exemption shall meet the requirements that qualify for an exemption under the applicable Worker's Compensation law.

POLLUTION AND REMEDIATION LIABILITY

A. **Limits:** with limits of not less than five million dollars (\$5,000,000.00) annual aggregate / two million dollars (\$2,000,000.00) per occurrence, including the cost of defense during the term of the contract and for a period of five (5) years following the completion thereof. Such coverage shall include, but not be limited to:

- i. Pollution Legal Liability- (legal liability arising out of the discharge, dispersal, release, seepage, migration or escape of smoke, vapors, soot, fumes, acids, alkalis, toxic chemicals, liquids or gasses, hazardous materials, waste materials, or other irritants, contaminants, pollutants, into or upon the land, the atmosphere, or any watercourse or body of water, including groundwater at, under, or emanating from the work).
- ii. Remediation Legal Liability Expense - expenses incurred for or in connection with investigation, monitoring, removal, disposal, treatment, or neutralization of a condition arising from the discharge, dispersal release, seepage, migration, or escape of smoke, vapors, soot, fumes acids, alkalis toxic chemicals, liquids or gases, hazardous materials, waste materials, or other irritants, contaminants, or pollutants into or upon the land, the atmosphere, or any watercourse or body of water, including groundwater at, under, or emanating from the work, as well as the cost to repair or replace real or personal property damaged during the course of Remediation Expense in order to restore the required Federal, State, Local, or Provincial laws, ordinances, regulations, or statutes, or any subsequent amendments thereof; and
- iii. Transportation Legal Liability / Expense Pollution Legal Liability or Remediation Legal Liability/Expense arising out of the movement by the Contractor of product or waste of the Owner to its final delivery point as specified in the resulting contract.

Contractor agrees that the insurer shall waive its rights of subrogation, if any, against the Owner on Commercial General Liability and Worker's Compensation insurance coverage. The ACORD Certificate of Liability Insurance, with endorsements, shall be completed by the authorized Agent and returned to the Owner.

Loss Deductible Clause: The Owner shall be exempt from, and in no way liable for, any sums of money that may represent a deductible in any insurance policy. The payment of such deductible shall be the sole responsibility of the Contractor

The Contractor shall promptly remedy damage and loss to property caused in whole or in part by the Contractor, its subcontractors of every tier, anyone directly or indirectly employed by any of them, or anyone for whose acts they may be liable.

B. CONDITIONS:

Each insurance policy shall include the following conditions by endorsement to the policy:

- i. Each policy shall require that thirty (30) days prior to expiration, cancellation, nonrenewal or any material change in coverage's or limits, a notice thereof shall be given to the Owner by certified mail to: Contractor shall also notify the Owner, in a like manner, within twenty-four (24) hours after receipt, of any notices of expiration, cancellation, non-renewal, or material change in coverage received by said Contractor from its insurer; and nothing contained herein shall absolve the Contractor of this requirement to provide notice.
- ii. Companies issuing the insurance policy, or policies, shall have no recourse against the Owner for payment of premiums.

The term "Owner" shall include all Authorities, Boards, Bureaus, Commissions, Divisions, Departments, and Offices of the City and individual members, elected officials, employees thereof in their official capacities, and/or while acting on behalf of the Owner.

Owner shall be named as an additionally insured on all policies of insurance. The policy clause "Other insurance" shall not apply to any insurance coverage currently held by the Owner to any such future coverage, or to the Owner's Self-Insured Retentions as, if any, of whatever nature.

END OF SECTION

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CONTRACTOR'S RELEASE AND WAIVER OF LIEN

For good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the undersigned _____, hereinafter termed "CONTRACTOR", hereby waives and releases any and all liens and any and all claims and right to liens, against at _____ (city), _____ (state), for _____, hereinafter termed "SAID PROJECT", and upon any and all other property owned by or the title to which is in the name of _____, and upon any and all funds or monies appropriate or available for the construction and/or equipping of said hereinabove-mentioned project, and any and all warrants drawn upon or issued against any such funds or monies which Contractor may have acquired or possess, or may hereafter acquire or possess, as a result or on account of the furnishing by the undersigned or Labor or materials, or both, used in connection with the construction or equipping of said project, whether furnished by the undersigned under and pursuant to the certain Contract between it and said _____, bearing date of _____ and pertaining to said project, or otherwise, and which said liens or claims or right of lien may exist under the laws of the State of _____.

The undersigned further hereby acknowledges that the sum of _____ Dollars (\$ _____) constitutes the entire balance due the undersigned from said _____ for all labor and materials furnished and work done by it, upon or for said project and/or under said Contract and that the payment in full to the undersigned for everything furnished and/or done by the Contract or otherwise, and will satisfy in full, and will operate to fully and completely release said _____, and all claims, demands, of whatever nature, which the undersigned may have or assert against it, arising out of construction and equipping of said project, said Contract, and any and all things done or furnished by the undersigned in connection herewith.

DATED THIS _____ day of _____, 2026.

Witness to Signature:

Title:

By:

Title:

By:

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**SECTION 01 0100
SUMMARY OF WORK**

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK COVERED BY CONTRACT DOCUMENTS

The Project consists of the construction of the **COPA LIFEGUARD HEADQUARTERS**. Including all required demolition, building repairs and site improvements.

Project Name and location:

COPA LIFEGUARD HEADQUARTERS

303 Ninth St.

Port Aransas, TX 78373

Owner:

City of Port Aransas

710 W. Avenue A

Port Aransas, Texas, 78373

The Project Architect:

EDR Architects, PLLC

Contact: Emily D. Rozypal, AIA

PO Box 271613

Corpus Christi, Texas 78427

Phone: (361) 537-4400

E-mail: erozypal@edrarchitects.com.

Summary of Work:

Summary Project Description (Including, but not limited to): The Work scheduled to be performed includes Demolition, New construction single-story Building, Masonry, Site Work, Accessible ramps, Accessible stairs, vehicular ramps, Guardrails, Accessible Handrails, Signage, Flagpole, Landscaping, Parking, Board Formed Retaining Walls, MEP, Utilities, Kitchen, Restrooms, etc.

PART 2 – PRODUCTS: Not Applicable

PART 3 – EXECUTION: Not Applicable

END OF SECTION

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SECTION 01 0270
APPLICATION FOR PAYMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.
- B. Related Sections: The following Sections contain requirements that relate to this Section.
 - 1. Schedules: The Contractor's Construction Schedule and Submittal Schedule are specified in Division 01 Section "01 3000 – Submittals".

1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
 - a. Contractor's Construction Schedule.
 - b. Application for Payment forms, including Continuation Sheets.
 - c. List of Subcontractors.
 - d. Schedule of Submittals.
 - 2. Submit the Schedule of Values to the Architect at the earliest possible date but no later than 7 days before the date scheduled for submittal of the initial Application for Payment.
- B. Format and Content:
 - 1. Identification: Use AIA Document G703 – 2017 Continuation Sheet as the form for the Schedule of Values. Include the following Project identification on the Schedule of Values:
 - a. Project name and location.
 - b. Name of the Architect.
 - c. Project Architect's Project Number
 - d. Contractor's name and address.
 - e. Date of Submittal.

2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of Work.
 - c. Change Orders (numbers) that affect value.
 - d. Dollar value.
3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.
4. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. Include requirements for insurance and bonded warehousing, if required.
5. Provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed valued of that part of the Work.
6. Schedule Updating: Update and resubmit the Schedule of Values with each Application for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include each Change Order as a new line item.

1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.
- B. Payment-Application Times: Progress payments will be made each month. The period covered by each Application for Payment starts on the day following the end of the preceding period and ends the last day of each month.
- C. Payment-Application Forms: Use AIA G702-2017 Application and Certificate for Payment and G703-2017 Continuation Sheets as the form for Applications for Payment.
- D. Application Preparation: Complete every entry on the form. Include notarization and execution by a person authorized to sign legal documents on behalf of the Contractor.
 1. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.
 2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

- E. Transmittal: Submit signed and notarized Application for Payment to the Architect via email at erozypal@edrarchitects.com. Include waivers of lien and similar attachments.

PART 2 – PRODUCTS: Not Applicable

PART 3 – EXECUTION: Not Applicable

END OF SECTION

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**SECTION 01 0300
BID ALTERNATES**

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

This Section included administrative and procedural requirements governing allowances.

1.2 DEFINITIONS

- A. Definition: An alternate is an amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. The cost for each alternate is the total addition to the Contract Sum to incorporate the Alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent Work as necessary to completely and fully integrate that Work into the Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate.
- B. Notification: Immediately following the award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicated whether alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- C. Execute accepted alternates under the same conditions as other Work of this Contract.
- D. Schedule: A "Schedule of Alternates" is included at the end of this Section. Contractor shall provide all materials necessary to achieve the Work describe under each alternate.

PART 2 – PRODUCTS

PART 3 – EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Both the base bid and any accepted alternate shall be complete and finished structures with any necessary building component or system required for a reasonable functionality. Bid alternates are additive to the base bid. Base Bid: The Base Bid shall include all work indicated on the Construction

Documents (not specifically indicated as a Bid Alternate) required to provide a total and completed product implied by the overall project scope.

SCHEDULE A

NO BID ALTERNATES AT THIS TIME

PART 2 – PRODUCTS: Not Applicable

PART 3 – EXECUTION: Not Applicable

END OF SECTION

**SECTION 01 0350
MODIFICATION PROCEDURES**

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing contract modifications.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 01 Section 01 3000 "Submittals" for requirements for the Contractor's Construction Schedule.
 - 2. Division 01 Section 01 0270 "Applications for Payment" for administrative procedures governing Applications for Payment.

1.3 MINOR CHANGES IN WORK

- A. The Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or Contract Time, on AIA Form G710-2017 Architect's Supplemental Instructions.

1.4 CHANGE ORDER PROPOSAL REQUESTS

- A. Owner-initiated Proposal Requests: The Architect will issue a detailed description of proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal requests issued by the Architect for information only. Do not consider them as an instruction either to stop work in progress or to execute the proposed change.
 - 2. Within 7 days of receipt of a proposal request, submit an estimate of cost necessary to execute the change to the Architect for the Owner's review.
 - a. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.

- B. Contractor-initiated Proposals: When latent or unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.
 - 1. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
 - 2. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made where requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
- C. Proposal Request Form: Use AIA Document G709-2017 Work Changes Proposal Request.

1.4 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: When the Owner and the Contractor disagree on the terms of a Proposal Request, the Architect may issue a Construction Change Directive on AIA Form G714-2017 Construction Change Directive. This Construction Change Directive instructs the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 1. The Construction Change Directive contains a complete description of the change in the Work. It also designates the method to be followed to determine change in the Contract Sum or Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - 1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.5 CHANGE ORDER PROCEDURES

- A. Upon the Owner's approval of a Proposal Request, the Architect will issue a Change Order for signatures of the Owner and the Contractor on AIA Form G701-2017 Change Order.

PART 2 – PRODUCTS: Not Applicable

PART 3 – EXECUTION: Not Applicable

END OF SECTION

**SECTION 01 0400
COORDINATION**

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:

1. General project coordination procedures.
2. Coordination Drawings.
3. Administrative and supervisory personnel.
4. Cleaning and protection.

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

1. Division 01 Section 01 2000 "Project Meetings" for progress meetings, coordination meetings, and pre-installation conferences.
2. Division 01 Section 01 3000 "Submittals" for preparing and submitting the Contractor's Construction Schedule.
3. Division 01 Section 01 6000 "Materials and Equipment" for coordinating general installation.
4. Division 01 Section 01 7000 "Contract Closeout" for coordinating contract closeout.

1.3 COORDINATION

A. Coordinate construction operations to assure complete, efficient and orderly installation of each part of the Work for its intended use. Coordinate construction operations, materials and systems that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to assure maximum accessibility for required maintenance, services, and repair.
3. Make provisions to accommodate items scheduled for later installation.
4. Coordinate installation of any/all Supplemental Framing as required for complete installation per all codes, ordinances, laws, and manufacturer's full system warranties.

5. Coordinate the light-gage metal stud shop drawings with the TDI Windstorm compliant soffit shop drawings to ensure that the soffit framing will resist all applied wind pressures. This includes all stud sizes, blocking/bridging, fasteners, connections to support structure, applicable details, and verification that the necessary stud gage required for anchorage of the soffit materials is being furnished. This is for all Soffit and Ceiling assemblies.
- B. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 1. Preparation of schedules.
 2. Installation and removal of temporary facilities.
 3. Delivery and processing of submittals.
 4. Progress meetings.
 5. Project closeout activities.

1.4 SUBMITTALS

- A. Coordination Drawings: Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities.
 1. Show the relationship of components shown on separate Shop Drawings.
 2. Indicate required installation sequences.
 3. Comply with requirements contained in Section 01 3000 "Submittals".

PART 2 – PRODUCTS: Not Applicable

PART 3 – EXECUTION

3.1 GENERAL COORDINATION PROVISIONS

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

3.2 CLEANING AND PROTECTION

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

- B. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.
- C. Limiting Exposures: Supervise construction operations to assure that no part of the construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

END OF SECTION

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**SECTION 01 0450
CUTTING AND PATCHING**

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for cutting and patching.
- B. Related Section: The following Sections contain requirements that relate to this Section.
 - 1. Division 01 Section 01 0400 "Coordination" for procedures for coordinating cutting and patching with other construction activities.
 - 2. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - a. Requirements of this Section also apply to mechanical and electrical installations.

1.3 QUALITY ASSURANCE

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying or load-deflection ratio.
 - 1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:
 - i. Foundation construction
 - ii. Bearing and retaining walls
 - iii. Structural concrete
 - iv. Lintels
 - v. Structural decking
 - vi. Miscellaneous structural metals
 - vii. Equipment supports
 - viii. Piping, ductwork, vessels, and equipment
- B. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction cut and patched in a visually unsatisfactory manner.

PART 2 – PRODUCTS

2.1 MATERIALS, GENERAL

- A. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible if identical materials are unavailable or cannot be used. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding. Before proceeding, meet at the Project Site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of work to be cut.
- B. Protection: Protect existing condition during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- C. Avoid cutting existing pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
- B. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining construction.
 - 1. In general, where cutting, cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Cut through concrete and masonry using a cutting machine, such as Carborundum saw or a diamond-core drill.

4. Where services are required to be removed, relocated, or abandoned, by-pass utility services, such as pipe or conduit, before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
- C. Patching: Patch with durable seams that are as invisible as possible.
1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
 2. Provide an even surface of uniform color and appearance. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing the patch after the area has received primer and second coat.

3.4 CLEANING

- A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials.

END OF SECTION

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**SECTION 01 2000
PROJECT MEETINGS**

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project meetings, including, but not limited to, the following:
 - 1. Pre-construction conferences
 - 2. Pre-installation conferences
 - 3. Progress meetings
 - 4. Project closeout meetings
 - 5. Building permit review
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 01 Section 01 0400 "Coordination" for procedures for coordinating project meetings with other construction activities.
 - 2. Division 01 Section 01 3000 "Submittals" for submitting the Contractor's Construction Schedule.
 - 3. Division 01 Section 01 7000 "Contract Closeout" for administrative and procedural requirements for contract closeout.

1.3 PRE-CONSTRUCTION CONFERENCE

- A. Schedule a pre-construction conference before starting construction, at a time convenient to the Owner and the Architect, but no later than 15 days after approval to proceed with construction. Hold the conference at the Project Site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
- B. Attendees: Authorized representatives of the Owner, Architect, and their consultants; the Contractor and its Superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
- C. Agenda: Discuss items of significance that could affect progress, including the following:
 - 1. Tentative construction schedule.
 - 2. Critical work sequencing.
 - 3. Designation of responsible personnel.
 - 4. Procedures for processing field decisions and Change Orders.
 - 5. Procedures for processing Applications for Payment.

6. Distribution of Contract Documents.
7. Submittal of Shop Drawings, Product Data and Samples.
8. Preparation of record documents.
9. Use of the premises.
10. Parking availability.
11. Office, work, and storage areas.
12. Equipment deliveries and priorities.
13. Safety procedures.
14. First aid.
15. Security.
16. Housekeeping.
17. Working hours.
18. Project closeout.

1.4 PRE-INSTALLATION CONFERENCES

- A. Conduct a pre-installation conference at the Project Site before each construction activity that requires coordination with other construction.
- B. Submittal review process for that portion of the Work under discussion must have been completed prior to scheduling of the pre-installation meeting.
- C. Attendees: The installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Architect of scheduled meeting dates.
 1. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for the following:
 - a. Contract documents
 - b. Options
 - c. Related Change Orders
 - d. Purchases
 - e. Deliveries
 - f. Shop Drawings, Product Data, and quality-control samples
 - g. Possible conflicts
 - h. Compatibility problems
 - i. Time schedules
 - j. Weather limitations
 - k. Manufacturer's recommendations
 - l. Warranty requirements
 - m. Compatibility of materials
 - n. Acceptability of substrates
 - o. Temporary facilities
 - p. Space and access limitations
 - q. Governing regulations

- r. Safety
 - s. Inspecting and testing requirements
 - t. Required performance results
 - u. Recording requirements
 - v. Protection
2. Contractor shall record significant discussions and agreements and disagreements of each conference, and the approved schedule. Promptly distribute the record of the meeting to everyone concerned, including the Owner and the Architect.
 3. Do not proceed with the installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.5 PROGRESS MEETINGS

- A. Progress meetings will occur bi-monthly at a regular time and day as mutually agreed by the Owner and Contractor. Coordinate dates of meetings with preparation of the payment request.
- B. Attendees: Authorized representatives of the Owner, Architect, and their consultants; the Contractor and its Superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
- C. Agenda:
 1. Review minutes of previous meetings.
 2. Review of Work progress.
 3. Field observations, problems, and decisions.
 4. Identification of problems which impede planned progress.
 5. Review of submittals schedule and status of submittals.
 6. Review of off-site fabrication and delivery schedules.
 7. Maintenance of progress schedule.
 8. Corrective measures to regain project schedules.
 9. Planned progress during succeeding work period.
 10. Coordination of project progress.
 11. Review status of Requests for Information (RFI's).
 12. Change Orders
 13. Maintenance of quality and work standards.
 14. Effect of proposed changes on progress.
 15. Report on lost-time injuries, doctor cases and other safety issues.
 16. Housekeeping.
 17. Other business relating to Work.
- D. Reporting: No later than three (3) days after each meeting, Contractor shall distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

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

1.6 PROJECT CLOSEOUT MEETING

- A. No less than one week before Substantial Completion, conduct a project closeout meeting.
- B. Attendees: Representative(s) of the Owner, general contractor, contractor responsible for separate contract items.
- C. Agenda:
 - 1. Develop a schedule for project closeout items related to Substantial Completion.
 - a. Completion of contractor's pre-punch list.
 - b. Submittal of Operation and Maintenance manuals with warranties, workmanship bonds, maintenance agreements, final certifications and similar documents. (Draft copy 14 days before Substantial Completion.)
 - c. Inspections of project for occupancy permit.
 - d. Testing and balance of HVAC equipment, if any.
 - e. Review of building systems with Owners' representative and the following:
 - I. Electrical subcontractor
 - II. Plumbing subcontractor
 - III. Specific equipment moving
 - f. Final cleaning
 - g. Walk-thru of project for development of punch list to be issued with the Certificate of Substantial Completion.
 - h. Establish preliminary date for Substantial Completion.
 - i. Start date for warranties.
 - 2. Establish date for submittal of record documents.
 - 3. Discuss disposition of extra materials.
 - 4. Establish preliminary date for final completion.
 - 5. Advise Owner of pending insurance and utility change-over requirements.

PART 2 – PRODUCTS: Not Applicable

PART 3 – EXECUTION: Not Applicable

END OF SECTION

**SECTION 01 3000
SUBMITTALS**

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project meetings, including, but not limited to, the following:
 - 1. Contractor's Construction Schedule.
 - 2. Shop Drawings.
 - 3. Product Data.
 - 4. Samples.
 - 5. Estimated monthly payment schedule.
- B. Administrative Submittals: Refer to Division 01 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:
 - 1. Applications for Payment.
 - 2. Insurance Certificates.
 - 3. List of Subcontractors.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 01 Section 01 0270 "Application for Payment" specifies requirements for submittal of the Schedule of Value.
 - 2. Division 01 Section 01 2000 "Project Meetings" specifies requirements for submittal and distribution of meeting and conference minutes.

1.3 DEFINITIONS

- A. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.

1.4 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
3. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.
 - a. Allow two (2) weeks for initial review. Allow additional time if the Architect must delay processing to permit coordination with subsequent submittals and other consultants.
 - b. If an intermediate submittal is necessary, process the same as the initial submittal.
 - c. Allow two (2) weeks for reprocessing each submittal.
 - d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.

B. Submittal Preparation: Provide a cover sheet with each submittal for identification. Indicate the name of the entity that prepared each submittal on the cover sheet.

1. Provide a space approximately 4 x 5 inches on the cover sheet or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
2. Include the following information on the cover sheet for processing and recording action taken.
 - a. Project name
 - b. Date
 - c. Name and address of the Architect
 - d. Name and address of the Contractor
 - e. Name and address of the Subcontractor
 - f. Name and address of the Supplier
 - g. Name of the Manufacturer
 - h. Number and title of appropriate Specification Section
 - i. Drawing number and detail references, as appropriate

C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Architect using a transmittal form. The Architect will not accept submittals received from sources other than the Contractor.

1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Documents requirements, including variations and limitations. Include Contractor's

certification that information has been reviewed by the General Contractor and complies with Contract Document requirement.

- D. Submittals shall be submitted in electronic PDF format. Electronic submittals, including shop drawings, shall be complete and clearly organized. Partial submittals shall not be accepted, and electronic submission does not modify or change required submission of material, color samples, or mock-ups. Submittal mark-ups shall be returned in electronic PDF format.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart type, contractor's construction schedule. Submit within 15 days after approval to proceed with construction.
 - 1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values".
 - 2. Within each time bar, indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
 - 3. Prepare the schedule on a sheet, or series of sheets, of reproducible media, of sufficient width to show data for the entire construction period.
 - 4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the Work.
 - 5. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other schedules.
 - 6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for Certification of Substantial Completion.
- B. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with scheduled dates as requested. Post copies in the Project meeting room and temporary field office.
 - 1. When revisions are made, distribute to the same parties and post in the same locations.
- C. Schedule Updating: Revise the schedule after each meeting, event, or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.6 SHOP DRAWINGS

- A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
- B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:
 - 1. Dimensions.
 - 2. Identification of products and materials included by sheet and detail number.
 - 3. Compliance with specified standards.
 - 4. Notation of coordination requirements.
 - 5. Notation of dimensions established by field measurement.
 - 6. Initial Submittal: All submittals shall be made in PDF format.
 - 7. Final Submittal: All submittals shall be made in PDF format.
 - 8. Do not use Shop Drawings without an appropriate final stamp indicating action taken.

1.7 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. HVAC, Plumbing and Electrical submittals shall be submitted as three complete submittals within 30 days of award of contract. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
 - 1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
 - a. Manufacturer's printed recommendations.
 - b. Compliance with trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Application of testing agency labels and seals.
 - e. Notation of dimensions verified by field measurement.
 - f. Notation of coordination requirements.
 - 2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
 - 3. Submittals: Submit copies of each required submittal in quantities sufficient to provide one (1) record copy for the Architects, one (1) copy for the Owner's record, one (1) copy for the Architect's Consultants whose review is necessary, and as many copies as the Contractor requires to be returned. The Architect will retain two (2) copies and will return the other marked with action taken and corrections or modifications required.
 - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

4. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
 - a. Do not proceed with installation until a copy of Product Data is in the installer's possession.
 - b. Do not permit use of unmarked copies of Product Data in connection with construction.
5. See 1.4 (D) for electronic format submission and requirements.

1.8 SAMPLES

- A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
 1. Mount or display Samples in the manner to facilitate review of qualities indicated. Prepare Samples to match the Architect's sample. Include the following;
 - a. Specification Section number and reference.
 - b. Generic description of the Sample.
 - c. Sample source.
 - d. Product name or name of the manufacturer.
 - e. Compliance with recognized standards.
 2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
 - a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
 - b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
 3. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit three (3) sets. The Architect will return one set marked with the action taken.
 4. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.
 - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
 - b. Sample sets may be used to obtain final acceptance of the construction associated with each set.

- B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, Manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.

1.9 QUALITY ASSURANCE SUBMITTALS

- A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.
- B. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.
 - 1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.
- C. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 01 Section 01 4000 "Quality Control".

1.10 ARCHITECT'S ACTION

- A. Submittals, such as Shop Drawings, Product Data and Samples are reviewed and approved for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. Submittals shall not modify the Contract Documents.
- B. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract.
- C. In accordance with the General Conditions, Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents.
- D. Upon receipt of submittals requiring review, the Architect/Engineer will review submittals and return them to the Contractor with results of the review.

PART 2 – PRODUCTS: Not Applicable
PART 3 – EXECUTION: Not Applicable

END OF SECTION

**SECTION 01 4000
QUALITY CONTROL**

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 RESPONSIBILITIES

- A. Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction. Costs for these services shall be included in the Contract Sum.
 - 1. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Contractor's responsibility, the Contractor shall employ and pay a qualified independent testing agency to perform quality-control services. Costs for these services are included in the Contract Sum.
- B. Retesting: The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.

1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required test performed on original construction indicate noncompliance with Contract Document requirements.
- C. Associated Services: Cooperate with agencies performing required inspections, test, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:
1. Provide access to the Work.
 2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
 3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
 4. Provide facilities for storage and curing of test samples.
 5. Deliver samples to testing laboratories.
 6. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
 7. Provide security and protection of samples and test equipment at the Project Site.
- D. Duties of the Testing Agency: The independent agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual Sections shall cooperate with the Architect and the Contractor in performance of the agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.
1. The agency shall notify the Architect and the Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. The agency is not authorized to release, revoke, alter, or enlarge requirements of the
 3. Contract Documents or approve or accept any portion of the Work.
 4. The agency shall not perform any duties of the Contractor.
- E. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

1.4 SUBMITTALS

- A. Unless the Contractor is responsible for this service, the independent testing agency shall submit a certified written report, via email, of each inspection, test, or similar service to the Architect. If the Contractor is responsible for the service, submit a certified written report, via email, of each inspection, test or similar service through the Contractor.
1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.

2. Report Data: Written reports of each inspection, test, or similar service include, but are not limited to, the following:
 - a. Date of Issue.
 - b. Project title and number.
 - c. Name, address, and telephone number of testing agency.
 - d. Dates and locations of samples and tests or inspections.
 - e. Names of individuals making the inspection or test.
 - f. Designation of the Work and test method.
 - g. Identification of product and Specification Section.
 - h. Complete inspection or test data.
 - i. Test results and an interpretation of test results.
 - j. Ambient conditions at the time of sample taking and testing.
 - k. Comments or professional opinion on whether inspected or test Work complies with Contract Document requirements.
 - l. Name and signature of laboratory inspector.
 - m. Recommendations on retesting.

1.5 QUALITY ASSURANCE

- A. Qualifications for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are pre-qualified as complying with the American Council of Independent Laboratories' "Recommended Requirements for Independent Laboratory Qualification" and that specializes in the types of inspections and tests to be performed.
 1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.

PART 2 – PRODUCTS: Not Applicable

PART 3 – EXECUTION

3.1 REPAIR AND PROTECTION

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

END OF SECTION

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SECTION 01 4100
TESTING LABORATORY SERVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 PROCEDURES

- A. Testing Laboratory: An independent testing laboratory will be selected and furnished by the **Contractor** to inspect and test the materials and methods of construction as hereinafter specified for compliance with the specification requirements of the Contract Documents and to perform such other specialized technical services as required by the Owner or his representative. All testing lab services shall be paid for by the **Contractor**.

1.3 QUALIFICATIONS OF TESTING LABORATORY

- A. The Testing Laboratory selected shall meet the basic requirements of ASTM E329 "Standard of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction", and shall submit to the Contractor, Owner, Architect, and Engineer, a copy of the report of inspection of their facilities made by the American Association of State Highway Transportation Officials (AASHTO) or similar nationally recognized third party laboratory accreditation program during the most recent tour of such inspections, and shall submit a memorandum stating steps taken to remedy all deficiencies reported by this inspection.
- B. Testing machines shall be calibrated at intervals not exceeding 12 months by devices of accuracy traceable to the National Bureau of Standards or accepted values of natural physical constants. The Testing Laboratory shall submit a copy of certificate of calibration made by an accredited calibration agency.
- C. Tests and inspections shall be conducted in accordance with specified requirements, and if not specified, in accordance with the applicable standards of the American Society for Testing and Materials or other recognized and accepted authorities in the field.
- D. All Testing shall be directly supervised, and all final reports reviewed and signed by a licensed Professional Engineer registered with the Texas Board of Professional Engineers.

1.4 CONTRACTORS RESPONSIBILITY

- A. Cooperation with Design Team: The **Contractor** shall pay for all testing lab services. The Contractor shall cooperate with laboratory personnel; provide access to the work, and to manufacturers operations.

- B. **Furnishing Samples:** The Contractor shall provide to the laboratory representative, samples of materials proposed for use in the work in quantities sufficient for accurate testing as specified.
- C. **Furnishing Casual Labor, Equipment and Facilities:** The Contractor shall furnish casual labor, equipment, and facilities as required for sampling and testing by the Laboratory and otherwise facilitate all required inspections and tests.
- D. **Advance Notice:** The Contractor shall be responsible for notifying the Testing Laboratory sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests.
- E. **Payment for Substitution Testing:** The Contractor shall arrange with the Testing Laboratory and pay for any additional samples and tests above those required by the Contract Documents as requested by the Contractor for his convenience in performing the work.
- F. **Payment for Retesting:** The Contractor shall pay for any additional inspections, sampling, testing, and retesting as required when initial tests indicate work does not comply with the requirements of the Contract Documents.
- G. **Payment by Contractor:** The Contractor shall furnish and pay for the following items:
 - 1. Concrete mix designs as prepared by his concrete supplier.
 - 2. Concrete coring, tests of below strength concrete, and load tests, if ordered by the Owner, Architect, or Engineer.
 - 3. Certification of reinforcing steel.
 - 4. Certification of Portland cement, lime, and fly ash.
 - 5. Certification of welders.
 - 6. Any other tests when such costs are required by the Contract Documents to be paid by the Contractor.
- H. **Notification of Source Change:** The Contractor shall be responsible for notifying the Owner, Architect, Engineer, and Testing Laboratory when the source of any material is changed after the original tests or inspections have been made.
- I. **Tests for Suspected Deficient Work:** If in the opinion of the Owner, Architect, or Engineer any of the work of the Contractor is not satisfactory, the Contractor shall make all tests that the Owner, Architect, or Engineer deem advisable to determine its proper construction.

1.5 PAYMENT OF TESTING LABORATORY

- A. The Contractor shall pay for all Laboratory services for testing of materials for compliance with the requirements of the Contract Documents. The Contractor shall pay for testing

and retesting of materials that do not comply with the requirements of the Contract Documents and all other items as specified in these Specifications.

PART 2 – PRODUCTS: Not Used

PART 3 – EXECUTION

3.1 SCOPE OF WORK

- A. The work to be performed by the Testing Laboratory shall be as specified in the Specifications and the contract drawings, and as determined by the Contractor, Owner, Architect, and Engineer.

END OF SECTION

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SECTION 01 4101

THE AIR BARRIER SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section includes administrative and procedural requirements for accomplishing an airtight building enclosure that controls infiltration or exfiltration of air.
 - 1. The airtight components of the building enclosure and the joints, junctures and transitions between materials, products, and assemblies forming the air-tightness of the building enclosure are called "the air barrier system". Services include coordination between the trades, the proper scheduling and sequencing of the work, preconstruction meetings, inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by Architect.
 - 2. The Contractor shall ensure that the intent of constructing the building enclosure with a continuous air barrier system to control air leakage into, or out of the conditioned space is achieved. The air barrier system shall have the following characteristics:
 - a. It must be continuous, with all joints sealed.
 - b. It must be structurally supported to withstand positive and negative air pressures applied to the building enclosure.
 - c. Connection shall be made between:
 - 1) Foundation and walls.
 - 2) Walls and windows or doors.
 - 3) Different wall systems.
 - 4) Wall and roof.
 - 5) Wall and roof over unconditioned space.
 - 6) Walls, floor and roof across construction, control and expansion joints.
 - 7) Walls, floors and roof to utility, pipe and duct penetrations.
 - 3. Air Barrier Penetrations: All penetrations of the air barrier and paths of air infiltration / exfiltration shall be sealed.
- B. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.
- C. Requirements of this section relate to the coordination between subcontractors required to provide an airtight building enclosure, customized fabrication and installation procedures, not production of standard products.

1. Continuity of the air barrier materials and products with joints to provide assemblies. Continuity of all the enclosure assemblies with joints and transition materials to provide a whole building air barrier system.
2. Specific quality-control requirements for individual construction activities are specified in the sections of the specifications. Requirements in those sections may also cover production of standard products. It is the Contractor's responsibility to ensure that each subcontractor is adequately and satisfactorily performing the quality assurance documentation, tests and procedures required by each section.
3. Specified inspections, tests, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with Contract Document requirements.
4. Requirements for Contractor to provide an airtight building enclosure is not limited by quality-control services required by Architect, Owner, or authorities having jurisdiction and are not limited by provisions of this section.

1.2 AREA OF INTENT

- A. It is the Contractors responsibility to verify that the whole building is constructed in accordance with this specification. The building envelope of the conditioned space only shall be tested by the Contractor in accordance with specification 01 41 10 – BUILDING ENVELOPE TESTING.

1.3 RELATED SECTIONS

- A. Division 01 4100 Testing Laboratory Services
- B. Division 01 4110 Building Envelop Testing

1.4 RESPONSIBILITIES

- A. Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide coordination of the trades, and the sequence of construction to ensure continuity of the air barrier system joints, junctures and transitions between materials and assemblies of materials and products, from substructure to walls to roof. Provide quality assurance procedures, testing and verification as specified herein. Facilitate inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction or by the Owner. Costs for these services are included in the Contract Sum.
 1. Organize preconstruction meetings between the trades involved in the whole building's air barrier system to discuss where each trade begins and ends and the responsibility and sequence of installation of all the air-tight joints, junctures, and transitions between materials, products and assemblies of products specified in the different sections, to be installed by the different trades.

2. Build a mock-up before proceeding with the work, satisfactory to the Architect, of each air-tight joint type, juncture, and transition between products, materials and assemblies.
- B. Associated Services: Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:
1. Provide access to the Work.
 2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
 3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
 4. Deliver samples to testing laboratories.
 5. Provide security and protection of samples and test equipment at the Project Site.
- C. Duties of the Testing and Inspection Agency: The independent agency engaged to perform inspections, sampling, and testing of air barrier materials, components and assemblies specified in individual Sections shall cooperate with the Architect and the Contractor in performance of the agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.
1. The agency shall notify the Architect and the Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.
 3. The agency shall not perform any duties of the Contractor.
- D. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

1.5 PERFORMANCE REQUIREMENTS

- A. Compliance Alternatives:
- a. Materials: materials used for the air barrier system in the opaque envelope shall have an air permeance not to exceed 0.004 cfm/ft² under a pressure differential of 0.3 in. water (1.57psf) (0.02 L/s.m² @ 75 Pa) when tested in accordance with ASTM E 2178. Or,
 - b. Assemblies of materials and components: shall have an air permeance not to exceed 0.04 cfm/ft² under a pressure differential of 0.3 in. water (1.57psf) (0.2 L/s.m² @ 75 Pa) when tested in accordance with ASTM E 2357. Or:
 - c. The entire building: The air leakage of the entire building shall not exceed 0.4 cfm/ft² under a pressure differential of 0.3 in. water (1.57psf) (2.0 L/s.m² @ 75 Pa) when tested according to ASTM E 779.

1.5 QUALIFICATIONS

- A. The testing of the air barrier systems will be performed by an independent, impartial technical firm and is not a part or subsidiary of any other project contractor or subcontractor, to include, but not limited to General Contractor, and Mechanical Contractor. The testing work will be done under the direct supervision of qualified Professional Engineer employed as a full-time employee of testing firm.
- B. The testing agency shall be either a member of ABAA or certified by the NEBB and certified in all categories and functions where measurements or performance are specified on the plans and specifications.
- C. QUALIFICATIONS OF CONTRACTOR PERSONAL: Submit evidence to show that the people who shall be in charge of correcting deficiencies for balancing the systems are qualified.

1.6 SUBMITTALS

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

1.7 QUALITY ASSURANCE

- A. Qualifications for Air Barrier Testing and Inspection Agencies: Engage air Barrier inspection and testing service agencies, including independent testing laboratories, that

are prequalified and that specialize in the types of air barrier system inspections and tests to be performed.

PART 2 - PRODUCTS

(not used)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

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

3.2 TESTING AND INSPECTION

- A. The **Contractor** will hire a testing and inspection agency to provide Continuous observation and inspection during installation of the air barrier system. The testing and inspection agency will provide the following listed services:
 - 1. Qualitative Testing and Inspection:
 - a. Daily reports of observations, with copies to the Owner, Contractor and Architect.
 - b. Continuity of the air barrier system throughout the building enclosure with no gaps, holes.
 - c. Structural support of the air barrier system to withstand design air pressures.
 - d. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions and mortar droppings.
 - e. Site conditions for application temperature and dryness of substrates.
 - f. Maximum length of exposure time of materials to ultra-violet deterioration.
 - g. Surfaces are properly primed.
 - h. Laps in material are 2" minimum, shingled in the correct direction (or mastic applied on exposed edges), with no fish-mouths.
 - i. Mastic applied on cut edges.
 - j. Roller has been used to enhance adhesion.
 - k. Measure application thickness of liquid-applied materials to manufacturer's specifications for the specific substrate.

- l. Materials used for compatibility.
 - m. Transitions at changes in direction, and structural support at gaps.
 - n. Connections between assemblies (membrane and sealants) for cleaning, preparation and priming of surfaces, structural support, integrity and continuity of seal.
 - o. All penetrations sealed.
 - p. ASTM E 1186 "Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Retarder Systems."
 - 1) Infrared scanning with pressurization/depressurization.
 - 2) Smoke pencil with pressurization/depressurization.
 - 3) Pressurization/depressurization with use of anemometer
 - 4) Generated sound with sound detection
 - 5) Tracer gas measurement of decay rate
 - 6) Chamber pressurization/depressurization in conjunction with smoke tracers
 - 7) Chamber depressurization using detection liquids
2. Quantitative tests:
- a. Provide written test reports of all tests performed, with copies to the Owner, Contractor and Architect.
 - b. Material compliance for maximum air permeance, ASTM E 2178.
 - c. ASTM E 283, Determining rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences Across the Specimen.
 - d. Whole building, floors, or suites, ASTM E779, Determining Airtightness of Buildings Air Leakage Rate by Single Zone Air Pressurization. Refer to specification section 01 41 10 for Building Envelope Testing.
 - e. Windows and connections to adjacent opaque assemblies, ASTM E783 method B
 - f. Tracer gas testing, ASTM E741
 - g. Pressure test, ASTM E330
 - h. Bond to substrate, ASTM D4541

END OF SECTION

SECTION 01 4110 BUILDING ENVELOPE TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

This Section includes testing building envelope systems.

1.2 DEFINITIONS

Acceptance Criteria: The measured value(s) or range(s) that determine if the results of the test pass or fail.

Accuracy: The capability of an instrument to indicate the true value of a measured quantity.

ACH₇₅: The ratio of the air leakage rate at 75 Pa (0.3 in. H₂O), corrected for a standard air density, to the volume of the test zone (1/h).

AHJ: The local governing **A**uthority **H**aving **J**urisdiction over the installation.

Air Barrier System: A system in the building construction that is designed and installed to reduce air leakage either into or through the building envelope.

Air Change Rate: The calculated number of times the total air volume of a defined space is replaced in a given unit of time. This is ordinarily computed by dividing the total volume of the room supply or exhaust air in cubic meters (cubic feet), per unit of time, by the total volume of the subject space. It is normally expressed as air changes per hour, ACH.

Air Exfiltration: Air leakage out of the building.

Air Infiltration: Air leakage into the building.

Airflow Rate: The volume of airflow through the fan or blower door per unit of time (m³/s or ft³/min, cfm).

Air Leakage Area: The effective leakage area (A_L) at the test pressure.

Air Leakage Change Rate: Air leakage rate in volume units/h divided by the building space volume with identical volume units, normally expressed as air changes per hour, ACH.

Air Leakage Graph: A graphic representation that shows the relationship of measured airflow rates to the corresponding measured pressure differences, usually plotted on a log-log scale.

Air Leakage Rate: The total volume of air passing through the test zone or building envelope per unit of time (ft^3/min [cfm] or m^3/s). Discussion: This movement includes flow through joints, cracks, and porous surfaces, or a combination thereof. The driving force for such an air leakage, in service can be mechanical pressurization and de-pressurization, natural wind pressures, or air temperature differentials between the building interior and the outdoors, or a combination thereof.

Air Leakage Site: A location on the building envelope or air barrier system where air can move between the building interior and the outdoors.

Air Tightness: The degree to which a test zone or building envelope resists the flow of air. Discussion: Air leakage rate, effective leakage area and the rating term such as ACH_{50} are examples of measures of building tightness.

Anomalous Thermal Image: An observed thermal pattern of a structure that is not in accordance with the expected thermal pattern.

Baseline Building Pressure: The natural building pressure difference measured when there is no flow through the blower door. This is also referred to as the Bias Pressure.

Blower Door: A fan pressurization device incorporating a controllable fan and instruments for airflow measurement and building pressure difference measurement that mounts securely in a door or other opening.

Building Envelope: The boundary or barrier separating the interior volume of a building from the outside environment. Discussion: For the purpose of this test procedural standards, the interior volume is the deliberately conditioned space within a building, generally not including attics, basements, and attached structures, for example, garages, unless such spaces are connected to the heating and air conditioning system, such as a crawl space plenum.

Building Pressure Difference: The pressure differential across the test zone or building envelope.

Calibrate: The act of comparing an instrument of unknown accuracy with a standard of known accuracy to detect, correlate, report, or eliminate by adjustment any variation in the accuracy of the tested instrument.

Certificate of Compliance (Conformance): A written statement, signed by a qualified party, attesting that the items or services are in accordance with specified requirements, and accompanied by additional information to substantiate the statement.

Certification: The process of validation required to obtain a certificate of compliance.

CFM₇₅: The airflow leakage value in cubic feet per minute at a test pressure of 75 Pascals (Pa). The subscript value defines the test pressure.

Closed: The condition of a building used to test the air barrier in an unoccupied building to test the air barrier with intentional openings sealed.

Differential Pressure (ΔP): The difference between two pressures measured between a sample point and reference point. Discussion: This movement includes flow through joints, cracks, and porous surfaces, or a combination thereof. The driving force for such an air leakage in service can be wind pressures, or air temperature differentials between the building interior and the outdoors, or a combination thereof.

Deficiency: Any circumstance or operation that affects the measurement results as compared to the design criteria required by the contract documents.

Effective Leakage Area: In order to take values generated by fan pressurization and to use them in determining natural air exchange, the effective leakage area of a building must be calculated. Each gap and crack in the building envelope contributes a certain amount of area to the total leakage area of the building. The Effective Leakage Area assumes that all of the individual leakage areas in the building are combined into a single idealized orifice or hole. The ELA will change depending on the reference pressure used to calculate it.

Envelope: The construction, taken as a whole or in part, that separates the indoors of a building from the outdoors.

Equivalent Leakage Area: EqLA, usually taken at 10Pa using 0.61 discharge coefficient, but for the purposes of this Specification, it is taken at 75 Pa.

Field-of-View (FOV): The total angular dimensions, expressed in degrees or radians, within which objects can be imaged, displayed, and recorded by a stationary imaging device.

Framing Spacing: Distance between the centerlines of joists, studs, or rafters.

Function: Function in this standard refers to the specific type of data measurement specified in Section 4, *Standards for Instrumentation and Calibration*.

Infrared Imaging System: An instrument that converts the spatial variations in infrared radiance from a surface into a two-dimensional image of that surface, in which variations in radiance are displayed as a range of colors or tones.

Infrared Thermography: The process of generating thermal images that represent temperature and emittance variations over the surfaces of objects.

Instantaneous Field of View (IFOV): The smallest angle, in milliradians, that can be instantaneously resolved by a particular infrared imaging system.

Intentional Opening: Openings within the envelope that are designed to remain open to atmosphere during the buildings operation. Intentional openings include building components such as air intake, exhaust louvers, pressure relief dampers or louvers, dryer and exhaust vents,

combustion flues and any other leakage site that is designed to remain open during the buildings normal operation. Windows, doors, conduits, mechanical piping, sleeves and structural steel are not intentional openings.

M³/S₇₅: The airflow leakage value in cubic meters per second at a test pressure of 75 Pascals (Pa). The subscript value defines the test pressure.

Masonry Veneer: Frame construction with a non-load bearing exterior masonry surface.

May: Used to indicate a course of action that is permissible as determined by the NEBB Certified BET Firm.

Minimum Resolvable Temperature Difference (MRTD): A measure of the ability of the operators of an infrared imaging system to discern temperature differences with that system. The MRTD is the minimum temperature difference between a four-slot test pattern of defined shape and size and its blackbody background at which an average observer can discriminate the pattern with that infrared imaging system at a defined distance.

N/A: *Not Available, Not Applicable, or Not Accessible.* The simple notation “N/A” without definition is not allowed.

NEBB Certified BET Firm: A *NEBB Certified BET Firm* is a firm that has met and maintains all the requirements of the National Environmental Balancing Bureau for firm certification in Building Envelope Testing and is currently certified by NEBB. A NEBB Certified BET Firm shall employ at least one NEBB Certified BET Professional in a full time management position.

NEBB Certified BET Report: The data presented in a NEBB Certified BET Report accurately represents system measurements obtained in accordance with the current edition of the *NEBB Procedural Standards for Building Envelope Testing*. A NEBB Certified BET Report does not necessarily guarantee that systems measured conform to the design requirements or stated guidelines. The report is an accurate representation of the measured results only.

NEBB Certified BET Professional: A *NEBB Certified BET Professional* is a full time employee of the firm in a management position who has successfully passed the professional level written and practical qualification examinations and maintains the professional re-qualification requirements of NEBB.

Nominal Airflow Rate: The flow rate indicated by the blower door using the manufacturer's calibration coefficients (m³/s or ft³/min, CFM).

Orifice Blower Door: A blower door in which airflow rate is determined by means of the pressure drop across an orifice or nozzle.

Open: The condition of a building used to test the ventilation rate in a occupied building with intentional openings unsealed.

Precision: The ability of an instrument to produce repeatable readings of the same quantity under

the same conditions. The precision of an instrument refers to its ability to produce a tightly grouped set of values around the mean value of the measured quantity.

Precision Index of the Average: The sample standard deviation divided by the square root of the number of samples.

Pressure Station: A specified induced change in the building pressure difference from the initial zero-flow building pressure difference (Pa, in. w.c.).

PPM: Parts per million

Procedure: The approach to and execution of a sequence of work operations to yield a repeatable and defined result.

Range: The upper and lower limits of an instrument's ability to measure the value of a quantity for which the instrument is calibrated.

Resolution: The smallest change in a measured variable that an instrument can detect.

Shall: The term is used to indicate mandatory requirements that must be followed in order for the project to become a NEBB certified project. Work must conform to these standards and procedures and no deviation is permitted: In the event unique circumstances prevent a required action from being fulfilled, a notation shall be included in the BET report explaining the reason that the requirement was not completed. For example, such notation could be one of the following: *Not Available*, *Not Applicable*, or *Not Accessible*. The simple notation "N/A" without definition is not allowed.

Should: The term is used to indicate that a certain course of action is preferred but not necessarily required.

Single Zone: A space in which the pressure differences between any two places differ by no more than 5% of the inside to outside pressure difference. Discussion: A multi-room space that is interconnected within itself with door-sized openings through any partitions or floors is likely to satisfy this criterion if the fan airflow rate is less than 3 m³/s (6357 ft³/min).

Specified Test Pressure: The required induced differential static air pressure across the specimen.

Standard: A required qualification, action, or result for BET work.

Standard Operating Procedure: An internal policy prepared by each BET firm and / or prepared by the Owner/Buyer. Procedures are written to provide guidance, direction, and step-by-step details relating to issues such as safety, testing protocols, acceptance criteria, etc. NEBB BET Firm SOP's shall be utilized in the absence of SOP's prepared by the Owner.

Test Pressure Difference or Differential: The measured pressure difference across the building envelope, expressed in Pascals (Pa) or in inches of water column (in. w.c.).

Test Zone: A building or a portion of a building that is configured as a single zone for the purpose of this standard. For detached dwellings, the test zone envelope normally comprises the thermal envelope.

Test Zone Envelope: The barrier or series of barriers between a test zone and the outdoors and internal spaces not included in the test zone.

Testing: The use of specialized and calibrated instruments to measure fluid quantities, temperatures, pressures, rotational speeds, electrical characteristics, velocities, and sound and vibration levels,

Testing, Adjusting, and Balancing (TAB): A systematic process or service applied to heating, ventilating and air-conditioning (HVAC) systems and other environmental systems to achieve and document air and hydronic flow rates. The standards and procedures for providing these services are addressed in the current edition of the NEBB *“PROCEDURAL STANDARDS FOR THE TESTING, ADJUSTING AND BALANCING OF ENVIRONMENTAL SYSTEMS”*.

Thermal Pattern: A representation of colors or tones that indicate surface temperature and emittance variation.

Thermogram: A recorded image that maps the apparent temperature pattern of an object or scene into a corresponding contrast or color pattern.

Total air flow: The volume of air flowing per unit of time through the test zone inclusive of the air flowing through the test zone under differential test pressure conditions converted to standard conditions for temperature and density.

Unit of Length: The sum of all perimeters of operable ventilators, sash, or doors that are contained in the test specimen based on overall dimensions of such parts. Where two such operable parts meet two adjacent length's of perimeter shall be counted as only one length.

Zone: A volume of building served by a single ventilation system. For buildings with natural ventilation only, the whole building shall be considered a zone.

1.3 BET FIRM QUALIFICATIONS

The BET Firm shall be NEBB Certified in Building Envelope Testing. Building envelope testing shall be conducted by the NEBB Certified BET Professional or by technicians directly under the supervision of the NEBB Certified BET Professional.

1.4 BET FIRM SUBMITTALS

1.4.1 Qualification Data: When requested, submit 2 copies of evidence that BET firm and this Project's BET team members meet the qualifications specified in Sub-section 1.3 *BET Firm Qualifications*.

1.4.2 BET Agenda: When requested, submit 2 copies of the BET Agenda. Include a complete set of report forms intended for use on this Project.

1.4.3 Certified BET Reports: Submit a final BET report in accordance with the current edition of the NEBB *Procedural Standards for Building Envelope Testing*.

1.5 QUALITY ASSURANCE

1.5.1 The NEBB Certified BET Firm shall submit a copy of the firm's NEBB BET Certification.

1.5.2 When requested, the NEBB Certified BET Firm shall provide the NEBB Certificate of Conformance Certification.

1.5.3 BET Report Forms: Prepare report forms in accordance with the requirements from the current edition of the NEBB *Procedural Standards for Building Envelope Testing*.

1.5.4 Instrumentation Calibration: Calibration of instruments shall be in accordance with the current edition of the NEBB *Procedural Standards for Building Envelope Testing*.

1.6 CONSTRUCTION TEAM RESPONSIBILITY TO BET AGENCY

1.6.1 Provide the NEBB Certified BET Firm with a conformed set of contract documents that pertain to the air barrier (drawings, specifications, and approved submittals), including all current approved change orders and contract modifications.

1.6.2 Develop a project schedule with the input of the NEBB Certified BET Firm that coordinates the work of other disciplines and provides adequate time in the construction process to allow successful completion of the building envelope testing and remedial work.

1.6.3 Notify the NEBB Certified BET Firm of all schedule changes.

1.6.4 Ensure that the building enclosure is complete, including but not limited to, all structural components, the air barrier and vapor barrier complete, windows and doors installed, door hardware complete, door sweeps and weather stripping complete, floor and ceilings complete. Ensure that the building enclosure and components are complete and operational such that the performance of the building envelope tests would not be adversely affected.

1.6.5 Provide all project preparation and setup for the BET tests, this may include but is not limited to temporary sealing of intentional openings, removing ceiling tile, opening access doors, opening interior doors and affixing them so they cannot close during the tests. This may include preparation of adjoining spaces. This would also include staging the building so no people will be opening doors or windows during the BET tests.

1.6.6 Provide temporary or permanent power for BET tests.

1.6.7 For building pressure test method using the Building Air Moving Equipment systems:

- a. Ensure that all necessary building systems are complete and are operating in a safe manner.
- b. Complete the installation of permanent electrical power systems serving the building systems. Such electrical systems shall be properly installed in accordance with all applicable codes to ensure the safety of all construction personnel.
- c. Perform start-up of all building systems in accordance with manufacturers' recommendations.
- d. Complete the installation, programming, calibration and startup of all building control systems.

PART 2 - PRODUCTS (Not Applicable) PART 3 –

EXECUTION

3.1 EXAMINATION

Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper BET of systems and equipment. *Contract Documents* are defined in the General and Supplementary Conditions of Contract. Report deficiencies discovered.

3.1 PRELIMINARY PROCEDURES FOR BUILDING ENVELOPE TESTING

Conduct the Preliminary Procedures in accordance with procedures contained in the current edition of the NEBB *Procedural Building Envelope Testing* and this section. This includes that the Design Professionals and/or the Owner are responsible for defining the objectives and the acceptance criteria for the testing. Additionally, they are responsible to define which air leakage test(s) are to be performed by the NEBB Certified BET Firm.

3.3 INSTRUMENTS AND EQUIPMENT

Instruments and equipment necessary to perform Building Envelope Testing shall meet the requirements of the current edition of the NEBB *Procedural Building Envelope Testing* and this section.

3.4 COMMON TEST PROCEDURES FOR BUILDING ENVELOPE TESTING

Perform Building Envelope Testing on all systems to be tested according to the procedures contained in the current edition of the NEBB *Procedural Building Envelope Testing* and this section. As stated in Section 3.1 above, the test method shall be defined by the Design Professionals and /or the Owner. The procedures listed below apply to both test methods and shall be followed when performing either the Blower Door Test Method or the Building Air Moving Equipment System Test method.

- 3.4.1 Establish the exterior test zone envelope. This is accomplished by defining the test zone envelope and ensuring it is appropriate for the goals of the test.

3.4.2 Select the appropriate test envelope condition; open or closed. For the closed condition, close all operable openings and seal other intentional openings to evaluate envelope air tightness. For the open condition, leave all operable openings in the normal operating condition of the building's occupancy to assess the envelope's effect on natural air change rates. The closed condition shall be the default option if no compelling reason exists to utilize the open condition.

3.4.3 Adjust all building components in accordance with Table 1 below and/or per the specification. For testing a building in the closed condition, close all operable openings and seal other intentional openings to evaluate envelope air tightness. For occupied condition, leave all operable openings in the normal operating condition of the building's occupancy.

3.4.4 Prior to conducting the test, perform the preliminary procedures identified in Section 3.1. If the performance of these preliminary procedures is the responsibility of others, survey the site and building to insure that all preliminary procedures have been properly completed.

3.4.5 Establish the interior test zone. This is accomplished by opening all interior building doors including fire doors, corridor doors, pass-throughs, in the test zone so that a uniform inside pressure is created within the zone. If there are hard ceilings with access doors, all access doors are to be open.

3.4.6 Measure and record the wind velocity and direction on the windward side of the building at a distance 30 to 50 feet away from the buildings. Preferred test conditions are wind velocity of 0 to 2 m/s (0 to 4 mph). If the surrounding building induced winds or the wind is gusting more than 4 mph above the steady state wind then the test should not be performed due to accuracy limits.

3.4.7 Measure and record the outside temperature. Preferred test conditions are outside temperatures from 2°C to 35°C (35°F to 95°F). If test is performed below 2°C (35°F) there is a possibility of freezing pipes. If the test is performed above 35°C (95°F) damaging finished materials, building finishes or worker safety becomes a concern.

3.4.8 Measure and record the indoor and outdoor temperatures at the beginning of the test so that their average values can be calculated.

3.4.9 Determine the height & temperature factor. The factor is the product of the absolute value of the indoor/outdoor air temperature difference multiplied by the building height. **If the factor is less than 200 m°C (1,180 ft°F), perform the test. If the factor is greater than 200 m°C (1,180 ft°F), the stack effect may influence the building envelope pressure difference and will reduce the accuracy of the result. When the factor is greater than the above stated values, the entire test shall be performed both under a pressurization and depressurization modes utilizing ASTM E 1827 Blower Door Test Method and the minimum induced test pressure shall be 25 Pa (0.10 in.w.c.).**

TABLE 1: Recommended Pre-Test Building Preparations

Building Component	Envelope Conditions	
	Closed	Open
Exhaust fans with back draft dampers	Sealed	No preparation
Supply fans with back draft dampers	Sealed	No preparation
Furnace room door for furnace outside test zone	Closed	Closed
Combustion air intake damper for boilers	Closed	Closed
Outside air intake damper for Air Handling Unit inside test zone	Sealed	Closed
Outside air intake for Air Handling Unit inside test zone without damper	Sealed	No preparation
Exhaust, Air Handling Units, Make-up Air Units, Energy Recovery Units, Supply fans, Furnaces, Fan Coil Units, Boilers, Gas Hot Water Heaters, All equipment requiring combustion air (including kitchen equipment, HVAC, etc.)	Off	Off
Fan inlet grilles with motorized damper	Closed	Closed
Fan inlet grills without motorized damper	Sealed	No preparation
Ventilators designed for continuous use	Sealed	Sealed
Supply and exhaust ventilator dampers	Sealed	Held closed
Clothes dryer	Off	Off
If clothes dryer is connected to the dryer vent	No preparation	No preparation
Vented combustion appliance	Off	Off
Ventilation to other zones	Sealed	Sealed
Windows	Closed and Latched	Closed and Latched
exterior doors	Closed and Latched	Closed and Latched
Window air conditioners	Sealed	No preparation
Through the wall air conditioners outside air vent	Sealed	No preparation
Openings leading to outside the test zone	Closed	Closed
All HVAC ducts going from inside the test zone to outside the test zone and back into the test zone	Sealed	Sealed
All electrical conduits going from inside the test zone to outside the test zone and back into the test zone	Sealed	Sealed
Openings within the test zone	Open	Open
Floor drains and plumbing traps	Filled	Filled

Elevator pressure relief openings	Closed	Closed
Elevator Doors	Closed	Closed
Elevator Door Frame spacing between the elevator door and frame if the elevator connects an area outside the air barrier	Sealed	Open
Elevator Door Frame spacing between the elevator door and frame if the elevator connects an area within the air barrier	Open	Open
Rooms with Exterior, non-ducted louvers (interior doors)	Closed	Closed
Loading Dock Doors (interior doors)	Closed	Closed

3.4.10 Open all doors, windows, and other openings that connect portions of the building outside the test zone envelope with the outdoors. For example, if the building is a combination of office and warehouse, and only the office portion of the building is to be tested then open the warehouse doors. If the entire office and warehouse is to be tested, then all office and warehouse doors are to be closed to the outside but the doors between the office and warehouse are to be open.

3.4.11 Remove sufficient ceiling tiles for lay-in ceilings, or open sufficient access panels for hard ceilings, where the pressure between the ceiling cavity and the room is equalized to within +/-10% of the building envelope test pressure.

3.4.12 Record the condition of the building's components including windows, exterior doors, interior doors, stairwell doors, elevator doors, walls, access doors, roof and floor (i.e. sealed or unsealed, open or closed, etc.).

3.5 BLOWER DOOR TEST METHOD PROCEDURES

3.5.1 Install the blower door in an entry door, window or vent opening. The openings must be sealed or taped to avoid leakage at these points. Orient the blower door appropriately for depressurization or pressurization as required. The installation should have minimal obstructions of airflow into and out of the building.

3.5.2 Install the pressure measuring instrument across the building envelope. It is good practice to use more than one location across the building envelope for pressure measurement. Preferred locations for exterior pressure measurement locations should be those that avoid extremes of exterior pressures. A good location avoids exterior corners and complex architectural features and should be close to the middle of the exterior wall.

3.5.3 In addition, buildings more than 4 floors or 12.2 m (48.0 ft) in height, shall have pressures measured at a minimum of 2 locations or every 4 floors, whichever is greater.

3.5.4 Average 10 baseline pressures points of 10 seconds per point, where the variation

between any point and the mean must be no greater than 1 Pascal.

3.5.5 Zero the pressure sensor by connecting the differential ports together. **Note:** Some blower doors may perform this or an equivalent step automatically. Follow the manufacturer's instructions accordingly.

3.5.6 Before beginning the test, measure and record the baseline building differential pressure across the airflow measurement device with the blower off. If a damper is used to control airflow, it should be in a fully closed position for the baseline building pressure measurements. If the air moving equipment employs a blank-off plate, it should be fully closed for the baseline building tests.

3.5.7 Start the blower door fans and pressurize / depressurize the building to the highest specified induced pressure differential. Measure and record the building envelope differential pressure.

3.5.8 Pressure readings are to be taken to produce an accurate average building pressure. Fluctuations in pressure due to wind require pressure measurements

to be taken on both the windward and leeward side of the building and averaged. If the buildings height or building configuration causes internal building pressure fluctuations, then interior pressure shall be taken and averaged.

3.5.9 Perform a minimum of 10 building envelope pressure differentials and their corresponding airflow measurements for both the pressurization mode and the depressurization mode (a total of 20 measurements). The measurements shall be taken over a minimum of 10 seconds. The range of the building envelope pressure differences should be from a minimum of 25 Pa (0.10 in. w.c.) to maximum of 75 Pa (0.30 in. w.c.). Use increments of 5 Pa (0.02 in. w.c.) for the full range of building envelope pressure differences. (i.e. 25, 35, 40, 45, 50, 55, 60, 65, 70, 75 Pa) or (0.10, 0.14, 0.16, 0.18, 0.20, 0.22, 0.24, 0.26, 0.28, and 0.30 in. w.c.).

3.5.10 Conduct tests at each building envelope pressure differential. Allow the fan and instrumentation to stabilize prior to taking any measurements. At each pressure differential, measure the airflow rate and the pressure differences across the envelope over at least a 10 second time interval. Average the airflow and pressure differentials over this time interval. For each building envelope pressure differential test, collect data for both pressurization and de- pressurization.

3.5.11 After conducting the pressure tests, measure and record the baseline building differential pressure across the airflow measurement device with the fan off and sealed.

3.5.12 Report the building envelope pressure differential, and the airflow for each test and the beginning and ending baseline building differential pressure.

3.5.13 Subtract the average baseline differential pressure from the building envelope differential pressure and report this value for both pressurization and depressurization.

NOTE: Some equipment may perform this step, or an equivalent step, automatically follow the manufacturer's instructions accordingly.

3.5.14 Measure and record the indoor and outdoor temperatures at the end of the test so that their average values can be calculated.

3.5.15 Repeat steps 8.2.3.9 through 8.2.3.14 for the alternate pressurization.

3.6 BUILDING AIR MOVING EQUIPMENT SYSTEM TEST METHOD PROCEDURES

This test method can be utilized for pressurization or depressurization testing of the building envelope; however, the test is not as accurate as the ASTM 779 that is the blower door tests. This test should not be considered an equal to those tests. This is due to several reasons; none of which pertain to the abilities of the NEBB Certified BET Firm or the capabilities of the required instrumentation and equipment to perform the Building Air Moving Equipment Test Method. The major features that could affect the ability to perform the test and the accuracy of this test relate to the following:

1. The ability of the installed HVAC equipment and systems to mechanically bring in sufficient amounts of outside air for pressurization and / or mechanically exhaust sufficient amounts of building air for depressurization.
2. The ability of the installed mechanical equipment and systems to generate the required airflows and associated static pressures to properly conduct the test
3. The configuration of the equipment installed in the system to accurately measure airflow and static pressures. The most accurate method to measure airflow in the field is by performing a duct traverse using a Pitot tube and digital manometer. To accurately perform a traverse measurement requires an adequate length of straight duct downstream from any equipment, fittings or obstructions to provide an ideal duct traverse plane in which to obtain an accurate duct traverse.
4. The ability of the most building air moving equipment systems to be manipulated in order to produce meaningful building pressure gradients

3.6.1 When using the Building Air Moving Equipment System Method Test, the NEBB Certified BET Firm shall follow NEBB TAB procedures to measure the airflow. The preferred method to measure the airflow is by the traverse method that complies with NEBB procedures. If airflow monitoring stations are used, it is the NEBB firm's responsibility to verify the accuracy of the airflow monitor.

3.6.2 If neither the traverse method nor the use of airflow monitoring stations is available, then three (3) alternate methods of measuring airflow per the NEBB TAB procedures shall be used. The three different methods should correlate flow to each other within 10%.

3.6.3 The Building Air Moving Equipment Test Method consists of taking two sets of data at two different building pressures. The first set of data, identified as P_1 , is taken the higher differential pressure value. The second set of data identified as P_2 , is taken the lower differential pressure value. The criteria limits for values of P_1 and P_2 values shall be as follows:

- a. P_1 value shall be between 75 and 35 Pa (0.30 in.w.c. and 0.14 in.w.c).
- b. P_2 value shall be 1/3 of the P_1 value and shall be between 25 and 10 Pa (0.10 in.w.c. and 0.04 in.w.c).

If the above criteria cannot be achieved, then **the Blower Door Test Method SHALL be performed utilizing both the pressurization and the depressurization modes.**

A minimum of five replicate measurements of building envelope differential pressure and the corresponding airflow shall be taken at each value of P_1 and P_2 . Thus, a total of 10 pressures measurements and 10 airflow measurements are required.

3.6.4 Install the pressure measuring instrument across the building envelope. It is good practice to use more than one location across the building envelope for pressure measurement. Preferred locations for exterior pressure measurement locations should be those that avoid extremes of exterior pressures. A good location avoids exterior

corners and complex architectural features and should be close to the middle of the exterior wall.

3.6.5 In addition, buildings more than 4 floors or 12.2 m (48.0 ft) in height shall have pressures measured at a minimum of 2 locations or every 4 floors, whichever is greater.

3.6.6 The pressures from each location should be averaged, typically using a manifold. Average the pressures over at least a 10 second time period.

3.6.7 Zero the pressure sensor

3.6.8 Measure and record the baseline building differential pressure by closing the dampers or otherwise seal off the fan(s) that will be creating the test flows.

3.6.9 Conduct five (5) tests at the P_1 building envelope pressure differential. Allow the fan and instrumentation to stabilize prior to taking any measurements. Measure the airflow and the building pressure differential simultaneously. Repeat until all 5 airflow measurements and 5 envelope pressure differential measurements have been taken. Each of the flow and corresponding pressure differentials measurements must occur within 5 minutes of each other.

3.6.10 Repeat the entire procedure at P_2 and conduct five (5) tests at the P_2 building envelope pressure differential. Allow the fan and instrumentation to stabilize prior to taking any measurements. Measure the airflow and then measure the building pressure differential. Repeat until all 5 airflow measurements and 5 envelope pressure differential measurements have been taken. Each of the flow and corresponding pressure differentials measurements must occur within 5 minutes of each other.

3.6.11 Average the 5 airflow measurements to each other and average the 5 pressure differentials to each other for the data obtained at P_1 .

3.6.12 Average the 5 airflow measurements to each other and average the 5 pressure differentials to each other for the data obtained at P_2 .

3.6.13 Measure and record Baseline Building Pressure Differential at the end of the test.

3.6.14 Measure and record the indoor and outdoor temperatures at the end of the test so that their average values can be calculated.

NOTE: It is advisable to check that the condition of the building envelope has not changed after each pressure reading, for example, that sealed openings have not become unsealed or that doors, windows, or dampers have not been forced open by the building envelope pressure testing.

3.7 DATA ANALYSIS AND CALCULATIONS FOR BOTH THE BLOWER DOOR TEST METHOD AND THE BUILDING AIR MOVING EQUIPMENT SYSTEM TEST METHOD

3.7.1 If the airflow measuring instrumentation being utilized does not provide the volumetric airflow at the temperature and pressure of the air flowing through the flowmeter during the test, the airflow values must be corrected for density.

3.7.2 When correcting the readings of the airflow measurements for density, the preferred method is to use the temperature and the actual barometric pressure. A method to correct for density using temperature and elevation is available, but does not account for weather impact. In the pressurization mode this will be the outside air temperature and barometric pressure. For depressurization test this will be the inside air temperature and barometric pressure.

3.7.3 Average the baseline building envelope pressures measured before and after the flow measurements. Subtract the average from the measured envelope differential pressures readings to determine the corrected induced envelope pressures.

3.7.4 Plot the measured airflow against the corrected induced pressure differences on a log-log plot to complete the air leakage graph for both pressurization and depressurization (for an example, see Appendix C, Section C.10 of the current edition of the NEBB *Procedural Building Envelope Testing*).

3.7.5 Use the data to determine the air leakage coefficient.

3.7.6 Correct the air leakage coefficient (C) to standard conditions. Use the data to determine the pressure exponent separately for pressurization and depressurization.

3.7.7 If the pressure exponent (n) is less than 0.45 or greater than 0.8, then the test is invalid and shall be repeated.

3.7.8 Use a log-linearized linear regression technique and the associated equation in Appendix C, Section C.5.5 of the current edition of the NEBB *Procedural Building Envelope Testing*, where Q is the airflow rate, in m³/s (cfm), and ΔP is the differential pressure in Pa (in.w.c.). In determining the fit of the above equation, the confidence intervals of the derived air leakage coefficient (C) and pressure exponent (n) should be calculated.

3.7.10 The effective leakage area, A_L , can be calculated from the corrected air leakage coefficient and the pressure exponent using a reference pressure (ΔP_r). Calculate the leakage areas separately for pressurization and depressurization.

3.7.11 To obtain a single value for flow coefficient, pressure exponent and leakage area for use in other calculations, the average of these values from the pressurization and depressurization envelope flows and pressure differences, with their offsets removed, may be combined together. This combined data set then is used in the same way as each individual data set to obtain C, n, and A_L for the combined data. If the flow at a specified pressure difference, such as 50 Pa, is desired, it should be determined using the derived C and n and the specified reference pressure.

3.7.12 Determine the upper confidence limits for the derived values which shall not exceed the leakage rate per square footage of air barrier.

3.8 ACCEPTANCE

The acceptance criteria should be as specified in the contract documents or as agreed to between the Owner / Buyer and the NEBB Certified BET Firm.

3.9 FINAL REPORT

The final report shall be in accordance with the requirements of the current edition of the NEBB *Procedural Standards for the Building Envelope Testing*.

END OF SECTION

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SECTION 01 4500
WINDSTORM CONSTRUCTION REQUIREMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. All components and cladding and exterior openings (exterior doors, windows, Louvers, overhead doors, and skylights) must be designed for compliance with the uniform static wind pressure requirements specified in this section.
- B. Exterior wall and roof openings shall be protected with impact resistant covers or designed to meet impact resistance requirements. For structures in Inland I area as adopted by the Texas Department of Insurance, glazed exterior openings shall be impact resistant or protected with an impact-resistant covering. For structures located in the Seaward area, all exterior openings shall be impact resistant or protected with an impact-resistant covering. Exterior openings shall include exterior doors, windows, overhead doors, and skylights. Exterior opening protection for windborne debris shall meet the requirements of an approved impact-resisting standard or ASTM E 1996 and ASTM E 1886. See section 1609.1.2 of the Texas revisions to the 2018 International Building Code for additional information.
- C. This project is located in the **SEAWARD** area.
- D. Contractor shall pay for engineering inspections and certifications required by Texas Department of Insurance for Windstorm.

1.3 DEFINITIONS

- A. Components and Cladding: elements of the building envelope (exterior wall and roof systems) that do not qualify as part of the main wind force-resisting system that are either directly loaded by the wind or receive wind loads originating at relatively close locations, and that transfer those loads to the main wind force resisting system. Examples: curtain walls, exterior glass windows and panels, roof sheathing, studs, soffits, etc.
- B. Exterior Wall and Roof Openings: Openings that are likely to be breached during high winds. Examples: windows, doors, roof hatches, louvers, etc.

1.4 DESIGN REQUIREMENTS

- A. Wind loads shall be determined from the pressures developed by a **163-mph** wind velocity (3-second gust), Exposure D, importance factor of 1.15, and appropriate

coefficients from the document American Society of Civil Engineers (ASCE) 7-16 "Minimum Design Loads for Buildings and Other Structures".

- B. Impact Resistance shall be as determined by the Texas Windstorm Code and section 1609.1.2 of the Texas revisions to the 2018 International Building Code.

1.5 SUBMITTALS

- A. All components and cladding listed in the Texas Windstorm Approved Materials catalog shall have the appropriate product evaluation number indicated on the submittal.
- B. Components and cladding not listed will require certification that they meet or exceed the design requirements of this section by the manufacturer.
- C. Installation instruction indicating fasteners, minimum attachment requirements, and other necessary pertinent information for installation shall be submitted.

1.6 EXECUTION

- A. The contractor shall provide and have available at the job site all necessary installation instructions during construction.
- B. Prior to covering or concealing the fasteners or connectors of the exterior elements, the contractor shall notify the architect and engineer in time to allow for a visual inspection as required for Windstorm Certification by the Engineer.
- C. Contractor shall furnish, upon completion, written confirmation to the structural engineer that the installation and materials used for all components and cladding elements is in conformance with the requirements of this section and the Texas Windstorm Code.

END OF SECTION

SECTION 01 5000
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for construction facilities and temporary controls, including temporary utilities, support facilities, and security protection.
- B. Temporary utilities include, but are not limited to, the following:
 - 1. Water service and distribution.
 - 2. Temporary electric power and light.
 - 3. Temporary heat.
 - 4. Ventilation.
 - 5. Telephone Service.
 - 6. Sanitary facilities, including drinking water.
 - 7. Job Site Identification Signage
- C. Support facilities include, but are not limited to, the following:
 - 1. Heated and air conditioned field offices.
 - 2. Storage sheds.
 - 3. De-watering facilities and drains.
 - 4. Temporary enclosures.
 - 5. Temporary signs and bulletin boards.
 - 6. Waste disposal services.
 - 7. Rodent and pest control.
 - 8. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities include, but are not limited to, the following:
 - 1. Temporary fire protection.
 - 2. Barricades, warning signs, and lights.
 - 3. Environmental protection.

1.3 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
 - 1. Building code requirements.
 - 2. Health and safety regulations.

3. Utility company regulations.
 4. Police, fire department, and rescue squad rules.
 5. Environmental protection regulations.
- B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities".
1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code".
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.4 PROJECT CONDITIONS

- A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.
- C. Existing Utilities: Contractor shall identify, locate and protect all existing utilities on site, prior to demolition, including but not limited to:
- a. Contractor shall notify the appropriate utility company at least 24 hours prior to beginning the Work.
 - i. Nueces County Water Control and Improvement District No. 4 (Water and Sanitary Sewer): 361-749-5201;
 - ii. Port Aransas Gas Department: 361-749-6330.

PART 2 – PRODCUTS

2.1 MATERIALS

- A. General: Provide new materials. If acceptable to the Architect, the Contractor may use undamaged previously used materials in serviceable condition. Provide materials suitable for use intended.

- B. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced, laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.
- C. Water: Provide potable water approved by local health authorities.
- D. Open-Mesh Fencing: Provide 0.120-inch-thick, galvanized 2-inch chain-link fabric fencing 6 feet high with galvanized top strand and galvanized steel pipe posts, 1 ½ inches I.D. for line posts and 2 ½ inches I.D. for corner posts.

2.2 EQUIPMENT

- A. General: Provide new equipment. If acceptable to the Architect, the Contractor may use undamaged previously used equipment in serviceable condition. Provide materials suitable for use intended.
- B. Water Hoses: Provide ¾ inch, heavy duty, abrasion-resistant, flexible rubber hoses 100 feet long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.
- C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-Volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.
- D. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
- E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.
- F. Field Offices: Contractor shall provide temporary field offices on site.
- G. Provide self-contained, single-occupant toilet units of the chemical, aerated recirculation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- H. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-Rated, Class ABC, dry chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities as directed by Architect/Owner to serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized used of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
 1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
 3. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect. Neither the Owner nor Architect will accept cost or use charges as a basis of claims for Change Orders.
- B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use. Contractor will pay for cost of water used during construction. Exercise measures to conserve water.
- C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear, as required.
- D. Temporary Lighting: Provide temporary lighting with local switching, as required.
 1. Install and operate temporary lighting that will fulfill security and protection requirements. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.
- E. Temporary Heat: Provide temporary heat required by construction activities for curing or drying of completed installations or for protection of installed construction from adverse

effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.

1. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.
- F. Temporary Telephones: Provide temporary telephone service throughout the construction period for all personnel engaged in construction activities. Install telephone on a separate line for each temporary office and first-aid station.
1. Provide a PC with e-mail access in the field office.
 2. Post a list of important telephone numbers.
- G. Sanitary facilities include temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
1. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.
- H. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.
- I. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers cannot be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
1. Filter out excessive amounts of soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
 2. Connect temporary sewers to the municipal system, as directed by sewer department officials.
 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.

3.3 SUPPORT FACILITIES INSTALLATION

- A. Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.
1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Field Offices: Provide temporary offices of sufficient size to accommodate required office personnel at the Project Site. Keep the office clean and orderly for use for small progress meetings.

- C. **Storage and Fabrication Sheds:** Install storage and fabrication sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere on-site.
- D. **Temporary Enclosures:** Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
- E. **Project Identification and Temporary Signs:** Prepare project identification – 4' x 8' in size. Install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative-treated wood. Do not permit installation of unauthorized signs.
 - 1. **Project Identification Signs:** Engage an experienced sign painter to apply graphics.
 - 2. **Temporary Signs:** Prepare signs to provide directional information to construction personnel and visitors.
- F. **Collection and Disposal of Waste:** Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully. Contractor shall collect and submit to Owner a copy of all Load tickets confirming lawful disposal of all Waste material. Load tickets shall be submitted with each Pay Application.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Architect.
- B. **Temporary Fire Protection:** Install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."
 - 1. Locate fire extinguishers where convenient and effective for their intended purpose.
 - 2. Store combustible materials in containers in fire-safe locations.
 - 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
 - 4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

- C. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- D. Environmental Protection Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise.
- E. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than the Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are the Contractor's property.
 - 2. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:
 - a. Replace significantly worn parts and parts subject to unusual operating conditions.
 - b. Replace lamps burned out or noticeable dimmed by hours of use.

END OF SECTION

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SECTION 01 6000
MATERIALS AND EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for governing the Contractor's selection of products for use in the Project.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 01 Section 01 3000 "Submittals" specifies requirements for submittal of the Contractor's Construction Schedule and the Submittal Schedule.

1.3 DEFINITIONS

- A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "systems", "structure", "finishes", "accessories", and similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry.
 - 1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or take from previously purchased stock. The term "product" includes the terms "material", "equipment," "system", and terms of similar intent.
 - a. "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature that is current as of the date of the Contract Documents.
 - 2. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the work.
 - 3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.4 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.
- B. Compatibility of Options: When the Contractor is given the option of selecting between two (2) or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

PART 2 – PRODUCTS

2.1 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.
 - 1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
 - 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. Product Selection Procedures: The Contract Documents and governing regulations govern product selection. Procedures governing product selection include the following:
 - 1. Propriety Specification Requirements: Where Specifications name only a single product or manufacturer, provide the product indicated. No substitutions will be permitted.
 - 2. Semi-propriety Specification Requirements: Where Specifications name two (2) or more products or manufacturers, provide one (1) of the products indicated. No substitutions will be permitted.

3. Nonproprietary Specification: When Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements.
4. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
5. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by manufacturer for the application indicated.
 - a. Manufacturer's recommendations may be contained in published product literature or by the manufacturer's certification of performance.
6. Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.
7. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.
8. Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern, and texture from the product line selected.

PART 3 – EXECUTION

3.1 INSTALLATION OF PRODUCTS

- A. Comply with manufacturers' instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
 1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- B. Coordinate installation of any/all Supplemental Framing as required for complete installation of all Work, per all codes, ordinances, laws, and manufacturer's recommendations for manufacturer's full system warranties.
- C. Coordinate the light-gage metal stud shop drawings with the TDI Windstorm compliant soffit shop drawings to ensure that the soffit framing will resist all applied wind pressures. This includes all stud sizes, blocking/bridging, fasteners, connections to support structure, applicable details, and verification that the necessary stud gage required for anchorage of the soffit materials is being furnished. This is for all Soffit and Ceiling assemblies.

END OF SECTION

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**SECTION 01 7000
CONTRACT CLOSEOUT**

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for contract closeout including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Project record document submittals.
 - 3. Operation and maintenance manual submittal.
 - 4. Submittal of warranties.
 - 5. Final cleaning.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Closeout requirements for specific construction activities.
 - 2. Division 01 Section 01 2000 "Project Meetings" for project closeout meeting.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
 - 1. Comply with the General Conditions Contractor (Punch-list) comprehensive list of items to be completed or corrected.
 - 2. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete.
 - a. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 - b. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
 - 3. Advise the Owner of pending insurance changeover requirements.
 - 4. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
 - 5. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 6. Complete startup testing of systems and instruction of the Owner's operation and maintenance personnel. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements.

7. Complete final cleanup requirements, including touch-up painting.
 8. Touch up and otherwise repair and restore marred, exposed finishes.
- B. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1.4 FINAL ACCEPTANCE

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

1.5 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for the Architect's reference during normal working hours.
- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
 - 1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work.
 - 2. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.
 - 3. Note related change order numbers where applicable.
 - 4. Organize record drawing sheets into manageable sets. Bind sets with durable paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.
- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda. Include with the Project Manual one (1) copy of other written construction documents, such as Change Orders and modifications issued in printed form during construction.
 - 1. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.
 - 2. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.
 - 3. Not related record drawing information and Product Data.
 - 4. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.
- D. Record Product Data: Maintain one (1) copy of each Product Data submittal. Note related Change Orders and markup of record drawings and Specifications.
 - 1. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site and from the manufacturer's installation instructions and recommendations.
 - 2. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation.
 - 3. Upon completion of the markup, submit complete set of record Product Data to the Architect for Owner's records.

- E. Maintenance Manuals: Organize operation and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual, heavy-duty, 2-inch, 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Submit three (3) copies of the final maintenance manual prior to final acceptance of the project. Include the following types of information:
1. Emergency instructions.
 2. Spare parts list.
 3. Copies of warranties.
 4. Wiring diagrams.
 5. Recommended "turn-around" cycles.
 6. Inspection procedures.
 7. Shop Drawings and Product Data.
 8. Contact names, addresses and telephone numbers for service and supplies.
- F. Electronic Submission Requirements: Provide Thumb Drive electronic copies (PDF format) of all final submittals, shop drawings, product data, record drawings, record specifications and maintenance manuals. Organize electronic files to match submitted paper documents.

PART 2 – PRODUCTS

PART 3 – EXECUTION

3.1 CLOSEOUT PROCEDURES

- A. Operation and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:
1. Maintenance manuals
 2. Record documents
 3. Spare parts and materials
 4. Tools
 5. Lubricants
 6. Fuels
 7. Identification systems
 8. Control sequences
 9. Hazards
 10. Cleaning
 11. Warranties and bonds
 12. Maintenance agreements and similar continuing commitments.
- B. As part of instruction for operating equipment, demonstrate the following procedures:
1. Startup
 2. Shutdown
 3. Emergency operations

4. Noise and vibration adjustments
5. Safety procedures
6. Economy and efficiency adjustments
7. Effective energy utilization
8. Interlocking operation with other systems.

3.2 FINAL CLEANING

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

END OF SECTION

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**SECTION 01 7100
CLEAN UP**

PART 1 – GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

- A. Cleaning for Specific Products of Work: Specification Section for that Work.

1.2 SAFETY REQUIREMENTS

- A. Maintain project in accordance with laws, ordinances and rules of legal regulatory agencies.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Use only cleaning materials recommended and allowed by law.

PART 3 – EXECUTION

3.1 DURING CONSTRUCTION

- A. Execute cleaning to insure that grounds, adjacent property, and public properties are maintained free from accumulations of waste materials and rubbish.
- B. Wet down dry materials to prevent blowing dust on site.

3.2 FINAL CLEANING

- A. Employ experienced workmen, or professional cleaner for final cleaning.
- B. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from sight exposed interior and exterior finishes.
- C. Broom clean paved surfaces; rake clean other surfaces of grounds.
- D. Maintain site clean up until project is complete.
- E. At completion of Work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials and clean sight-exposed surfaces; leave project site clean and neat.

END OF SECTION

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SECTION 01 7400 WARRANTIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 01 Section 01 3000 "Submittals" specifies procedures for submitting warranties.
 - 2. Division 01 Section 01 7000 "Contract Closeout" specifies contract closeout procedures.
- C. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.3 DEFINITIONS

- A. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.4 WARRANTY REQUIREMENTS

- A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement.

The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
- D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights or remedies.
 - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
- E. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.5 SUBMITTALS

- A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.
 - 1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within 15 days of completion of that designated portion of the Work.
- B. When the Contract Documents require the Contractor, or the Contractor and subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Architect, for approval prior to final execution.
- C. Prepare a written document utilizing the appropriate form, ready for execution by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Submit a draft to the Owner, through the Architect, for approval prior to final execution.

- D. Form of Submittal: At Final Completion compile three (3) copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer.
- E. Bind warranties in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness a necessary to accommodate contents, and sized to receive 8 ½ x 11-inch paper.
 - 1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty.
 - 2. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.
 - 3. Identify each binder on the front and spine with a typed or printed tile "WARRANTIES", Project title or name, and name of the Contractor.
 - 4. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 – PRODUCTS: Not Applicable

PART 3 – EXECUTION: Not Applicable

END OF SECTION

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SECTION 01 7700
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
- B. Related Requirements:
 - 1. Closeout requirements for specific construction activities are included in the appropriate Sections in Division 02 through 33.
 - 2. Section 01 31 00 "Project Management and Coordination" for project closeout meeting.

1.3 DEFINITIONS

- A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.4 ACTION SUBMITTALS

- A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

1.5 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.

- B. Certificate of Insurance: For continuing coverage.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.7 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete. Comply with the General Conditions 9.8.2 Contractor (Punch List) comprehensive list of items to be completed or corrected.
- B. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete.
 - 1. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 - 2. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
- C. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item

and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.

5. Submit testing, adjusting, and balancing records.
 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- D. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise the Owner of pending insurance changeover requirements.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise the Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct the Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings as needed to fully explain each item or procedure.
 6. Advise the Owner of changeover in utility services.
 7. Participate with the Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements.
 10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- E. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Request the Architect's reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for Final Completion.

1.8 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final, updated Application for Payment in accordance with Section 012900 "Payment Procedures" with releases and supporting documentation not previously submitted and accepted.
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when the Owner took possession of and assumed responsibility for corresponding elements for the Work.
 5. Submit consent of surety to final payment.
 6. Submit pest-control final inspection report.
 7. Submit Final Completion photographic documentation.
- B. Re-inspection: The Architect will re-inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except for items that show completion is delayed under circumstances acceptable to the Architect.
1. Upon completion of re-inspection, the Architect will prepare a certificate of final acceptance. If the Work is incomplete, the Architect will advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
 2. If necessary, re-inspection will be repeated one time for a total of two (2) punch-list inspections, including the Substantial Completion punch-list. Additional re-inspections required due to Contractor's failure to complete the punch-list will be billed to the Contractor at the Architect's customary billing rates for the personnel involved.

1.9 LIST OF INCOMPLETE ITEMS

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1.10 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for the Architect's reference during normal working hours.

- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawing are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work.
 2. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.
 3. Note related Change Order numbers where applicable.
 4. Organize record drawing sheets into manageable sets. Bind sets with durable paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.
- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda. Include with the Project Manual one (1) copy of other written construction document, such as Change Orders and modifications issued in printed form during construction.
1. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.
 2. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.
 3. Not related record drawing information and Product Data.
 4. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.
- D. Record Product Data: Maintain one (1) copy of each Product Data submittal. Note related Change Orders and markup of record drawings and Specifications.
1. Mark these documents to show substantial variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site and from the manufacturer's installation instructions and recommendations.
 2. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation.
 3. Upon completion of the markup, submit complete set of record Product Data to the Architect for Owner's records.
- E. Maintenance Manuals: Organize operation and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual, heavy-duty, 2 inch, 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Submit a preliminary maintenance manual for

review by the Architect before or with the 50% application for payment. Submit three (3) copies of the final maintenance manual prior to final acceptance of the project. Include the following types of information:

1. Emergency instructions.
2. Spare parts list.
3. Copies of warranties.
4. Wiring diagrams.
5. Recommended "turn-around" cycles.
6. Inspection procedures.
7. Shop Drawings and Product Data.
8. Contact names, addresses and telephone numbers for service and supplies.

- F. Electronic Submission Requirements: Provide a Thumb Drive/CD-ROM disk with electronic copies (PDF format) of all final submittals, shop drawings, product data, record drawings, record specifications and maintenance manuals. Organize electronic files to match submitted paper documents.

1.11 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
1. Submit on digital media acceptable to Architect.
- E. Warranties in Paper Form:
1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- F. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.

- e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
 - i. Vacuum and mop concrete.
 - j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - l. Remove labels that are not permanent.
 - m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - 1) Clean HVAC system in compliance with NADCA ACR. Provide written report on completion of cleaning.
 - q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
 - r. Clean strainers.
 - s. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements of local, state and federal authorities having jurisdiction.
- D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations required by Section 01 73 00 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 01 7700

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SECTION 01 7810
PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project record documents, including, but not limited to, the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 01 Section 01 7000 “Contract Closeout” for general closeout procedures and maintenance manual requirements.
 - 2. Division 01 Section 01 7820 “Operation and Maintenance Data” for operation and maintenance manual requirements.

1.3 SUBMITTALS

- A. Record Drawings: Comply with the following.
 - 1. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Final Submittal: Submit one (1) set of marked-up Record Prints.
 - b. Submit one (1) electronic copy (PDF file format) of marked-up Record Drawings and Specifications.

PART 2 – PRODUCTS

1.1 RECORD DRAWINGS

- A. Record Prints: Maintain one (1) set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
 - 1. Preparation: Mark Record Prints to show the actual installation where installation varies from individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:

- a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to rerouting of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Locations of concealed internal utilities.
 - i. Changes made by Change Order or Construction Change Directive.
 - j. Changes made following Architect's written orders.
 - k. Field records for variable and concealed conditions.
 - l. Record information on the Work that is shown only schematically.
 - 3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
 - 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
 - 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 - 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing Record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
- 1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 - 2. Consult with Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- C. Format: Identify and date each Record Drawing: Include designation "PROJECT RECORD DRAWING" in a prominent location.
- 1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets.
 - 2. Identification: as follows:
 - a. Project name
 - b. Date
 - c. Designation "PROJECT RECORD DOCUMENTS"
 - d. Name of Architect
 - e. Name of Contractor

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specification, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the propriety name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of the manufacturer, supplier, installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
 5. Note related Change Orders, Record Drawings, and Product Data where applicable.

PART 3 – EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one (1) copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of the Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION

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SECTION 01 7820
OPERATION AND MAINTENANCE DATA

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project record documents, including, but not limited to, the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Maintenance manuals for the care and maintenance of products, materials, finishes, systems and equipment.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 01 Section 01 3000 "Submittals" for submitting copies of submittals for operation and maintenance manuals
 - 2. Division 01 Section 01 7000 "Contract Closeout" for submitting operation and maintenance manuals.
 - 3. Division 01 Section 01 7810 "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

- A. Final Submittal: Submit one (1) copy of each manual in final form at least 15 days before substantial completion. Architect will return copy with comments within 15 days following substantial completion.
 - 1. Correct or modify each manual to comply with Architect's comments. Submit three (3) copies of each corrected manual within 15 days of receipt of Architect's comments.

1.5 COORDINATION

- A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 – PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Organization: Include a section in the directory for each of the following:
 - 1. List of documents.
 - 2. List of systems.
 - 3. List of equipment.
 - 4. Table of Contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with the same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title Page.
 - 2. Table of Contents.
 - 3. Manual Contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of Submittal.
 - 5. Name, address, and telephone number of Contractor.

6. Name and address of Architect.
 7. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
1. Binders: Heavy-duty, 3-ring, vinyl covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple volume sets.
 2. Dividers: Heavy paper dividers with plastic covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
 4. Supplementary Text: Prepared on 8-1/2-by-11-inch, white bond paper.
 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 OPERATION MANUALS

- A. Content: In addition to requirements in the Section, include operation data required in individual Specification Sections and the following information:
 - 1. Systems, subsystem, and equipment descriptions.
 - 2. Performance and design criteria if Contractor is delegated design responsibility.
 - 3. Operating standards.
 - 4. Operating procedures.
 - 5. Operating logs.
 - 6. Wiring diagrams.
 - 7. Control diagrams.
 - 8. Piped system diagrams.
 - 9. Precautions against improper use.
 - 10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Equipment identification with serial number of each component.
 - 4. Equipment function.
 - 5. Operating characteristics.
 - 6. Limiting conditions.
 - 7. Performance curves.
 - 8. Engineering data and tests.
 - 9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
 - 1. Startup procedures.
 - 2. Equipment or system break-in procedures.
 - 3. Routing and normal operating instructions.
 - 4. Regulation and control procedures.
 - 5. Instructions on stopping.
 - 6. Normal shutdown instructions.
 - 7. Seasonal and weekend operating instructions.
 - 8. Required sequences for electric or electronic systems.
 - 9. Special operating instruction and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUAL

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in the manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

- C. **Manufacturers' Maintenance Documentation:** Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard printed maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. **Maintenance Procedures:** Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training videotape, if available
- E. **Maintenance and Service Schedules:** Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. **Scheduled Maintenance and Service:** Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. **Maintenance and Service Record:** Include manufacturers' forms for recording maintenance.
- F. **Spare Parts List and Source Information:** Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. **Maintenance Service Contracts:** Include copies of maintenance agreements with name and telephone number of service agent.
- H. **Warranties:** Include copies of warranties and lists of circumstances and conditions that would affect validity of warranties.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 3 – EXECUTION

3.1 MANUAL PREPARATION

- A. **Operation and Maintenance Manuals:** Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

- B. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data includes more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- C. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original Project Record Documents as part of operation and maintenance manuals.
 - 2. Comply with requirements of newly prepared Record Drawings in Division 01 Section 01 7810 "Project Record Documents".
- D. Comply with Division 01 Section 01 7000 "Contract Closeout" for the schedule for submitting operation and maintenance documentation.
- E.

END OF SECTION

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SECTION 03 3540
SEALED CONCRETE FLOOR FINISHING

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Installation of acrylic concrete sealer to new concrete.

1.2 RELATED SECTIONS

- A. Section 01 33 00 – Submittal Procedures
- B. Section 03 30 00 – Cast-in-Place Concrete
- C. Division 09 – Finishes

1.3 REFERENCES

- A. ACI 310 – Guide to Decorative Concrete

1.4 SUBMITTALS

- A. Comply with Section 01 33 00 – Submittal Procedures.
 - 1. Manufacturer's chemical and product data sheets for:
 - a. Acrylic concrete sealer
- B. Installer's Certification:
 - 1. Provide list of 5 completed projects performed with last three years of similar type, size and complexity. Submit project names, addresses, contacts and phone numbers for each project. General Contractor is to validate references and contractor's capabilities prior to submitting bid.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Accessibility Requirements: Comply with applicable requirements of the Texas Accessibility Standards and Americans with Disabilities Act

Accessibility Guidelines (ADAAGs) for Buildings and Facilities; Final Guidelines, revisions, and updates for static coefficient of friction for walkway surfaces.

2. Environmental Requirements: Comply with current Federal and local toxicity and air quality regulations and with Federal requirements on content of lead, mercury, and other heavy metals. Do not use solvents in floor polish products that contribute to air pollution or impact food quality.

B. Manufacturer Qualifications:

1. A firm with a minimum of 5 years of experience in manufacturing concrete floor sealing systems.
2. Firm shall have completed work similar in material, design, and extent to that indicated for this Project with a record of successful in-service performance.

C. Pre-installation Meeting:

1. General contractor shall schedule and convene a pre-installation meeting at the project site before start of installation of sealed concrete floor system.
2. Require attendance of parties directly affecting work of this section, including:
3. Owner's Representative
4. Architect
5. General Contractor
6. Sealing Subcontractor including Project Manager and Foreman
7. Meeting agenda to include (but not limited to): Review of existing conditions, surface preparation, system installations, field quality control, protection, environmental requirements, coordination with other work, controls to limit damage from dust and field quality control methods and reporting.
8. Unacceptable finishes include blisters, cracking, curling, delamination, surface discoloration, efflorescence, pop outs, scaling, and spalling.

1.6 MOCK-UP

- A. Provide benchmark mock-up to verify finish indicated and to demonstrate aesthetic effects and set quality standards for materials and execution, i.e., typical joints, surface finish, color variation (if any), and standard of workmanship.
- B. Notify the Architect seven days in advance of date and time when mock-up will be constructed.
- C. Provide a sealed concrete floor finish mock-up, a minimum of 100 square feet, illustrating completed sealed floor. No grinding is necessary.
- D. Mock-up will include properly installed repairs per section 03 30 00.

- E. Locate mock-up where directed by the Architect.
- F. If the Architect determines that mock-up does not meet requirements, re-finish floor sample in new location until mock-up is approved.
- G. Accepted mock-up will serve as standard to judge quality and workmanship of completed concrete floor finish.
- H. Accepted mock-up shall remain as part of finished product.

1.7 PROJECT CONDITIONS

- A. Sequence application of concrete grinding and sealing until post completion of other construction activities that would be damaging to the completed concrete finish.
- B. Close areas to traffic during and after floor application for time period recommended in writing by manufacturer.

PART 2 – PRODUCTS

2.1 LIQUID FLOOR TREATMENTS

- A. Manufacturer: Provide listed products of Euclid Chemical Co., Cleveland, OH, www.euclidchemical.com
 - 1. Basis of Design: Euco Diamond Hard by the Euclid Chemical Company.
- B. Liquid Densifier Sealer: High performance, deeply penetrating concrete densifier, odorless, colorless, VOC – compliant, non-yellowing silicate and silicate based solution designed to harden, dustproof, and protect concrete floors.
- C. Substitutions are not permitted.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine floor to receive sealed concrete floor system.
- B. Notify the Architect of conditions that would adversely affect installation or subsequent use prior to commencement.

- C. Do not begin surface preparation or installation until conditions are corrected and approved.

3.2 SURFACE PREPARATION

- A. Protection: Protect surrounding areas and adjacent surfaces from the following:
 - 1. Contact with overspray of sealer.
- B. Clean Surfaces: Remove dirt, dust, debris, oil, grease, curing agents, bond breakers, paint, coatings, and other surface contaminants, which could adversely affect installation of sealed concrete floor system.
- C. Fill concrete joints in accordance with specification requirements prior to installation of any sealer. Failure to install joint filler will cause failure as the sealer will bond to the side wall of the joint which will prevent joint sealant from bonding correctly.

3.3 INSTALLATION

- A. Repair all cracks and existing conditions or damage prior to installation of the sealed concrete flooring.
- B. Install sealed concrete floor system in accordance with manufacturer's instructions at locations indicated on the Drawings.
- C. New Concrete Floor Sealing Only:
 - 1. Clean floor thoroughly using an auto-scrubber and allow to completely dry per manufacturer's instructions.
 - 2. Apply Sealer:
 - a. Apply sealer per manufacturer's instructed coverage rate using sprayers to insure consistent application.
 - b. Apply a second coat within the manufacturer's approved recoat time frame.
 - c. Per manufacturer's instructions, remove or spread excess product completely from areas of over application.
 - d. If required, use manufacturer's approved non-slip additive to achieve a non-slip floor finish.

3.4 FIELD QUALITY CONTROL

- A. Inspect completed sealed concrete floor system with Architect for compliance and comparison with mock-up. Correct any deficiencies noted.
- B. Review procedures with Architect to correct unacceptable areas of completed sealed concrete floor system.

3.5 PROTECTION

- A. Protect completed sealed concrete floor system from damage until Substantial Completion.
 - 1. Prohibit parking of vehicles on concrete slab.
 - 2. If construction equipment must be used for overhead construction, the General Contractor is to require that all trades diaper components that might drip oil, hydraulic fluid, or other liquids.
 - 3. Prohibit pipe cutting or threading using machinery on concrete slab.
 - 4. Prohibit temporary placement and storage of steel members on concrete slab.
 - 5. Cover concrete floors with drop cloths or use breathable drop cloths during painting. If paint is spilled on concrete floor, remove paint immediately.
 - 6. Protect completed sealed concrete surface from standing moisture for 72 hours to prevent re-emulsification of surface treatment prior to cure
- B. Immediately remove mortar splatter, spilled liquids, oil, grease, paint, coatings, and other surface contaminants that could adversely affect completed sealed concrete floor system.
- C. Repair damaged areas of completed sealed concrete floor system to satisfaction of the Architect.
- D. Protect finished work until project is turned over to the Owner.

END OF SECTION 03 35 40

SECTION 05 5000

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Metal bollards.
 - 2. Loose bearing and leveling plates.
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
 - 2. Steel weld plates and angles for casting into concrete.

1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Nonslip aggregates and nonslip-aggregate surface finishes.
 - 2. Fasteners.
 - 3. Shop primers.
 - 4. Shrinkage-resisting grout.
 - 5. Slotted channel framing.
 - 6. Manufactured metal ladders.
 - 7. Ladder safety cages.
 - 8. Metal bollards.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design ladders.

- B. Structural Performance of Aluminum Ladders: Ladders are to withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 316.
- D. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- E. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless steel fasteners for fastening stainless steel.
- B. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Division 09 Painting.

- B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 8 inches from ends and corners of units and 24 inches o.c.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
- B. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.
 - 1. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches o.c.
- C. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

2.7 REMOVABLE METAL BOLLARDS

- A. Provide removable bollards consisting of 6-inch diameter galvanized standard-weight steel pipe with form-domed cap and related accessories.
 - 1. Height: 3-feet (36 inches)
- B. Bollard will remove completely from the ground sleeve and provide flush surface.
- C. All surfaces to be primed with rust and corrosion resistant, zinc rich primer with 5000-hour salt spray performance.
 - 1. Color: RAL1028 Yellow
- D. Install bollards to depth as shown on drawings.
 - 1. Clean bollard holes free of loose dirt and debris, and thoroughly compact bottom of hole to correct elevation for placement of the bollards.
 - 2. Place bollards to correct alignment, elevation, and plumb

2.8 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize bearing and leveling plates.

- C. Prime plates with zinc-rich primer.

2.9 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.10 GENERAL FINISH REQUIREMENTS

- A. Finish metal fabrications after assembly.

2.11 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with primers specified in Section 09 91 13 "Exterior Painting" unless zinc-rich primer is indicated.
- C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
 - 4. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLATION OF METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
- B. Anchor bollards in concrete in formed or core-drilled holes not less than 42 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with shrinkage-resistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.
- C. Fill bollards solidly with concrete and install plastic bollard covers.

3.3 INSTALLATION OF BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 REPAIRS

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 50 00

SECTION 05 5213
PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum handrails.

1.2 RELATED SECTIONS

A. Related Sections include the following:

1. Division 03 "Cast-in-Place Concrete" for placement of anchors in concrete.
2. Division 05 "Metal Fabrications"
3. Division 06 "Composite Decking and Railing System" for guardrails.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer's product lines of mechanically connected railings.
2. Handrail brackets.
3. Shop primer.

B. Shop Drawings: Indicate profiles, sizes, connections/attachments to other work, anchorage, size and type of fasteners and accessories.

1. Include the design engineer's seal and signature on each sheet of shop drawings.

C. Delegated Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Mockups:

1. Handrail mockup required for review and approval. Mockup to be full-height, 36" long section showing materials and welded corners to show full extension with return.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For delegated design professional engineer.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Texas, or personnel under direct supervision of such engineer.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Railings: Superior Aluminum Products, Inc; Series 9000 Heavy Duty:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.3 RAILINGS, GENERAL

- 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 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.

2.4 ALUMINUM RAILINGS

- A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
 1. Circular cross section 1-1/2" outside diameter; Schedule 40.
 2. Compliant with all TDLR/TAS Standards.
- B. Extruded: ASTM B221, Alloy 6063-T5/T52.
- C. Extruded Structural: ASTM B429/B429M, Alloy 6063-T6.

1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.
- D. Drawn Seamless Tubing: ASTM B210/B210M, Alloy 6063-T832.
- E. Plate and Sheet: ASTM B209, Alloy 6061-T6.
- F. Die and Hand Forgings: ASTM B247, Alloy 6061-T6.
- G. Castings: ASTM B26/B26M, Alloy A356.0-T6.
- H. Perforated Metal Infill Panels: Aluminum sheet, ASTM B209, Alloy 6061-T6, thick.

2.5 FASTENERS

- A. Fastener Materials:
 1. Aluminum Railing Components: 316 stainless steel fasteners.
- B. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.

2.6 MISCELLANEOUS MATERIALS

- A. Handrail Brackets: Aluminum center of handrail 2-1/2 inches from wall.
- B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welding.

2.7 FABRICATION

- A. Cut, drill, and punch metals cleanly and accurately.
 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
 2. Remove sharp or rough areas on exposed surfaces.
- B. Form work true to line and level with accurate angles and surfaces.
- C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.

3. Remove flux immediately.
 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds: ornamental quality with no evidence of a welded joint.
- D. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
- E. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
- F. Form changes in direction as follows:
1. By bending or by inserting prefabricated elbow fittings.
- G. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- H. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.
- I. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- J. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- K. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
 2. Coordinate anchorage devices with supporting structure.

2.8 ALUMINUM FINISHES

- A. High Performance Organic Coating System: AAMA 2604 multiple coat, thermally cured fluoropolymer system.
- B. Color: Anodized Aluminum: Polished.

- C. Touch-Up Materials: As recommended by coating manufacturer for field application.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing railings.
 - 1. Fit exposed connections together to form tight, hairline joints.
 - 2. Install railings level, plumb, square, true to line, without distortion, warp, or rack.
 - 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 - 4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 5. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

3.2 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.

3.3 ATTACHING RAILINGS

- A. Attach handrails to walls with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.
- B. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

3.4 CLEANING

- A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.

END OF SECTION 05 52 13

SECTION 06 1000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Rough opening framing for doors, windows, and roof openings.
- B. Roof-mounted curbs.
- C. Roofing nailers.
- D. Preservative treated wood materials.
- E. Communications and electrical room mounting boards.
- F. Concealed wood blocking, nailers, and supports.
- G. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

- A. Section 05 5000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.
- B. Section 31 3116 - Termite Control: Field-applied termiticide and mildewcide for wood materials.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
- B. AWP A U1 - Use Category System: User Specification for Treated Wood; 2017.
- C. PS 1 - Structural Plywood; 2009.
- D. PS 20 - American Softwood Lumber Standard; 2015.
- E. SPIB (GR) - Grading Rules; 2014.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. Species: Southern Pine, unless otherwise indicated.
 - 2. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
 - 3. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
- B. Lumber fabricated from old growth timber is not permitted.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. 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: 316 Stainless steel.

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. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
- B. Preservative Treatment:
 - 1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - b. Treat lumber exposed to weather.
 - c. Treat lumber in contact with roofing, flashing, or waterproofing.
 - d. Treat lumber in contact with masonry or concrete.

PART 3 EXECUTION

4.01 PREPARATION

- A. Coordinate installation of rough carpentry members specified in other sections.

4.02 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.

4.03 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 metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- 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. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- E. Provide the following specific non-structural framing and blocking:
 - 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.

4.04 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 specifically indicated otherwise. Form corners by alternating lapping side members.

4.05 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.

END OF SECTION

SECTION 06 2000
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Finish carpentry items.
- B. Wood moldings and trim.
- C. Hardware and attachment accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 06 4100 - Architectural Wood Casework: Shop fabricated custom cabinet work.
- C. Section 08 1416 - Flush Wood Doors.
- D. Section 09 9123 - Interior Painting: Painting and finishing of finish carpentry items.

1.03 REFERENCE STANDARDS

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2016).
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2016, with Errata (2017).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- C. Samples: Submit two samples of wood trim 6 inch long.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect work from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.

C. Interior Woodwork Items:

1. Solid Lumber Paneling and Accent Ceiling, Tongue and Groove "V" Joint; Plain White Oak, Select Grade.
 - a. Size: 1 x 6 inches.
 - b. Prepare for transparent finish or paint finish as scheduled on the drawings.
4. Base: 3/4 inch square top edge. Plain White Oak, Select Grade
 - a. Size: 1 x 6 inches.
 - b. Prepare for transparent finish or paint finish as scheduled on the drawings.
5. Miscellaneous Trim: Plain White Oak, Select Grade.
 - a. Prepare for transparent finish or paint finish as scheduled on the drawings.
6. Loose Shelving: Birch plywood; prepare for paint finish.

2.02 WOOD-BASED COMPONENTS

- A. Wood fabricated from old growth timber is not permitted.

2.03 FASTENINGS

- A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
- C. Fasteners: 316 Stainless steel.

2.04 ACCESSORIES

- A. Wood Filler: Solvent base, tinted to match surface finish color.

2.05 HARDWARE

- A. Heavy Duty Shelf Standards & Brackets:
1. Material: Galvanized Steel.
 2. Finish: Manufacturer's standard, factory-applied powder coat.
 3. Color: Selected by Architect from manufacturer's full range.
 4. Heavy Duty Standards to support heavy loads.

2.06 FABRICATION

- A. Shop assemble work for delivery to site, permitting passage through building openings.
- B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.07 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.
- D. Finish for Accent Wall shall be as recommended by manufacturer. Colors as selected by Architect from manufacturer's full line of colors.
- E. Finish work scheduled to receive transparent finish 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: As selected by Architect.
- c. Sheen: Flat.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.

3.02 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated and as recommended by manufacturer.
- B. Set and secure materials and components in place, plumb and level.
- C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.
- D. Install hardware in accordance with manufacturer's written instructions.

3.03 PREPARATION FOR SITE FINISHING

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.
- B. Site Finishing: See Section 09 9123.

3.04 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch.
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 07 2119
FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Foamed-in-place insulation.

1.02 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.
- B. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2012.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
- D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- E. 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).
- F. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.
- C. Certificates: Certify that products of this section meet or exceed specified requirements.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

1.04 FIELD CONDITIONS

- A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.
- B. Do not apply foam when temperature is within 5 degrees F of dew point.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Foamed-In-Place Insulation: Medium-density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
 - 1. Regulatory Requirements: Comply with applicable code for flame and smoke and concealment limitations AND install Intumescent Paint.
 - 2. Thermal Resistance: R-value of 5.0, minimum, per 1 inch thickness at 75 degrees F mean temperature when tested in accordance with ASTM C518.

3. Water Vapor Permeance: Vapor retarder; 2 perms, maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
4. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
5. Air Permeance: 0.04 cfm/sq ft, maximum, when tested at intended thickness in accordance with ASTM E2178 or ASTM E283 at 1.57 psf.
6. Closed Cell Content: At least 90 percent.
7. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
8. Basis of Design:
 - a. Icynene-Lapolla; Icynene ProSeal LE: www.icynene.com/#sle.

2.02 ACCESSORIES

- A. Primer: As required by insulation manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify work within construction spaces or crevices is complete prior to insulation application.
- B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

3.02 PREPARATION

- A. Mask and protect adjacent surfaces from over spray or dusting.
- B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

- A. Apply insulation in accordance with manufacturer's instructions.
- B. Apply insulation by spray method, to a uniform monolithic density without voids.
- C. Apply to achieve a thermal resistance R-value of 19 at walls and floor and R-value of 38 at underside of Roof Deck.
- D. Apply Intumescent Paint, as tested in accordance with insulation manufacturer, to all foam-in-place insulation.
- D. Patch damaged areas.

3.04 PROTECTION

- A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

SECTION 07 1413

METAL ROOF PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications apply to this Section.
- B. Mechanically-seamed, standing seam metal roof panels, with related metal trim and accessories.

1.2 RELATED REQUIREMENTS

- A. Substitution Requests will not be accepted.
- B. Division 05 Section "Structural Steel Framing" for structural steel framing supporting metal panels.
- C. Division 05 Section "Steel Decking" for continuous metal decking supporting metal panels.
- D. Division 05 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal panels.
- E. Division 07 Section "Thermal Insulation" for thermal insulation installed under metal panels.
- F. Division 07 Section "Fluid-Applied Membrane Air Barrier" for air barriers within roof assembly.
- G. Division 07 Section "Fiber Cement, Siding, and Trim" and "Fiber Cement Soffitts".
- H. Division 07 Section "Sheet Metal Flashing and Trim" for formed sheet metal copings, flashings, reglets, and roof drainage items.
- I. Division 07 Section "Joint Sealants" for field-applied joint sealants.

1.3 REFERENCES

- A. American Architectural Manufacturer's Association (AAMA):

1. AAMA 621 – Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot-Dipped Galvanized and Zinc-Aluminum Coated Steel Substrates.
 2. AAMA 809.2 – Voluntary Specification Non-Drying Sealant.
- B. American Society of Civil Engineers (ASCE):
1. ASCE 7 – Minimum Design Loads for Buildings and Other Structures.
- C. ASTM International (ASTM):
1. ASTM A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 2. ASTM A 755 - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
 3. ASTM A 792/A 792M - Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 4. ASTM A 980 - Standard Specification for Steel, Sheet, Carbon, Ultra High Strength Cold Rolled.
 5. ASTM C 645 - Specification for Nonstructural Steel Framing Members.
 6. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 7. ASTM D 1003 - Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.
 8. ASTM D 2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
 9. ASTM D 4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
 10. ASTM E 1514 - Standard Specification for Structural Standing Seam Steel Roof Panel Systems.
 11. ASTM E 1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
 12. ASTM E 1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
 13. ASTM E 1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.
 14. ASTM E 1980 - Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces
- D. FM Global (FM):
1. ANSI/FM 4471 – Approval Standard for Class 1 Panel Roofs.

- E. International Accreditation Service (IAS):
 - 1. IAS AC 472 – Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems, Part B.
- F. Underwriters Laboratories (UL):
 - 1. UL 580 – Tests for Uplift Resistance of Roof Assemblies

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meeting: Prior to erection of framing, conduct pre-installation meeting at site attended by Owner, Architect, Construction Manager, manufacturer's technical representative, inspection agency and related trade contractors.
 - 1. Coordinate building framing in relation to metal panel system.
 - 2. Coordinate openings and penetrations of metal panel system.
 - 3. Coordinate work of Division 07 Sections related to specialties and accessories, including openings, penetrations, and manufacturer's accessories with installation of metal panels.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Provide metal roof panel assembly and accessories from a single manufacturer providing fixed-base roll forming, and accredited under IAS AC 472, Part B.
- B. Manufacturer's Qualifications: Approved manufacturer listed in this Section with minimum five (5) years of experience in manufacture of similar products in successful use in similar applications.
 - 1. Substitutions following award of contract are not allowed.
- C. Installer Qualifications: Experienced installer with minimum of five (5) years of experience with successfully completed projects of a similar nature and scope.
 - 1. Installer's Field Supervisor: Experienced mechanic supervising work on site whenever work is underway.
- D. Buy American Compliance: Materials provided under work of this Section shall comply with the following requirements:
 - 1. Buy American Act of 1993 BAA-41 U.S.C §§ 10a – 10d.

1.6 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets for specified products.
- B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2 inch per foot of edge condition, joints, fastener and sealant placement, flashings, openings, penetrations, roof accessories, lightning arresting equipment, and special details. Make distinctions between factory and field assembled work.
 - 1. Indicate points of supporting structure that must coordinate with metal panel system installation.
 - 2. Include data indicating compliance with performance requirements.
 - 3. Include structural data including compliance with Texas Department of Insurance Windstorm requirements.
- C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.
- D. Samples for Initial Verification: Provide 12-inch-long section of each metal panel profile. Provide color chips verifying color selection.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Indicating compliance of products with requirements, witnessed by a professional engineer.
- B. Letter from system manufacturer stating fastener type and density/spacing for each zone meeting wind uplift resistance.
- C. Qualification Information: For installer firm and installer's field supervisor.
- D. Manufacturer's Warranty: Sample copy of manufacturer's standard warranty.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance data.
- B. Manufacturer's Warranty: Executed copy of manufacturer's standard warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.
- B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.10 COORDINATION

- A. Coordinate sizes, profiled, and locations of roof curbs and other roof-mounted equipment and penetrations, based upon sizes of actual selected equipment.

1.11 WARRANTY

- A. Special Manufacturer's Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal panel assemblies that fail in materials and workmanship within one (1) year from the date of Substantial Completion.
- B. Special Panel Finish Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal panels that evidence deterioration of factory applied finish within 25 years from the date of Substantial Completion, including:
 - 1. Color fading in excess of five (5) Hunter units per ASTM D 2244.
 - 2. Chalking in excess of No. 8 rating per ASTM D 4214.
 - 3. Failure of adhesion, peeling, checking, or cracking.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design Manufacturer: **MBCI Metal Roof and Wall Systems, Division of NCI Group, Inc.**; Houston, Texas. Tel: (877) 713-6224; Email: info@mbci.com; Web: www.mbc.com.

2.2 ARCHITECTURAL METAL ROOF PANELS

- A. Architectural Metal Roofing: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

1. Basis of Design: **MBCI, SuperLok**, www.mbc.com/superlok.html
- B. Metal Panels: Factory-formed panels with factory-applied finish.
 1. Steel Panels:
 - a. Aluminum-zinc alloy-coated steel complying with ASTM A792/A792M; minimum AZ50 coating.
 - b. Steel thickness: Minimum 24-gauge.
 2. Profile: Standing seam, with minimum 2.0-inch seam height; concealed fastener system for field seaming with special tool.
 3. Texture: Smooth, with intermediate ribs for added stiffness.
 4. Length: Maximum possible length to minimize lapped joints. Where lapped joints are unavoidable, space laps so that each sheet spans over three or more supports.
 5. Width: Maximum panel coverage of 16-inches.

2.3 ATTACHMENT SYSTEM

- A. Concealed System: Provide manufacturer's standard stainless steel concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.4 METAL ROOF PANEL ACCESSORIES

- A. General: Provide complete metal roof panel assembly incorporating trim, copings, fasciae, gutters and downspouts, and miscellaneous flashings in profiles as indicated. Provide required fasteners, closure strips, thermal spacers, splice plates, support plates, and sealants as indicated in manufacturer's written instructions.
- B. Flashing and Trim: Match material, thickness, and finish of metal panel face sheet.
- C. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.
- D. Panel Clips: Provide panel clips of type specified, at spacing indicated on approved shop drawings.
 1. Two-Piece Floating: ASTM C 645, with ASTM A653/A653M, **G90 (Z180)** hot-dip galvanized zinc coating, configured for concealment in panel joints, and identical to clips utilized in tests demonstrating compliance with performance requirements.

2. Single-Piece Fixed: ASTM C 645, with ASTM A 653/A 653M, G90 (Z180) hot-dip galvanized zinc coating, configured for concealment in panel joints, and identical to clips utilized in tests demonstrating compliance with performance requirements.
- E. Panel Fasteners: Self-tapping screws and other acceptable fasteners recommended by roof panel manufacturer. Where exposed fasteners cannot be avoided, supply long life fasteners with EPDM or neoprene gaskets, with heads matching color of metal panels by means of factory-applied coating.
 - F. Joint Sealers: Manufacturer's standard or recommended liquid and preformed sealers and tapes, and as follows:
 1. Factory-Applied Seam Sealant: Manufacturer's standard hot-melt type.
 2. Tape Sealers: Manufacturer's standard non-curing butyl tape, AAMA 809.2.
 - G. Steel Sheet Miscellaneous Framing Components: ASTM C 645, with ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized zinc coating.
 - H. Roof Accessories: Approved by metal roof panel manufacturer. Refer to Section 07 72 00 – ROOF ACCESSORIES for requirements for curbs, equipment supports, roof hatches, heat and smoke vents, ventilators, and preformed flashing sleeves.

2.5 FABRICATION

- A. General: Provide factory fabricated and finished metal panels and accessories meeting performance requirements, indicated profiles, and structural requirements.
- B. Fabricate metal panel joints configured to accept factory-applied sealant providing weathertight seal and preventing metal-to-metal contact and minimizing noise resulting from thermal movement.
- C. Form panels in continuous lengths for full length of detailed runs, except where otherwise indicated on approved shop drawings.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings. Form from materials matching panel substrate and finish.

2.6 FINISHES

- A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's written instructions.

- B. Fluoropolymer Two-Coat System: 1.00 – 1.20 mil primer with 0.70 – 0.80 mil 70-percent PVDF fluoropolymer color coat, AAMA 621.
 - 1. Basis of Design: **Sherwin Williams Flurothane® Coastal Coating System (coil.sherwin.com)**
- C. Interior Finish: 0.5 mil total dry film thickness consisting of primer coat and wash coat of manufacturer's standard light-colored acrylic or polyester backer finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.
- B. Examine metal panel substrate and supports with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panel installation.
 - 1. Inspect metal panel support substrate to determine if support components are installed as indicated on approved shop drawings. Confirm presence of acceptable supports at recommended spacing to match installation requirements of metal panels.
 - 2. Panel Support Tolerances: Confirm that panel supports are within tolerances acceptable to metal panel system manufacturer but not greater than the following:
 - a. **¼ inch** in **20 foot** in any direction.
 - b. **3/8 inch** over any single roof plane.
- C. Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal roof panel system installation.

3.2 PREPARATION

- A. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.
- B. Remove protective film from surface of roof panels immediately prior to installation. Strip film carefully, to avoid damage to prefinished surfaces.

- C. Miscellaneous Supports: Install subframing, girts, furring, and other miscellaneous panel support members according to ASTM C 754 and manufacturer's written instructions.
- D. Flashings: Install flashings to cover exposed underlayment per Section 07 62 00 – SHEET METAL FLASHING AND TRIM.

3.3 METAL PANEL INSTALLATION

- A. Mechanically-Seamed, Standing Seam Metal Roof Panels: Install weathertight metal panel system in accordance with manufacturer's written instructions, approved shop drawings, and project drawings. Install metal roof panels in orientation, sizes, and locations indicated, free of waves, warps, buckles, fastening stresses, and distortions. Anchor panels and other components securely in place. Provide for thermal and structural movement.
- B. Attach panels to supports using clips, screws, fasteners, and sealants recommended by manufacturer and indicated on approved shop drawings.
 - 1. Fasten metal panels to supports with concealed clips at each location indicated on approved shop drawings, with spacing and fasteners recommended by manufacturer.
 - 2. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
 - 3. Provide weatherproof jacks for pipe and conduit penetrating metal panels of types recommended by manufacturer.
 - 4. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.

3.4 ACCESSORY INSTALLATION

- A. General: Install metal panel trim, flashing, and accessories using recommended fasteners and joint sealers, with positive anchorage to building, and with weather tight mounting. Provide for thermal expansion. Coordinate installation with flashings and other components.
 - 1. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.
 - 2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
 - 3. Provide concealed fasteners except where noted on approved shop drawings.

4. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.
- B. Joint Sealers: Install joint sealers where indicated and where required for weathertight performance of metal panel assemblies, in accordance with manufacturer's written instructions.
1. Prepare joints and apply sealants per requirements of Division 07 Section "JOINT SEALANTS".

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage an independent testing agency and inspecting agency acceptable to Architect to perform field tests and inspections and to prepare test reports.

3.6 CLEANING AND PROTECTION

- A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leave the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.
- B. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.
- C. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

END OF SECTION 07 41 13

SECTION 07 4647
FIBER-CEMENT SOFFITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fiber-cement, non-vented soffit. Cedarmill

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
2. Section 07 27 20 "Fluid Applied Air Barriers" for weather-resistive barriers.
3. Section 07 46 46 "Fiber-Cement Siding and Trim".
4. Section 07 92 00 "Joint Sealants" for sealing joints between adjacent construction and fixtures.
5. Section 09 91 13 "Exterior Painting" for field painting.

1.2 COORDINATION

- A.** Coordinate soffit installation with flashings and other adjoining construction to ensure proper sequencing.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Fiber-cement non-vented soffit.

- B.** Product Data Submittals: For each type of fiber-cement soffit. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- C.** Samples for Initial Selection: For fiber-cement soffits including related accessories.

D. Samples for Verification:

1. 12-inch- long-by-actual-width Sample of soffit.
2. 12-inch- long-by-actual-width Samples of trim and accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of fiber-cement soffit.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.
- C. Research/Evaluation Reports: For each type of fiber-cement siding required, from ICC-ES.
- D. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of fiber-cement soffit, including related accessories, to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with labels intact until time of use.
- B. Store materials on elevated platforms, under cover, and in a dry location.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including cracking and deforming.
 - b. Deterioration of materials beyond normal weathering.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain products, including related accessories, from single source from single manufacturer.

2.2 FIBER-CEMENT SOFFIT

- A. Fiber-Cement Soffit: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested in accordance with ASTM E136; with a flame-spread index of 25 or less when tested in accordance with ASTM E84.
 - 1. Manufacturers: Subject to compliance with requirements, provide products that may be incorporated into the Work include:
 - a. BASIS OF DESIGN: James Hardie Building Products, Inc.; HardieSoffit Non-Vented Cedarmill Soffit with batten strip.
 - 2. Nominal Thickness: Not less than 5/16 inch.
 - 3. Pattern: 24-inch- wide sheets with Cedarmill texture.
 - 4. Ventilation: Provide unperforated soffit.
 - 5. Factory Priming: Primed for paint.

2.3 ACCESSORIES

- A. Fasteners:
 - 1. For fastening fiber cement, use 316 stainless steel fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement soffit and related accessories.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 - 1. Do not install damaged components.

2. Install fasteners as required by Manufacturer in order to meet all applicable code requirements, including the windstorm code.
 3. Install panels in moderate contact at ends, provide battens.
- B. Install joint sealants as specified in Section 07 92 00 "Joint Sealants" and to produce a weathertight installation.

3.4 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07 46 46

SECTION 07 6200
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Formed Products:

- a. Formed roof drainage sheet metal fabrications.
- b. Formed equipment support flashing.
- c. Miscellaneous sheet metal accessories.
- d. Embedded metal thru-wall flashing.
- e. Gutters and downspouts.

B. Related Sections:

1. Section 04 20 00 "Masonry".
2. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
3. Section 07 41 13 "Metal Roof Panels"
4. Section 07 72 00 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.3 REFERENCES

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

1. A 153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware
2. A 240 - Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
3. A 653 - Steel Sheet, Zinc Coated, (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip process.
4. A 666 - Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.

5. A 755 - Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
 6. A 792 - Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 7. B 32B - Solder Metal.
 8. B 749 - Lead and Lead Alloy Strip, Sheet, and Plate Products.
 9. C 920 -Elastomeric Joint Sealants.
 10. C 1311B - Solvent Release Sealants.
 11. D 226 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 12. D 1187 - Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
 13. D 4397 - Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
 14. D 4586 - Asphalt Roof Cement, Asbestos-Free.
 15. D 4601 - Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.
- B. National Roofing Contractors Association (NRCA): Roofing and Waterproofing Manual.
 - C. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA): Architectural Sheet Metal Manual.
 - D. National Association of Architectural Metal Manufacturers (NAAMM): Metal Finishes Manual for Architectural and Metal Products

1.4 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies as indicated to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Edge Design: Fabricate and install parapet Copings that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist roof edge design pressure (P) as identified in ANSI/SPRI-ES-1, as calculated according to ASCE 7.
 1. Design Pressures: As per Engineer of Record calculations provided in the Construction Drawings.
- C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.
 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

- D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.5 ACTION SUBMITTALS

- A. Product List: Submit list of proposed Products and manufacturers, including all items specified in Part 2 – Products or otherwise required by the Work.
- B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- C. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:
 - 1. Identification of material, thickness, weight, and finish for each item and location in Project.
 - 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 - 3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 - 4. Details of termination points and assemblies, including fixed points.
 - 5. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 - 6. Details of special conditions.
 - 7. Details of connections to adjoining work.
 - 8. Detail formed flashing and trim at a scale of not less than 3 inches per 12 inches.
- D. Samples for Initial Selection: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified fabricator.
- B. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.
- C. Warranty: Sample of special warranty.

1.7 QUALITY ASSURANCE

- A. General: Work of this Section to physically protect membrane roofing, base flashings, and expansion joints from damage that would permit water leakage to building interior.
- B. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance, with three years minimum experience.
- C. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.
- D. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
 - 2. Review methods and procedures related to sheet metal flashing and trim.
 - 3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 - 4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing.
 - 5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- C. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- D. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.9 COORDINATION

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

- B. Coordinate installation of flanged metal components, including gravel guards, pitch pans, and accessories to ensure strip-in with hot bitumen (where applicable) on same day they are installed.
- C. Schedule work to avoid storage on, and traffic over finished work.

1.10 WARRANTY

- A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.
- B. Metallic-Coated Steel Sheet Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.
 - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 coating designation; structural quality.
 - 2. Aluminum-Zinc Alloy-Coated (Galvalume) Steel Sheet: ASTM A 792, Class AZ50 coating designation, Grade 40; structural quality.
 - 3. Thickness: 24 Gauge.
 - 4. Surface: Smooth, flat.
- C. Prepainted Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.
 - 1. Aluminum-Zinc Alloy-Coated (Galvalume) Steel Sheet: ASTM A 792, Class AZ50 coating designation, Grade 40; structural quality.
 - 2. Thickness: 24 Gauge.

3. Surface: Smooth, flat.
 4. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Minimum Exposure Tests:
 - 1) Humidity Resistance: 2000 hours.
 - 2) Salt-Spray Resistance: 2000 hours.
 5. Color:
 - a. As selected by Architect from manufacturer's full range.
 6. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.
- D. Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet.

2.2 UNDERLAYMENT MATERIALS

- A. "Dry" Sheet Membrane: Polystick MTS Plus High Temp Self-adhesive.
- B. Separation Sheet for Preservative Treated Wood: Polystick MTS Plus High Temp Self-adhesive.
- C. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- D. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

- a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
- 2. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 - 3. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Hot-dip galvanized steel according to ASTM A 153 or ASTM F 2329 or Series 300 stainless steel.
 - 4. Rust-resistant and compatible with materials to be joined.
 - 5. Length: As required for thickness of material to penetrate substrate 1/2-inch minimum.

C. Fasteners And Anchors

- 1. General Requirements:
 - a. All types of “powder-actuated” fastening systems, “hammer drive” fastening systems, “ram-set” systems and similar type fastening systems are strictly prohibited from use on the project for permanent or temporary fasteners into permanent building components, except as indicated on Drawings or as specifically approved by the Architect.
 - b. All types of permanent or temporary fastening systems or components which are not removable without damage to permanent building components are strictly prohibited from use, except as indicated (example: concrete nails, clinched double nails in concrete pilot holes, rawl spikes, zamac nailins, etc.)
 - c. Wedge type expansion anchors are prohibited at all locations where wedging action would cause spalling or damage to permanent building components.
 - d. Plastic or nylon sleeves, nailins, plugs, cores, etc. are not acceptable as fastener components where exposed to weather.
 - e. All fasteners and other components exposed to weather or in exterior locations must be stainless steel, Monel or other approved corrosion-resistant material or finish. Cadmium-plated or electro-galvanized finishes are not acceptable.
 - f. All fasteners installed in or in contact with type ACQ treated lumber (Yellowwood) must be Type 316 stainless steel or be specifically approved for installation in ACQ treated materials.
 - g. Regardless of the fastening system utilized, the Contractor is responsible for sizing, frequency and spacing of fasteners according to substrate, load conditions and acceptable engineering practices and Texas Department of Insurance Windstorm Requirements.
- 2. Bolts, Nuts and Washers: ASTM A325, galvanized to ASTM A153 for galvanized components, stainless steel for stainless steel components.
- 3. Hardened Steel Self-Threading Screw Anchor (“Tapcon” Anchors): Anchorage to solid or hollow masonry and concrete, stainless steel at exterior locations.

4. Epoxy Resin Adhesive Type: Threaded studs in concrete, brick or concrete masonry, stainless steel.
 5. Buildex TEKS self-drilling screws or type required for anchorage to steel.
 6. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing, corrosion-resistant coating.
- D. Roofing Nails: Stainless steel (for fastening into ACQ treated lumber), hot-dipped galvanized or non-ferrous type for fastening into non-treated lumber); with annular rings, size as required to suit application; minimum 11-gage with 3/8-inch diameter head.
- E. Mechanical Fasteners for Sheet Metal to Metal Fabrications (Support Framing) Anchorage: Appropriate for purpose intended, size as required to suit application and achieve positive anchorage to substrate material.
- F. Solder:
1. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.
 2. For Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
 3. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.
- G. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2-inch-wide and 1/8 inch thick.
- H. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; low modulus, as specified in Division 07 Section "Sealants (for Roofing)"; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- I. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- J. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.
- K. Splash Blocks: Precast concrete of size and profile indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment; suitable for downspouts discharging at grade level or onto roof surface.

2.4 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design,

dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

- B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 1. Obtain field measurements for accurate fit before shop fabrication.
- C. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 - 1. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.
- D. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- E. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.
- F. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.
 - 1. Fabricate all components with allowance for expansion at joints. Provide enlarged or oval holes at all piercing fasteners.
- G. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- H. Form all sheet metal components (except corners) in longest practical length up to 10-foot maximum; true to shape, square, accurate in size, and free from distortion or defects detrimental to appearance or performance.
- I. Fabricate corners on all sheet metal components (gravel guards, copings, cap flashings, etc.) to form one piece with minimum 18-inch and maximum 36-inch long legs.
- J. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
 - 1. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.

- K. Soldered Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- L. Unsoldered Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- M. Hem exposed edges of metal 1/2-inch; miter and seam corners.
- N. Fabricate vertical faces with bottom edge formed outward 3/4-inch at 30 degrees and hemmed to form drip.
 - 1. Where vertical height exceeds 8-inches, fabricate with stiffing grooves in accordance with SMACNA, unless specifically approved otherwise.
- O. Form all sheet metal material to provide watertight joints:
 - 1. Unprotected Horizontal Surfaces (expansion joint covers, etc.): Standing seam or drive cleat joints.
 - 2. Vertical Surfaces (copings, cap flashings, gravel guards, etc.): Flat lock or cover and backer plate seams.
- P. Miter all sheet metal corners and solder, weld, or fasten and seal all joints watertight:
 - 1. Prepainted metallic-coated steel sheet: Apply minimum 1/4-inch bead of sealant between connecting metal flanges and drill and fasten with rivets at 2-inches o.c.
 - 2. Stainless Steel: Solder joints watertight.
 - 3. Unfinished Galvanized Steel: Solder joints watertight.
 - 4. After soldering, remove flux. Wipe and wash solder joints clean.
 - 5. Install sealant so it will not be visible on outside of joints.
- Q. Fabricate elements complete with required connection pieces.
- R. Fabricate all components with horizontal (flat) surfaces with built-in slope for drainage toward roof unless indicated otherwise.
- S. Do not use graphite pencils to mark metal surfaces.

2.5 EMBEDDED METAL THRU-WALL FLASHING

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
 - 1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch thick.

2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 ft. Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
4. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
5. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
6. Solder metal items at the corners.

2.6 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in 32-foot long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters. Powder coated 316 stainless steel, fully welded to match exterior wall.

1. Gutter Style: SMACNA designation A.
 - a. Size: Designed to meet roof drainage area, rainfall intensity criteria, and downspout size and spacing.
 - b. Supports: Minimum 1/8-inch x 1-inch Brackets and 0.1046 inch (12 gage) spacers at maximum 36-inches oc, staggered.
 - c. Join sections with riveted and sealed or soldered joints.
2. Expansion Joints: Lap type.
 - a. Spacing: Minimum twenty (20) feet, maximum fifty (50) feet between expansion joints.
3. Accessories: Wire ball downspout strainer.
4. Gutters with Girth up to 6-Inches: Fabricate from the following materials:
 - a. Aluminum-zinc alloy-coated steel complying with ASTM A792/A792M; 24-gauge minimum.
 - b. Fluoropolymer Two-Coat Systems: Sherwin Willaims Flurothane® Coastal Coating System.
5. Gutters with Girth 6-15 Inches: Fabricate from the following materials:
 - a. Aluminum-zinc alloy-coated steel complying with ASTM A792/A792M; 24-gauge minimum.
 - b. Finish: Fluoropolymer Two-Coat Systems: Sherwin Willaims Flurothane® Coastal Coating System.

- B. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
1. Fabricated Hanger Style: SMACNA figure designation 1-35A.
 2. Size: Designed to accept roof drainage area, rainfall intensity criteria, and downspout spacing.
 3. Length: Minimum twenty (20) feet or required height, maximum fifty feet between expansion joints.
 4. Joints: Sections with riveted and sealed or soldered joints.
 5. Supports: 12 Gage straps at maximum 8-feet oc. All strap edges rolled or smooth.
 6. Fabricate from the following materials:
 - a. Aluminum-zinc alloy-coated steel complying with ASTM A792/A792M; 24-gauge minimum.
 - b. Finish: Fluoropolymer Two-Coat Systems: Sherwin Willaims Flurothane® Coastal Coating System.
- C. Fabricate gutter and downspout accessories seal watertight.
- D. Eave and Rake Drip Flashing: Fabricate from the following materials:
1. Aluminum-zinc alloy-coated steel complying with ASTM A792/A792M; 24-gauge minimum.
 2. Finish: Fluoropolymer Two-Coat Systems: Sherwin Willaims Flurothane® Coastal Coating System.
- E. Counterflashing: Fabricate from the following materials:
1. Aluminum-zinc alloy-coated steel complying with ASTM A792/A792M; 24-gauge minimum.
 2. Finish: Fluoropolymer Two-Coat Systems: Sherwin Willaims Flurothane® Coastal Coating System
- F. Flashing Receivers: Fabricate from the following materials:
1. 316 Stainless Steel: 0.019 inch (26-gage) thick.
- G. Roof-Penetration Flashing: Fabricate from the following materials:
1. 316 Stainless Steel: 0.019 inch (26-gage) thick.
- H. Soil Pipe Flashing: Fabricate from the following material:
1. Lead: 4.0 lb/sq. ft., hard tempered.
- I. Concealed Continuous Cleats: Galvanized Steel Sheet: 20-gage thick.

- J. Parapet Scuppers: Fabricate scuppers to dimensions required with closure flange trim to exterior, 4-inch wide wall flanges to interior, and base extending 4-inches beyond cant or tapered strip into field of roof.

2.7 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:
 - 1. Aluminum-zinc alloy-coated steel complying with ASTM A792/A792M; 24-gauge minimum.
 - 2. Finish: Fluoropolymer Two-Coat Systems: Sherwin Williams Flurothane® Coastal Coating System.

2.8 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Exposed to View (Unfinished) Galvanized Steel Components: Paint to match prepainted metallic-coated steel prior to installation:
 - 1. Clean: Comply with SSPC-1 - Solvent Wipe.
 - 2. Primer: Apply specified or finish paint manufacturer's recommended primer in accordance with manufacturer's instructions.
 - 3. Finish Coat: Sherwin Williams Flurothane® Coastal Coating System.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.

2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 3. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
 4. Verify membrane termination and base flashings are in place, sealed, and secure.
- B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

- A. General: Install underlayment as recommended by SMACNA and as indicated on Drawings.
- B. Underlayment: Install underlayment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.3 INSTALLATION, GENERAL

- A. Field measure site conditions prior to fabricating work.
- B. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 3. Provide continuous cleats fastened not more than 12-inches on center. Anchor cleats with a minimum two fasteners.
 4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
 5. Install sealant tape where indicated.
 6. Torch cutting of sheet metal flashing and trim is not permitted.
 7. Do not use graphite pencils to mark metal surfaces.

- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
1. Coat back side of stainless-steel and lead sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - a. Minimum Dry Film Thickness: 15-mils.
 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.
 3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- D. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10-feet. Provide joints within 18- to 36inches of all corners or intersections. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1inch deep, filled with elastomeric sealant concealed within joints.
- E. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws; and metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance:
1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
 2. Stainless Steel: Use stainless-steel fasteners.
- F. Seal joints as shown and as required with elastomeric sealant for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants (for Roofing)."
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches except reduce pre-tinning where pre-tinned surface would show in completed Work.
1. Do not solder pre-painted metallic-coated steel sheet.

2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 3. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
- H. Rivets: Rivet joints where indicated and where necessary for strength.
- I. Protect all membrane penetrations as indicated and as recommended in SMACNA and NRCA manuals.

3.4 EMBEDDED THRU-WALL FLASHING

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install reglets and nailers for flashing and other related construction where they are indicated to be built into masonry.
- C. Install flashing as follows unless otherwise indicated:
1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and 1-1/2 inches into the inner wythe. Form 1/4-inch hook in edge of flashing embedded in inner wythe.
 3. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under water-resistive barrier or air barrier, lapping at least 4 inches. Fasten upper edge of flexible flashing to sheathing through termination bar.
 4. At lintels and shelf angles, extend flashing 6 inches minimum, to edge of next full unit at each end. At heads and sills, extend flashing 6 inches minimum, to edge of next full unit and turn ends up not less than 2 inches to form end dams.
 5. Interlock end joints of sawtooth sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.

6. Install metal drip edges with sawtooth sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.
 7. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
 8. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- D. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

3.5 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with elastomeric sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets and straps spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
1. Fasten gutter spacers to front and back of gutter.
 2. Loosely lock straps to front gutter bead and anchor to roof deck.
 3. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24-inches apart.
 4. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.
- C. Downspouts: Join sections with 1-1/2-inch telescoping joints.
1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c. in between.
 2. Connect downspouts to underground drainage system where available.
 3. Provide opening at base of downspout to direct water away from building.
 4. Set splash blocks under downspouts not connected to underground drainage system.

3.6 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install starter and edge strips, and cleats before starting installation.
 2. Strip in all sheet metal flanges the same day they are installed.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces specified in Part 1 and as indicated.
1. Backer Plates: Secure with fasteners suitable for substrate, 6-inches o.c. each face.
 2. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 12-inch centers.
 3. Apply 1/4-inch bead of sealant between each layer of metal at each edge.
 4. Cover Plates: Hook front or exposed face of cover plate over drip edge.
 5. Do not use mastic between sheet metal components.
- C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4inches over base flashing. Install stainless-steel draw band and tighten.
- D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4inches over base flashing. Lap counterflashing joints a minimum of 4inches and bed with elastomeric sealant.
1. Sawcut new reglets where required.
 - a. Provide bayonet style lap joints, minimum 4-inch overlap.
 - b. Fill voids between wedges with backer rod.
 - c. Seal receiver to vertical face of wall.
 2. Secure in a waterproof manner by means of snap-in installation and sealant or plastic wedges and sealant.
 3. Install surface mounted reglets true to lines and levels.
 - a. Seal top of reglets with sealant.
 - b. Secure in place with neoprene head screws at maximum 12-inches on center.
- E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
1. Install lead flashings at all soil pipe penetrations. Turn lead flashing down inside piping, being careful not to block vent piping with flashing.

2. Provide Penetration Seal System at all small penetrations not otherwise detailed.
 - a. Clean roof surfaces to receive Penetration Seal Systems.
 - b. Clean pipes and penetrating elements to remove plastic cement, bitumen, and other contaminants by wire brushing and scraping.
 - c. Caulk around penetrating elements with curb adhesive.
 - d. Apply beads of curb adhesive to flat side of first precast curb component. Place caulked curb onto roof surface to form half circle around penetrating element.
 - e. Apply beads of curb adhesive to flat side and to scarf joints of second precast curb component. Place second section of curb onto roof surface to form circle with first section. Press scarf joints together firmly and press both sections down.
 - f. Apply continuous bead of curb adhesive around outside edge of curb at roof.
 - g. Fill around penetrating element with pourable sealant to top of curb.
 3. Pitch pans are not desired. Install only where specifically indicated, or approved by Architect. Provide flanged umbrellas at all pitch pans.
 - a. Fill with non-shrink grout to 1-inch from top of flange.
 - b. Top with Pitch Pan Filler - Sealant Type ES-2.
 4. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.
- F. Protect all membrane penetrations as indicated and as recommended in SMACNA and NRCA manuals.

3.7 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.8 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.9 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.10 SCHEDULE - MATERIALS

- A. Exposed to View Components:
 - 1. One-Piece Flashing and Expansion Joint Terminations: Metallic coated steel sheet, powder coated to match adjacent prepainted metallic-coated steel sheet components.
 - 2. All Other Components: Metallic coated steel sheet, powder coated to match adjacent prepainted metallic-coated steel sheet components.
- B. Concealed from View Components, (Counterflashings, Expansion Joint Covers, Etc.): Stainless steel sheet.
- C. Roof Penetration Flashings: Stainless steel sheet.

END OF SECTION 07 62 00

SECTION 07 9200

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Urethane joint sealants.
 - 2. Mildew-resistant joint sealants.
 - 3. Latex joint sealants.

1.2 ACTION SUBMITTALS

- A. Product data.
- B. Samples: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-sealant schedule.

1.3 CLOSEOUT SUBMITTALS

- A. Warranty Documentation:
 - 1. Manufacturers' special warranties.
 - 2. Installer's special warranties.

1.4 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
- B. Urethane, M, NS, 25, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Use NT.

2.3 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

2.4 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

2.5 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, Type O (open-cell material), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant

manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Other porous joint substrates.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
 - e. Other nonporous joint substrates.

- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.
- G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.
- H. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.3 JOINT-SEALANT SCHEDULE

- A. Exterior joints in horizontal traffic surfaces:
1. Joint Locations (Joint sealants in paved roads, parking lots, walkways and curbing are specified in Division 32 of the specifications):

- a. Isolation and contraction joints in cast-in-place concrete slabs.
 - b. Tile control and expansion joints.
 - c. Joints between different materials listed above.
 - d. Other joints as indicated on Drawings.
- 2. Joint Sealant: Urethane, M, P, 50, T, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Exterior joints in vertical surfaces and horizontal nontraffic surfaces:

- 1. Joint Locations:
 - a. Control and expansion joints in unit masonry.
 - b. Joints between metal panels.
 - c. Joints between different materials listed above.
 - d. Perimeter joints between materials listed above and frames of doors, windows and louvers.
 - e. Control and expansion joints in ceilings and other overhead surfaces.
 - f. Other joints as indicated on Drawings.
- 2. Joint Sealant: Urethane, S, NS, 12, NT.
- 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Interior joints in horizontal traffic surfaces:

- 1. Joint Locations:
 - a. Control and expansion joints in tile flooring.
 - b. Other joints as indicated on Drawings.
- 2. Joint Sealant: Urethane, S, P, 25, T, NT.
- 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Interior joints in vertical surfaces and horizontal nontraffic surfaces:

- 1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Tile control and expansion joints.
 - c. Vertical joints on exposed surfaces of unit masonry walls and partitions.
 - d. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
 - e. Other joints as indicated on Drawings.
- 2. Joint Sealant: Urethane, S, NS, 25, NT.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces:
1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07 92 00

SECTION 08 1116
ALUMINUM DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section Includes:
 - 1. Glazed aluminum doors.
 - 2. Aluminum frames.
 - 3. Glazing.
- C. Related Requirements:
 - 1. Section 07 92 00 – Joint Sealants
 - 2. Section 08 12 13 – Hollow Metal Frames: Fire rated door frames.
 - 3. Section 08 71 00 – Door Hardware: Hardware for aluminum doors.
 - 4. Section 08 80 00 – Glazing: Glazing materials for aluminum doors and frames.

1.2 REFERENCE STANDARDS

- A. AAMA 609 & 610 – Cleaning and Maintenance Guide for Architecturally Finished Aluminum; current edition.
- B. AAMA 611 – Voluntary Specification for Anodized Architectural Aluminum; current edition.
- C. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; current edition.
- D. ADA Standards – Americans with Disability Act (ADA) Standards for Accessible Design; current edition.
- E. ASTM A123/A123M – Standard Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; current edition.
- F. ASTM B209/B209M – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; current edition.

- G. ASTM B221/B221M – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; current edition.
- H. ASTM E90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; current edition.
- 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; current edition.
- J. ASTM E331 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; current edition.
- K. ASTM E1996 – Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes; current edition.
- L. ASTM E2112 – Standard Practice for Installation of Exterior Windows, Doors, and Skylights; current edition.
- M. ICC A117.1 – Accessible and Usable Buildings and Facilities; current edition.

1.3 SUBMITTALS

- A. See Section 01 33 00 – Submittal Procedures.
- B. Product Data: Manufacturer's descriptive literature for each type of door; include information on fabrication methods.
- C. Shop Drawings: Include elevations of each opening type.
 - 1. Verify dimensions by field measurements before fabrication and indicate on shop drawings.
- D. Selection Samples: Complete set of color and finish options, using actual materials, for Architect's selection.
- E. Test Report: Submit certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.
- H. Warranty: Submit manufacturer warranty and ensure that forms that have been completed in Owner's name and registered with manufacturer.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver aluminum components in manufacturer's standard protective packaging, palletized, crated, or banded together.
- B. Inspect delivered components for damage and replace. Repaired components will not be accepted.
- C. Store components in clean, dry, indoor area, under cover in manufacturer's packaging until installation.
- D. Protect materials and finish from damage during handling and installation.

1.6 WARRANTY

- A. See Section 01 78 00 – Closeout, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FRP/ALUMINUM HYBRID DOORS

- A. Manufacturer: Special-Lite, Inc.; P.O. Box 6, Decatur, Michigan 49045; Toll Free: (800) 821-6531; www.special-lite.com
- B. Aluminum Man Door: Model: Special-Lite SL-15 Wide Stile Monumental Door
 - 1. Door Thickness: 1-3/4 inches
 - 2. Stiles:
 - a. 4-3/4 inches wide with integral glass stop on exterior side, no snap or applied stops allowed.
 - b. Aluminum extrusions made from 6063 aluminum alloys with a minimum temper of T5.
 - c. Screw or snap in place applied caps are not acceptable.
 - d. Meeting stiles to include integral pocket to accept pile brush weather seal.

3. Rails:
 - a. Top Rail: 6-1/2 inches
 - b. Bottom Rail: 10-inch ADA complaint
 - c. Integral glass stops on exterior side, no snap or applied stops allowed.
 - d. Aluminum extrusions made from 6063 aluminum alloys with a minimum temper of T5.
 - e. Screw or snap in place applied caps are not acceptable.
 4. Corners:
 - a. True mortise and tenon joints.
 - b. Secured with 3/8 inch diameter full-width steel tie rod.
 - c. Weld, glue, or other methods of corner joinery are not acceptable.
 5. Mid Rail:
 - a. Width: 6-1/2 inch
 - b. One-piece extrusion with integral exterior glass stops.
 - c. Secure to vertical stiles with mortise and tenon joints with 3/8 inch steel tie rods and locking hex nuts.
 6. Finish: Wood Grain Expression Aluminum Finish.
 7. Hardware:
 - a. Pre-machine doors in accordance with templates from specified hardware manufacturer.
 - b. Surface mounted closures will be reinforced for, but not prepared or installed at factory.
 - c. Factory install door hardware.
- C. FRP/Aluminum Hybrid Man Door: Special-Lite SL-19 Rustic Wood Grain Hybrid FRP Door.
1. Door Thickness: 1-3/4"
 2. Stiles and Rails:
 - a. Aluminum extrusions made from 6063 aluminum alloys with a minimum temper of T5.
 - b. Minimum 2-5/26" deep one-piece extrusion will have integral reglets to accept faces sheet on both interior and exterior sides of door which secure face sheet into place and permit flush appearance.
 - c. Screw or snap in place caps are not acceptable.
 - d. Top rails must have integral legs for interlocking continuous extruded aluminum flush cap.
 - e. Bottom rails must have integral legs for interlocking continuous weather bar with single nylon brush weather stripping or manually adjustable SL-301 door bottom with two nylon brush weather stripping.
 - f. Meeting stiles to include integral pocket to accept pile brush weather seal.

3. Corners:
 - a. Mitered.
 - b. Secured with 3/8-inch diameter full-width steel tie rod through extruded splines tops and bottom which are integral to standard tubular shaped rails.
 - c. 1-1/4" x 1-1/4" x 3/16" 6061 aluminum angle reinforcement at corner to give strong, flat surface for locking hex nut to bear on.
 - d. Weld, glue, or other methods of corner joinery are not acceptable.
4. Core:
 - a. Poured-in-place polyurethane foam.
 - b. Laid-in foam cores are not acceptable.
5. Face Sheet:
 - a. Interior and Exterior: 0.120" thick, rustic wood grain, stained FRP sheet.
 - b. Attachment of face sheet:
 - 1) Extruded stiles and rails to have integral reglets to accept face sheet on both interior and exterior side of door which secure face sheet into place and permit flush appearance.
 - 2) Use of glue to bond face sheet to core or extrusions is not acceptable.
6. Cutouts:
 - a. Manufacture doors with cutouts for required vision lites, louvers, and panels.
7. Hardware:
 - a. Pre-machine doors in accordance with templates from specified hardware manufacturers.
 - b. Surface mounted closures will be reinforced for but not prepared or installed at factory.
 - c. Factory install door hardware.
8. Reinforcements:
 - a. Aluminum extrusions made from 6063 aluminum alloys.
 - b. Sheet and plate to conform to ASTM B209.
 - c. Alloy and temper to be selected by manufacturer for strength, corrosion resistance, and application of required finish, and control of color.
 - d. Bars and tubes to meet ASTM B221.

D. FRP/Aluminum Hybrid (Fire-Rated): Special-Lite SL-19FR Contemporary Wood Grain Fire-Rated Fiberglass Door

1. Rated for 20-to-90-minute maximum duration.
2. Size: 3'x6" x 8'x0" maximum size single swing.
3. Door Thickness: 1-7/8" at door edge.
4. Single Swing: Hinge and lock stile, 2" minimum tectonite.
5. Rails:

- a. Top Rail: 6" minimum tectonite.
 - b. Bottom Rail: 4" minimum tectonite.
- 6. Core:
 - a. WSCP-412 proprietary mineral core.
 - b. 1-1/2" nominal thickness.
 - c. 18 pcf minimum density.
- 7. Face Sheet:
 - a. Interior and Exterior: 0.120" thick, contemporary wood grain, stained FRP sheet.
- 8. Edge Channels:
 - a. 0.062" thick, 3/4" leg, stainless steel edge channel.
 - b. Applied to entire perimeter of the door.
 - c. Sealed by 3M CP 25WB + Fire Barrier caulk applied to the inside edges of all steel edge channels.
- 9. Cutouts:
 - a. Manufacture doors with cutouts for required vision lites per the manufacturer's listing.
- 10. Hardware:
 - a. Pre-machine doors in accordance with templates from specified hardware manufacturer.
 - b. Field apply factory supplied gaskets and seals, full width intumescent and smoke seal required at top of door, smoke seals required on both jambs.

2.2 FRAMES

A. Frame: Aluminum Tube Framing with Applied Stops.

- 1. Perimeter Frame Members:
 - a. Box type with four (4) enclosed sides.
 - b. Factory fabricated.
 - c. Open-back framing is not acceptable.
- 2. Applied Door Stops:
 - a. 5/8" x 1-1/4" wall thickness, with screws and weatherstripping.
 - b. Provide solid 1/2" aluminum bar behind door stop for closer shoe attachment.
 - c. Pressure gasketing for weathering seal.
 - d. Counterpunch fastener holes in door stop to preserve full-metal thickness under fastener head.

3. Caulking:
 - a. Caulk joints before assembling frame members.
 4. Frame Member to Member Connections:
 - a. Secure joints with fasteners.
 - b. Provide hairline butt joint appearance.
 5. Hardware:
 - a. Pre-machine and reinforce frame members for hardware in accordance with manufacturer's standards and door hardware schedule.
 - b. Surface mounted closures will be reinforced for but not prepared or installed at factory.
 - c. Factory install door hardware.
 6. Anchors:
 - a. Anchors appropriate for wall conditions to anchor framing to wall materials.
 - b. Door Jamb and Header Mounting Holes: Maximum of 24-inch centers.
- B. Secure head and sill members of transom, side lites, and similar conditions.

2.3 PERFORMANCE REQUIREMENTS

- A. Provide door assemblies that have been designed and fabricated in compliance with specified performance requirements.
- B. Wind-Borne-Debris Resistance: Identical full-size glazed assembly without auxiliary protection, tested by independent agency in accordance with ASTM E1996 and Wind Zone 1 – Enhanced Protection for Large and Small Missile impact and pressure cycling at design wind pressure.
- C. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure of 7.5 psf.
- D. Air Leakage: Maximum of 0.1 cu.ft./min/sq.ft. at 6.27 psf differential pressure, when tested in accordance with ASTM E283.
- E. Condensation Resistance Factor: 50, measured in accordance with AAMA 1503.
- F. Overall U-value, Including Glazing: 0.35, minimum, measured on exterior door size required for this project.
- G. Acoustical Performance: Sound Transmission Class (STC) of 25, minimum, when tested in accordance with ASTM E90.

2.4 MATERIALS

- A. Aluminum Sheet: ASTM B209/B209M, alloy 5005, temper H14, stretcher leveled.
- B. Extruded Aluminum: ASTM B221/B221M, alloy 6063, temper T5, or alloy 6463, temper T5.

2.5 ACCESSORIES

- A. Fasteners: Aluminum, non magnetic stainless steel, or other material warranted by manufacturer as non-corrosive and compatible with aluminum components.
- B. Brackets and Reinforcements: Manufacturer's high-strength aluminum units where feasible, otherwise, non-magnetic stainless steel or steel hot-dip galvanized in compliance with ASTM A123/A123M.
- C. Thresholds:
 - 1. **Install aluminum, ADA/TAS compliant thresholds at all doors; ½" maximum with 1:2 slope.**

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that wall surfaces and openings are ready to receive frames and are within tolerances specified in manufacturer's instructions.

3.2 PREPARATION

- A. Perform cutting, fitting, forming, drilling, and grinding of frames as required for project conditions.
- B. Replace components with damage to exposed finishes.
- C. Separate dissimilar metals to prevent electrolytic action between metals.

3.3 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and approved shop drawings.
- B. Install exterior doors and frames in accordance with ASTM E2112.

- C. Set frames plumb, square, level, and aligned to receive doors. Anchor frames to adjacent construction in strict accordance with manufacturer's recommendations and within specified tolerances.
- D. Where aluminum surfaces contact metals other than stainless steel, zinc, or small areas of white bronze, protect from direct contact by painting dissimilar metal with heavy coating of bituminous paint.
- E. Hang doors and adjust hardware to achieve specified clearances and proper door operation.
- F. Install door hardware as specified in Section 08 71 00.
- G. Comply with glazing installation requirements of Section 08 80 00.

3.4 CLEANING

- A. Upon completion of installation, thoroughly clean door and frame surfaces in accordance with AAMA 609 and 610.
- B. Do not use abrasive, caustic, or acid cleaning agents.

3.5 PROTECTION

- A. Protect products of this section from damage caused by subsequent construction until Date of Substantial Completion.
- B. Replace damaged or defective components that cannot be repaired to a condition indistinguishable from undamaged components.

END OF SECTION 08 11 16

SECTION 08 1213
HOLLOW METAL FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal frames for non-hollow metal doors.
- B. Fire-rated hollow metal frames for non-hollow metal doors.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware: Hardware, silencers, and weatherstripping.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.
- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2016.
- G. 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; 2017.
- H. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2016.
- I. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- J. ITS (DIR) - Directory of Listed Products; current edition.
- K. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
- L. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
- M. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.
- N. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.
- O. UL (DIR) - Online Certifications Directory; Current Edition.
- P. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.

- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- E. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store in accordance with applicable requirements and in compliance with standards and/or custom guidelines as indicated.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 DESIGN CRITERIA

- A. Refer to Door and Frame Schedule on the drawings for frame sizes, fire ratings, sound ratings, finishing, door hardware to be installed, and other variations, if any.
- B. Door Frame Type: Provide hollow metal door frames with integral casings.
- C. Steel used for fabrication of frames shall conform to one or more of the following requirements; galvanized steel conforming to ASTM A653/A653M, cold-rolled steel conforming to ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel conforming to ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.
- D. Accessibility: Conform to ICC A117.1 and ADA Standards and TAS Standards.
- E. Combined Requirements: If a particular door and frame unit is indicated to conform to more than one type of requirement, conform to the specified requirements for each type; for instance, an exterior frame that is also indicated as being sound-rated must conform to the requirements specified for exterior frames and for sound-rated frames; where two requirements conflict, conform to the most stringent.
- F. Hardware Preparations, Selections and Locations: Comply with BHMA A156.115, NAAMM HMMA 830, NAAMM HMMA 831 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

2.02 HOLLOW METAL DOOR FRAMES WITH INTEGRAL CASINGS

- A. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 3 - Extra Heavy-duty.
 - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.

- B. Fire-Rated Door Frames: Full profile/continuously welded type.
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 3 - Extra Heavy-duty.
 - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
 - 2. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C or NFPA 252 ("positive pressure fire tests").
 - 3. Provide units listed and labeled by ITS (DIR) or UL (DIR).
 - a. Attach fire rating label to each fire rated unit.
 - 4. Frame Finish: Factory primed and field finished.

2.03 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.04 ACCESSORIES

- A. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.
- B. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

- A. Install frames in accordance with manufacturer's instructions and related requirements of specified frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Install door hardware as specified in Section 08 7100.

3.03 TOLERANCES

- A. Maximum Diagonal Distortion: 1/16 inch measured with straight edges, crossed corner to corner.

3.04 SCHEDULE

- A. Refer to Door and Frame Schedule on the drawings.

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 REFERENCE STANDARDS

- A. UL (FRD) - Fire Resistance Directory; Current Edition.

1.03 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.
- D. Manufacturer's Installation Instructions: Indicate installation requirements.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

- A. Wall-Mounted Units:
 - 1. Location: Allow for 6 wall-mounted units. Coordinate with Architect..
 - 2. Material: 316 Stainless Steel, powder coated.
 - 3. Size: 12 inch by 12 inch.
 - 4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 - 5. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
 - 6. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
 - 7. Masonry Mounting Criteria: Provide surface-mounted frame with door surface flush with frame surface.
- B. Wall-Mounted Units in Wet Areas:
 - 1. Location: Allow for 6 wall-mounted units in Wet Areas. Coordinate with Architect.
 - 2. Material: 316 Stainless Steel, powder coated.
 - 3. Size: 12 inch by 12 inch.
 - 4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 - 5. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.
 - 6. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
 - 7. Masonry Mounting Criteria: Provide surface-mounted frame with door surface flush with frame surface.
- C. Fire-Rated Wall-Mounted Units:
 - 1. Location: Allow for 6 fire-rated wall-mounted units. Coordinate with Architect.

2. Wall Fire-Rating: As indicated on drawings.
 3. Material: 316 Stainless Steel, powder coated.
 4. Size: 12 inch by 12 inch.
 5. Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle.
- D. Ceiling-Mounted Units:
1. Location: Allow for 6 ceiling-mounted units. Coordinate with Architect.
 2. Material: 316 Stainless Steel, powder coated.
 3. Size - Other Ceilings: 30 inch by 30 inch.
 4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
- E. Fire-Rated Ceiling-Mounted Units:
1. Location: Allow for 6 fire-rated ceiling-mounted units. Coordinate with Architect.
 2. Ceiling Fire-Rating: As indicated on drawings.
 3. Material: 316 Stainless Steel, powder coated.
 4. Size: 30 inch by 30 inch.
 5. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

2.02 WALL AND CEILING MOUNTED UNITS

- A. Wall and Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
1. Style: Exposed frame with door surface flush with frame surface.
 2. Door Style: Single thickness with rolled or turned in edges.
 3. Frames: 16 gage, 0.0598 inch, minimum thickness.
 4. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
 - a. Provide certificate of compliance from authorities having jurisdiction indicating approval of fire rated doors.
 5. Primed and Factory Finish: Polyester powder coat; color as selected from Manufacturer's full line of colors .
 6. Door/Panel Size: As indicated on the drawings.
 7. Hardware:
 - a. Hardware for Fire-Rated Units: As required for listing.
 - b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
 - c. Latch/Lock: Tamperproof tool-operated cam latch.

PART 3 EXECUTION

3.01 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 7100

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUBMITTALS

- A. See Section 01 33 00 – Submittal Procedures.
- B. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
- C. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.3 DESIGN AND PERFORMANCE CRITERIA

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.
- C. Provide door hardware products that comply with the following requirements:
 - 1. Applicable provisions of federal, state, and local codes.
 - 2. Fire-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings, indicated, based on testing at positive pressure in accordance with NFPA 252 or UL10C.
 - 3. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), testing firm acceptable to authorities having jurisdiction, or as suitable for application indicated.

PART 2 - PRODUCTS

2.1 REFER TO DRAWINGS FOR HARDWARE SCHEDULE

PART 3 - EXECUTION

3.1 INSTALLATION

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

END OF SECTION 08 71 00

SECTION 09 2216
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

1. Ceiling in Mechanical Room shall be installed in accordance with UL P523 (1 hour fire-rated).

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with AISI S220 and ASTM C645, Section 10 for conditions indicated.

1. Steel Sheet Components: Comply with AISI S220 and ASTM C645, Section 10 requirements for metal unless otherwise indicated
 2. Protective Coating: Comply with AISI S220; ASTM A653/A653M, G40; or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.
 - a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.
- B. Studs and Track: AISI S220 and ASTM C645, Section 10.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ClarkDietrich.
 - b. Marino\WARE.
 - c. Phillips Manufacturing Co.
 2. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection, 25 Gauge minimum typical. Provide 20 Gauge minimum at all locations with ceramic tile finish.
 3. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide the following:
1. Double-Track System: ASTM C645 top outer tracks, inside track with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
- D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- E. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch- wide flanges.
1. Depth: 1-1/2 inches.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C645.
1. Minimum Base-Steel Thickness: 0.0296 inch.
 2. Depth: 7/8 inch.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- C. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
- D. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.
 - 1. Depth: 1-1/2 inches.
- E. Furring Channels (Furring Members):
 - 1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
 - 2. Steel Studs and Tracks: ASTM C645. Use either conventional steel studs and tracks or embossed, high-strength steel studs and tracks.
 - a. Minimum Base-Steel Thickness: 0.033 inches or as indicated on drawings.
 - b. Depth: As indicated on Drawings.
 - 3. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch deep.
 - a. Minimum Base-Steel Thickness: 0.024 inches.
 - 4. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical.

2.4 GRID SUSPENSION SYSTEMS

- A. Grid Suspension Systems for Gypsum Board Ceilings (CONTRACTOR'S OPTION): ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.
- B. Refer to specification Section 09 22 26.23 "DRYWALL CEILING GRID SUSPENSION SYSTEMS."

2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.
 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.2 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

- a. Install two studs at each jamb unless otherwise indicated.
 - b. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Direct Furring:
- 1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.3 INSTALLING CEILING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

- a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 5. Do not attach hangers to steel roof deck.
 - 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports. Comply with UL P523.
- E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16

SECTION 09 2900

GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.
3. Texture finishes.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Gypsum wallboard.
2. Gypsum board, Type X.
3. Mold-resistant gypsum board.
4. Glass-mat, water-resistant backing board.
5. Cementitious backer units.
6. Interior trim.
7. Joint treatment materials.
8. Sound-attenuation blankets.
9. Acoustical sealant.
10. Textured finishes.

B. Samples:

1. Submit samples for each texture finish indicated on the same backing indicated for Work.
2. Submit full size samples in 12-inch-long lengths for each exposed trim accessory indicated.

1.3 QUALITY ASSURANCE

- ###### **A. Single-Source Responsibility for Panel Products:** Obtain each type of gypsum board and other panel products from a single manufacturer.

- B. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.
- C. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Install mockups for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations.
 - 2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
 - 3. Simulate finished lighting conditions for review of mockups.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completions.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.
- C. Handle gypsum board to prevent damage to edges, ends and surfaces. Do not bend or otherwise damage metal corner beads and trim.

1.5 FIELD CONDITIONS

- A. Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Installation of gypsum board joint treatments shall not start until the space to receive gypsum board joint treatments is heated to maintain a continuous and uniform temperature of not less than 55 deg. F, from one week prior to beginning of joint treatment until joint treatment is completed and thoroughly dry. Ventilation, either natural or supplied by fans, circulators or air conditioning systems shall be provided to remove excess moisture during joint treatment. Temperature requirements may be waived only on recommendation of gypsum board manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
 - 1. Fire-Resistance-Rated Assemblies: indicated by design designations from UL's "Fire Resistance Directory."
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
 - 1. STC-Rated Assemblies: Indicated by design designations form GA-600, "Fire Resistance Design Manual."

2.2 GYPSUM BOARD, GENERAL

- A. General: For fire-rated assemblies, provide materials, including accessories and fasteners produced by one manufacturer, or, when products of more than one manufacturer are used in a rated system, they shall be acceptable to authorities having jurisdiction.
- B. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Wallboard: ASTM C1396/C1396M.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Gypsum.
 - b. Certainteed; SAINT-GOBAIN.
 - c. Georgia-Pacific Gypsum LLC.
 - d. National Gypsum Company.
 - e. USG Corporation.
 - 2. Thickness at Vertical Surfaces: 5/8 inch, Type X.
 - 3. Thickness at Interior Ceiling Surfaces: 1/2 inch.

4. Long Edges: Tapered.

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Gypsum.
 - b. Certainteed; SAINT-GOBAIN.
 - c. Georgia-Pacific Gypsum LLC.
 - d. National Gypsum Company.
 - e. USG Corporation.
2. Thickness: 5/8 inch, Type X.
3. Long Edges: Tapered.
4. Location: Vertical surfaces, where required for fire-resistance-rated assembly, and where indicated on Drawings.

C. Moisture and Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Gypsum.
 - b. Certainteed; SAINT-GOBAIN.
 - c. Georgia-Pacific Gypsum LLC.
 - d. National Gypsum Company.
 - e. USG Corporation.
2. Core: 5/8 inch, Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.4 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C1178/C1178M, with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Georgia-Pacific Gypsum LLC.: Dens-Shield Tile Backer.
 - b. National Gypsum Company: GOLD BOND Brand E2²P.
 - c. USG Corporation: Securock Glass Mat Sheathing.

2. Core: 5/8 inch, Type X.
 3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
- B. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. C-Cure.
 - b. Certainteed; SAINT-GOBAIN.
 - c. Custom Building Products.
 - d. James Hardie Building Products, Inc.
 - e. National Gypsum Company.
 - f. USG Corporation.
 2. Thickness: 5/8 inch.
 3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
- C. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C1047; formed metal sheet steel zinc coated by hot-dipped process.
1. Shapes indicated below by reference to Fig.1 designations in ASTM C 1047:
 - a. Cornerbead, Impact-resistant (PR1): Pittcon SO-HSN-90, Fry DMCT-1250 or equivalent: Use at outside corners.
 - b. Channel Reveal: Pittcon SWR Series, Fry DCS, or equivalent.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound; use at exposed panel edges.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound: Use where indicated.
 - e. Expansion (control) joint: One-piece control joint formed with V-shaped slot, with removeable strip covering slot opening. Use where indicated.
 - f. Curved-Edge Cornerbead: With notched or flexible flanges; use at curved openings.

2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M and with the recommendations of both the manufacturers of the products and joint treatment materials for each application indicated.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 - 4. Finish Coat: For third coat, use drying-type, all purpose compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.
- D. Joint Compound for Tile Backing Panels:
 - 1. Glass-Mat, Water-Resistant Backing Panel: Use setting-type taping and setting-type, sandable topping compounds.
 - 2. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Sound-Attenuation Blankets: STR55 minimum; Owens Corning QuietZone Acoustic Batt Insulation System.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 - 2. Product: Subject to compliance with requirements, provide one of the following:

- a. Roxul AFB; Roxul Inc.
 - b. Rockwool Acoustic Slabs; Rockwool Ltd.
 - c. SAFB Blankets; Thermafiber LLC.
- D. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and opening in building construction as demonstrated by testing representative assemblies according to ASTM E 90. One of the following:
 - 1. SHEETROCK Acoustical Sealant; U.S. Gypsum.
 - 2. AC-20 FTR; Pecora.
 - 3. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. Laminating Adhesive: Adhesive recommended by the manufacturer for directly adhering gypsum panels to continuous substrate.

2.8 TEXTURE FINISHES

- A. Primer: As recommended by textured finish manufacturer.
- B. Textured finish as directed by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to which gypsum board assemblies attach or abut, installed door frames and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS

- A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840, GA-216, and the gypsum board manufacturer's recommendations, where standards conflict, the more stringent shall apply. Install

specialty gypsum board as specified below except where manufacturer's instructions conflict; follow manufacturer's instructions for specialty performance board to maintain warranty coverage.

- B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.
- C. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints or avoid them entirely.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of board.
 - b. At high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
- D. Multilayer Application:
 - 1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply base layers in the same sequence. Apply base layers at right angles to framing members and offset face layer joints one framing member, 16 inches minimum, from parallel base joints, unless otherwise indicated or required by fire-resistance-rated assembly.
 - 2. On partitions/walls: Apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite side of partitions.
- E. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- F. Multi-Layer Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- G. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, furring members, or base layer of gypsum board), comply

with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

H. Tile Backing Panels:

1. Cementitious Backer Unit Application: ANSI A108.11 at showers, where substrates are indicated to receive Tile Units having a face dimension greater than 8 by 8 inches, and where otherwise indicated.
2. Glass-Mat, Water-Resistant Backing Panel: Install with 1/4-inch gap where panels abut other construction or penetrations.

I. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

J. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite side of partitions.

K. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

L. Attach gypsum panels to framing provided at openings and cutouts.

M. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Fit gypsum panels around ducts, pipes and conduits.
2. Where partitions intersect open exterior and interior wall kickers, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by the wall kickers and other structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.
3. Where chase walls are shown, provide bracing between parallel rows of studs. Unless otherwise shown, provide gypsum board braces no less than 1/2-inch thick by 12 inches wide and cut to width of chase. Locate at quarter points in wall height between each pair of parallel studs. Fasten with not less than 3 screws at each stud.

N. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch-wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

- O. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
- P. Cut openings in gypsum board for electrical outlets, piping and other penetrations. Maintain close tolerances so that edges will be covered by plates and escutcheons. Cut both face and back paper. Do not install electrical outlets back-to-back on opposing sides of partitions.
- Q. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
 - 1. Space screws a maximum of 12 inches o.c. for vertical applications.
 - 2. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.
 - 3. Install fasteners not less than 3/8-inch from ends or edges of gypsum board sheets, spacing fasteners opposite each other on adjacent ends or edges.
 - 4. Begin fastening from center of gypsum board and proceed toward edges and corners.
 - 5. Apply pressure on surface of gypsum board adjacent to fasteners being driven to ensure that gypsum board will be secured tightly to supporting members.
 - a. Drive fastener with shank perpendicular to face of board.
 - b. Drive screws with a power screwdriver as recommended by gypsum board manufacturer. Set heads of screws slightly below surface of paper without cutting paper.

3.3 INSTALLING TRIM ACCESSORIES

- A. General: Fasten trim accessories according to manufacturer's written instructions for type, length, and spacing of fasteners.
- B. Install corner beads at external corners.
- C. Install interior trim accessories where edge of gypsum panels would otherwise be exposed or semi-exposed. Provide interior trim accessories with face flange formed to receive joint compound.
- D. Install aluminum trim accessories where indicated.
- E. Install control joints in locations indicated and where directed by the Architect for visual effect, or if not indicated or directed by the Architect, provide control joints in accordance with ASTM C 840 which is as follows:

1. Where a partition, wall or ceiling traverses a construction joint (expansion, seismic or building control element) in the base building structure.
2. Where a wall or a partition runs in an uninterrupted straight plane exceeding 30 linear feet.
3. Control joints in interior ceilings with a perimeter relief shall be installed so that linear dimensions between control joints do not exceed 50 feet and total area between control joints does not exceed 2500 square feet.
4. Control joints in interior ceilings without perimeter relief shall be installed so that linear dimensions between controls joints do not exceed 30 feet and total area between control joints does not exceed 900 square feet.
5. A control joint or intermediate blocking shall be installed where ceiling framing members change direction.

3.4 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Apply joint treatment at gypsum board joints, flanges of interior trim and aluminum trim accessories, interior angles, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration and levels of gypsum board finish indicated. Produce surfaces free of tool marks and ridges ready for decoration of type indicated. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Cementitious Backer Units: Finish according to manufacturer's written instructions.
- E. Glass-Mat, Water-Resistant Backing Panels: Do not use paper tape and joint compound. Finish according to manufacturer's written instructions.
- F. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
 1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
 2. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners and trim flanges where panels are substrate for tile and where indicated.
 3. Level 3: Typically not used.
 4. Level 4: Embed tape and apply separate first, fill and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.

5. Level 5: Embed tape and apply separate first, fill and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound over entire surface where gypsum board is indicated to receive wall coverings, semi-gloss and high gloss paints, and Italian plaster.

3.5 CLEANING AND PROTECTION

- A. Clean floors of all gypsum board debris and leave broom clean. Excess material, scaffolding, tools and equipment are to be removed upon completion of the Work.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 09 29 00

SECTION 09 9000
PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints, stains, varnishes, and other coatings.
- C. Scope: Finish all interior and 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. Mechanical and Electrical:
 - a. In finished areas, paint all 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 fully factory-finished unless specifically so 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. Stainless steel, anodized aluminum, bronze, terne, and lead items.
 - 6. Floors, unless specifically so indicated.
 - 7. Ceramic and other tiles.
 - 8. Glass.
 - 9. Concrete masonry in utility, mechanical, and electrical spaces.
 - 10. Acoustical materials, unless specifically so indicated.
 - 11. Concealed pipes, ducts, and conduits.

1.02 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 D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2016.

1.03 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. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 4. Manufacturer's installation instructions.
 5. If proposal of substitutions is allowed under submittal procedures, explanation of all substitutions proposed.
- 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.
 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.
 3. Allow 30 days for approval process, after receipt of complete samples by Architect.
- D. Manufacturer's Instructions: Indicate special surface preparation procedures.
- 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 coated 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 Coatings: 1 gallon of each color; store where directed.
 3. Label each container with color in addition to the manufacturer's label.

1.04 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.

1.05 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. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 - 1. Sherwin-Williams Company: www.sherwin-williams.com
- C. Transparent Finishes:
 - 1. Sherwin-Williams Company: www.sherwin-williams.com
 - 2. UGL Drylock Masonry Clear Water proofer as indicated in room finish schedules.
- D. Stains:
 - 1. Sherwin-Williams Company: www.sherwin-williams.com
- E. Primer Sealers: Same manufacturer as top coats.
- F. Block Fillers: Same manufacturer as top coats.
- G. Substitutions: **NO SUBSTITUTIONS**

2.02 PAINTS AND COATINGS - GENERAL

- A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
 - 1. Provide paints and coatings 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. 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.
 - 3. Supply each coating material in quantity required to complete entire project's work from a single production run.
 - 4. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
- B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- C. Volatile Organic Compound (VOC) Content:
 - 1. Provide coatings 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.
- 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 or selected during submittal phase.

1. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
2. Extend colors to surface edges; colors may change at any edge as directed by Architect.
3. 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 - EXTERIOR

- A. Paint E-OP - All Exterior Surfaces Indicated to be Painted or Stained as noted in plans, Unless Otherwise Indicated: Including but not limited to: gypsum board, concrete, concrete masonry, wood, uncoated steel, shop primed steel, and galvanized steel.
 1. Preparation as required by manufacturer.
 2. Two top coats and one coat primer minimum, but no fewer than recommended by the manufacturer for the manufacturer's full system warranty.
 3. Top Coat(s): as indicated on the room finish schedule.
 4. Top Coat Product(s): as indicated on the room finish schedule.
 5. Primer(s): As recommended by manufacturer of top coats.

2.04 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP - All Interior Surfaces Indicated to be Painted or Stained as noted in plans, Unless Otherwise Indicated: Including but not limited to: gypsum board, concrete, concrete masonry, wood, uncoated steel, shop primed steel, and galvanized steel.
 1. Preparation as required by manufacturer.
 2. Two top coats and one coat primer.
 3. Top Coat(s): as indicated on the room finish schedule.
 4. Flat: MPI gloss level 1; use this sheen as indicated on the Room Finish Schedule.
 5. Velvet: MPI gloss level 2; use this sheen as indicated on the Room Finish Schedule.
 6. Eggshell: MPI gloss level 3; use this sheen as indicated on the Room Finish Schedule.
 7. Satin: MPI gloss level 4; use this sheen as indicated on the Room Finish Schedule.
 8. Semi-Gloss: MPI gloss level 5; use this sheen as indicated on the Room Finish Schedule.
 9. Top Coat Product(s): as indicated on the room finish schedule..
 10. Primer(s): As recommended by manufacturer of top coats.
- B. Paint I-OP-MD-WC - Medium Duty Vertical/Overhead:
 1. Preparation as required by manufacturer.
 2. Two top coats and one coat primer.
 3. Top Coats: as indicated on the room finish schedule.
 4. Eggshell: use this sheen as indicated on the Room Finish Schedule.
 5. Top Coat Product(s): as indicated on the room finish schedule.
 6. Primer(s): As recommended by manufacturer of top coats.

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

- 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 affect proper application.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. 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 Unit Masonry: 12 percent.
 - 3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 - 4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to coating 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. 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 and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.
- H. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- I. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-SP 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).
- J. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand or power tool wire brushing or sandblasting; clean by washing with solvent. Apply

a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

- K. Shop-Primed Steel Surfaces to be Finish Painted: 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.
- L. Interior 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.
- M. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.
- N. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied. Back prime concealed surfaces before installation.
- O. 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. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.
- C. Apply products in accordance with manufacturer's instructions.
- D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- F. Apply each coat to uniform appearance.
- G. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- H. Sand wood and metal surfaces lightly between coats to achieve required finish.
- I. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- J. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- K. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

- A. Protect finished coatings until completion of project.
- B. Touch-up damaged coatings after Substantial Completion.

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. Occupant load signs.
- D. Building identification signs.
- E. Building Address signs.
- F. Exterior directional and informational signs.

1.02 RELATED REQUIREMENTS

- A. Section 22 0553 - Identification for Plumbing Piping and Equipment.
- B. Section 26 0553 - Identification for Electrical Systems.
- C. 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 - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- D. TAS Standards-Texas Accessibility Standards for State of Texas Accessible Design.

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 and Braille 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.
 - 2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 - 3. Submit for approval by Owner through Architect prior to fabrication.
- D. Samples: Submit one sample of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

- E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips from manufacturer's FULL line of colors and finishes.
- F. 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, labeled by floor or building.
- 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 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and Texas Accessibility Standards and Current TAS Standards, 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. Provide tactile signs for Exit Doors. Provide Occupant Load Signs.
 - 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: As required to comply with all standards for full Identification of space.
 - 5. Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section for replaceable occupant name.
 - 6. Conference and Meeting Rooms: Identify with room names and numbers to be determined later, not those shown on the drawings.
 - 7. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
 - 8. Rest Rooms: Identify with 6" tall pictograms, the names "MEN" and "WOMEN" and "RESTROOM", and braille as required to comply.
- C. Interior Directional and Informational Signs:
 - 1. Sign Type: Same as room and door signs.
 - 2. Provide tactile signs at each exit as required by code and TAS 2012.
- D. Building Identification Signs:
 - 1. Use individual aluminum metal letters.

2. Allow for total of 70 letters, 12 inches high, aluminum.
3. Allow for total of 9 numbers, 8 inches high, aluminum.
4. Mount on outside wall in location coordinated with Fire Marshal, Owner and Architect.

2.02 SIGN TYPES

- A. Flat Signs: Signage media without frame.
 1. Edges: Square.
 2. Corners: Square.
 3. Wall Mounting of One-Sided Signs: Tape adhesive.
- B. Color and Font: Unless otherwise indicated:
 1. Character Font: Helvetica, Arial, or other sans serif font.
 2. Character Case: Upper case only.
 3. Background Color: as selected by Architect.
 4. Character Color: Contrasting color as selected by Architect.

2.03 TACTILE SIGNAGE MEDIA

- A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
 1. Total Thickness: 1/16 inch.

2.04 DIMENSIONAL LETTERS

- A. Metal Letters:
 1. Metal: Aluminum casting.
 2. Finish: Custom Color TBD, Satin Finish.
 3. Mounting: Concealed Anchors.

2.05 ACCESSORIES

- A. 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 in accordance with the Texas Accessibility Standards.
- D. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION

SECTION 10 4400
FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

- A. Fire Extinguishers.
- B. Fire Extinguisher Cabinets.
- C. Accessories.

1.3 REFERENCE STANDARDS

- A. NFPA 10 – Standard for Portable Fire Extinguishers; current edition.

1.4 SUBMITTALS

- A. See Section 01 33 00 – Submittal Procedures.
- B. Product Data: Provide extinguisher operational features.
- C. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fire Extinguishers, Cabinets and Accessories:

1. Activar Construction Products Group – JL Industries: www.activarcpg.com
2. Kidde, a unit of United Technologies Corp: www.kidde.com
3. Larsen's Manufacturing Co: www.larsensmfg.com
4. Potter-Roemer: www.potterroemer.com

2.2 FIRE EXTINGUISHERS

A. Fire Extinguishers – General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Clean steel tank, with pressure gauge.

1. Class: A:B:C: Type.
2. Size: 5 pound
3. Finish: Baked polyester powder coat, red color.

2.3 FIRE EXTINGUISHER CABINETS

A. Cabinet Construction: Non-fire rated.

1. Clear Anodized Aluminum.

B. Cabinet Configuration: Semi-recessed type.

1. Size to accommodate accessories.
2. Trim: Flat square edge, with 1 ½ inch wide face.

C. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.

D. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

E. Weld, fill, and grind components smooth.

F. Finish of Cabinet Exterior Trim and Door: Red baked enamel.

G. Finish of Cabinet Interior: White colored enamel.

2.4 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, chrome-plated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure rigidly in place.
- C. Place extinguishers in cabinets.
- D. Coordinate with Fire Marshal for quantity and location.

END OF SECTION 10 44 00

SECTION 10 5126

PLASTIC LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Solid plastic lockers.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete base construction.

1.03 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. Texas Accessibility Standards; 2012.
- C. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.
- C. Shop Drawings: Indicate locker plan layout, numbering plan and combination lock code.
- D. Manufacturer's Installation Instructions: Indicate component installation assembly.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Solid Plastic Lockers:
 - 1. Columbia Lockers, a division of PSiSC; PolyLife Lockers: www.psisc.com/.
 - 2. List Industries, Inc: www.listindustries.com/.
 - 3. Scranton Products: www.scrantonproducts.com/.
 - 4. Bradley Corporation, Inc.: www.bradleycorp.com/.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LOCKER APPLICATIONS

- A. Wardrobe Lockers: Solid plastic lockers, wall mounted for base indicated on drawings.
 - 1. Width: 12 inches.
 - 2. Depth: 18 inches.
 - 3. Height: 72 inches.
 - 4. Locker Configuration: Two tier.
 - 5. Fittings: Size and configuration as indicated on drawings.
 - a. Hat shelf.
 - b. Coat rod.
 - c. Hooks: One single prong.

6. Ventilation: By open space between the back of the door and locker body.
7. Locking: Padlock hasps, for padlocks provided by Owner.
8. Provide sloped top.
9. ADA, TAS, A117.1 Compliant. Identify the Accessible Lockers with the ISA, Number and Braille to comply.

2.03 SOLID PLASTIC LOCKERS

- A. Lockers: Factory assembled, made of solid plastic panels, tested in accordance with NFPA 286, homogenous color throughout.
 1. Material: Antimicrobial solid high density polyethylene (HDPE).
 - a. Manufactured with EPA registered antimicrobial additive incorporated into HDPE material; suppresses growth of bacteria, algae, fungus, mold, and mildew.
 2. Doors: Full overlay without frame.
 3. Locker Body Construction: Manufacturer's standard for selected product.
 4. Where locker ends or sides are exposed, provide same finish as fronts or provide extra panels to match fronts.
 5. Provide filler strips where indicated, securely attached to lockers.
 6. Door Color: To be selected by Architect.
 7. Body Color: To be selected by Architect.
- B. Component Thicknesses:
 1. Doors: 1/2 inch minimum thickness.
 2. Locker Body: Tops, bottoms, backs, and shelves 3/8 inch minimum.
 3. End Panels and Filler Panels: 1/2 inch minimum thickness.
 4. Sloped Tops: 1/2 inch minimum thickness.
- C. Hinges: Full height of locker, manufacturer's standard heavy duty type.
- D. Coat Hooks: High impact plastic.
- E. Number Plates: Provide rectangular shaped aluminum plates. Number height and font shall be in compliance with Texas Accessibility Standards. Provide ISA (International Symbol of Accessibility at Accessible Lockers).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared bases are in correct position and configuration.
- B. Verify bases 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. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 pounds.
- E. Install end panels, filler panels, and sloped tops.
- F. Install fittings if not factory installed.

- G. Replace components that do not operate smoothly.

3.03 CLEANING

- A. Clean locker interiors and exterior surfaces.

END OF SECTION

SECTION 10 7500

FLAGPOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum Flagpoles.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete base and foundation construction.

1.03 REFERENCE STANDARDS

- A. AASHTO M 36 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains; 2016.
- B. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2016.
- C. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles; 2007.

1.04 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pole, accessories, and configurations.
- C. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, and imposed loads.
- D. Maintenance Data: Provide lubrication and periodic maintenance requirement schedules and _____.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Design flagpole foundation under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed Texas.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.
- B. Protect flagpole and accessories from damage or moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Flagpoles:
 - 1. Unites States Flag Store, Model EC20: www.united-states-flag.com/.
 - 2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FLAGPOLES

- A. Flagpoles: Designed in accordance with NAAMM FP 1001. Minimum Sizes below, and flagpole construction shall comply with all code requirements for project location.
 - 1. Material: Aluminum.
 - 2. Design: Straight shaft.
 - 3. Mounting: Ground mounted type.
 - 4. Outside Butt Diameter: 5 inches.

5. Outside Tip Diameter: 3 inches.
 6. Nominal Height: 30 ft; measured from nominal ground elevation.
 7. Halyard: External type.
- B. Performance Requirements: Minimum Requirements below, and flagpole construction shall comply with all code requirements for project location.
1. Wind Pressure Loading on Flagpole with Flag: Resistant without permanent deformation to 120 miles/hr flagged wind speed (315 miles/hr unflagged wind speed), in accordance with NAAMM FP 1001; the factor of safety used is 2.5.

2.03 POLE MATERIALS

- A. Aluminum: ASTM B241/B241M, 6063 alloy, T6 temper.

2.04 ACCESSORIES

- A. Finial Ball: Aluminum, 5 inch diameter.
- B. Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.
- C. Cleats: 9 inch size, aluminum with 316 Stainless fastenings.
- D. Halyard: 5/16 inch diameter polypropylene, braided, white.
- E. Exterior Commercial Grade American Flag: 3'x5'.
- F. Exterior Commercial Grade Texas Flag: 3'x5'.
- G. Full Set of Six (6) Separate Design, Exterior Commercial Grade, Beach Warning Flags (design shall be coordinated with Owner). Each flag in the set shall be 3'x5'.

2.05 MOUNTING COMPONENTS

- A. Foundation Tube Sleeve: AASHTO M 36, corrugated 16 gage, 0.0598 inch steel, galvanized, depth of 36 inches as indicated.
- B. Lighting Ground Rod: 18 inch long copper rod, 3/4 inch diameter.

2.06 FINISHING

- A. Aluminum: Mill finish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.

3.02 PREPARATION

- A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

3.03 INSTALLATION

- A. Install flagpole, base assembly, and fittings in accordance with manufacturer's instructions and all codes and ordinances.
- B. Fill foundation tube sleeve with concrete specified in Section 03 3000.
- C. Install foundation plate and centering wedges for flagpoles base set in concrete base and fasten.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1 inch.

3.05 ADJUSTING

- A. Adjust operating devices so that halyard and flag function smoothly.

END OF SECTION

SECTION 12 3661.19
QUARTZ AGGLOMERATE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications apply to this Section.
- B. Section Includes:
 - 1. Quartz agglomerate countertops.
 - 2. Quartz agglomerate backsplash.
 - 3. Quartz agglomerate end splashes and apron fronts.
 - 4. Quartz waterfall countertop edge returns.

1.2 RELATED REQUIREMENTS

- A. Division 10 Section "Toilet and Bath Accessories".
- B. Division 22 Section "Plumbing Fixtures" for sinks and plumbing fittings.

1.3 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
 - 1. Show locations and details of joints.
 - 2. Show directional pattern.
- C. Samples for Verification: For the following:
 - 1. Countertop and backsplash material, 6-inches square.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For quartz agglomerate countertops to include in maintenance manuals. Include product data for care products used or recommended by Installer and names, addresses, and telephone numbers of local source for products.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Provide work of this Section executed by competent installers with minimum 5-years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturer.
- C. Mock-Ups:
 - 1. Prior to final approval of Shop Drawings, erect one (1) full-size mockup of each component at Project site demonstrating quality of materials and execution for Architect review.
 - 2. Should markup not be approved, rework and remake until approval is secured. Remove rejected units from Project site.
 - 3. Approved mockup will be used as standard for acceptance of subsequent work.
 - 4. Approved mockups may remain as part of the finished work.

1.6 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Acceptance Requirements: Deliver no components to Project site until areas are ready for installation.
- B. Storage and Handling Requirements:
 - 1. Store components indoors prior to installation.
 - 2. Handle materials to prevent damage to finished surfaces.

1.8 WARRANTY

- A. Manufacturer Warranty: Provide manufacturer's standard warranty for material only for the period of 10 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to the satisfaction of Architect and at no expense to Owner.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

- A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of polymers, resins, and pigment and complying with ISFA 3-01.
 - 1. Basis of Design Manufacturer: **Corian® by DuPont**; www.corian.com
 - 2. Color and Patterns: as selected by Architect from manufacturer's full range.

2.2 COMPONENTS

- A. Counter Perimeter Frame: Ensure 1/2" [3/4"] thick, moisture resistant cores for countertops in wet areas having sinks or lavatories are 3/4" thick exterior grade plywood with waterproof adhesive.
 - 1. Waterfall edges at exposed ends; includes benches.

2.3 FABRICATION

- A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards".
- B. Configuration:
 - 1. Front: Radius edge with apron, as indicated in Drawings.
 - 2. Backsplash: Straight, to match counter
 - 3. End Splash: to match backsplash.
- C. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 - 1. Fabricate with loose backsplashes for field assembly.
- D. Joints:
 - 1. Fabricate countertops without joints.
 - 2. Fabricate countertops in sections for joining in field, with joints at locations indicated.
 - a. Joint Locations: Not within 18 inches of a sink and not where a countertop section less than 36 inches long would result, unless unavoidable.
 - b. Joint Type, Bonded: **1/32 inch (0.8 mm)** or less in width.

- c. Joint Type, Grouted: 1/16 inch (1.5 mm) in width.
- d. Joint Type, Sealant Filled: 1/16 inch (1.5 mm) in width.

E. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch (5 mm) into fixture opening.
 - b. Provide vertical edges, rounded to 3/8-inch (10-mm) radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting 3/16 inch (5 mm) into fixture opening.
 - c. Provide 3/4-inch (20-mm) full bullnose edges projecting 3/8 inch (10 mm) into fixture opening.
2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.4 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by quartz agglomerated manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 Joint Sealants.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive quartz agglomerate countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with all ADA, TDLR, and TAS height requirements.
- B. Install countertops level to a tolerance of **1/8 inch in 8 feet (3 mm in 2.4 m)**, **1/4 inch (6 mm)** maximum. Do not exceed **1/64-inch (0.4-mm)** difference between planes of adjacent units.
- C. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- D. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- E. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.
- F. Provide backsplashes and end splashes as indicated on Drawings. Adhere to countertops using a standard color-coordinated silicone sealant. Adhere applied side splashes to countertops using a standard color-matched silicone sealant. Provide coved backsplashes and side splashes at walls and adjacent millwork. Fabricate radius cove at intersection of counters with backsplashes to dimensions shown on reviewed Shop Drawings. Adhere to countertops using manufacturer's standard color-coordinated joint adhesive.
- G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- H. Adhere undermount sinks/bowls to countertops using manufacturer's recommended adhesive and mounting hardware.
- I. Apply sealant to gaps at walls; comply with Section 07 92 00 – Joint Sealants.

3.3 REPAIR

- A. Repair minor imperfections and cracked seams and replace area of severely damaged surfaces in accordance with manufacturer's "technical bulletins".

3.4 SITE QUALITY CONTROL

- A. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Architect at no cost to Owner.

3.5 CLEANING

- A. Remove excess adhesive and sealant from visible surfaces.
- B. Clean surfaces in accordance with manufacturer's "Care and Maintenance Instructions".

3.6 PROTECTION

- A. Provide protective coverings to prevent physical damage or staining following installation for duration of the Project.
- B. Protect surfaces from damages until the Date of Substantial Completion of the Work.

END OF SECTION 12 36 61.19

SECTION 31 3116
TERMITE CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Chemical soil treatment.

1.02 REFERENCE STANDARDS

- A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; 1947 (Revised 2001).

1.03 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.
- C. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements.
- D. Test Reports: Indicate regulatory agency approval reports when required.
- E. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.
- F. Manufacturer's Instructions: Indicate caution requirement.
- G. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three (3) years of documented experience.
- H. Maintenance Data: Indicate recommended re-treatment schedule .
- I. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing this type of work and:
 - 1. Having minimum of three (3) years documented experience.
 - 2. Approved by manufacturer of treatment materials.
 - 3. Licensed in Texas.

1.05 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year installer's warranty against damage to building caused by termites.
 - 1. Include coverage for repairs to building and to contents damaged due to building damage. Repair damage and, if required, re-treat.

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.

PART 3 EXECUTION

3.01 EXAMINATION

- A. 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 toxicant at following locations:
 - 1. Under Slabs-on-Grade.
 - 2. At all locations under the three buildings, stairs, ramps, porches, etc.
- D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.
- E. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.
- F. Re-treat disturbed treated soil with same toxicant as original treatment.
- G. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 PROTECTION

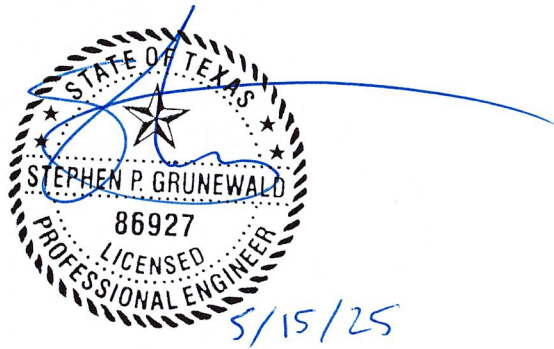
- A. Do not permit soil grading over treated work.

END OF SECTION

CIVIL TECHNICAL SPECIFICATIONS
FOR

CITY OF PORT ARANSAS LIFE GUARD HEAD QUARTERS

303 NINTH STREET



OWNER:
EDR Architects, PLLC
City of Port Aransas
710 West Avenue - A
Port Aransas, Texas 78373

Job No. 6100.C3.02 (10293)
MAY 2025



2725 SWANTNER DRIVE
CORPUS CHRISTI, TEXAS 78404

Firm No. 145
TBPLS Firm No.: 10032400

TABLE OF CONTENTS

DIVISION 01 – GENERAL REQUIREMENTS

- 01 51 36.10 Water for Construction
- 01 89 30 Technical Special Provisions

DIVISION 03 – CONCRETE

- 03 10 01 Concrete Formwork
- 03 11 13 Concrete Structures
- 03 20 01 Concrete Reinforcement
- 03 30 02 Normal Weight Aggregate Concrete

DIVISION 31 – EARTHWORK

- 31 10 00 Clearing, Grubbing and Stripping
- 31 20 00 Site Excavation and Fill
- 31 22 13 Site Grading
- 31 23 00 Structural Excavation and Backfill
- 31 23 16.13 Pipe Trench Excavation and Backfill
- 31 23 23 Compacted Embankment
- 31 25 13 Storm Water Pollution Prevention Plan (less than 1 acre)
- 31 32 16 Laboratory Testing

DIVISION 32 – EXTERIOR IMPROVEMENTS

- 32 11 33.13 Portland Cement Concrete Pavement
- 32 16 13.13 Concrete Curb, Gutter, and Concrete Valley Gutter
- 32 16 23 Concrete Sidewalk and Concrete Driveways
- 32 31 13 Chain Link Fence (Heavy Duty)

DIVISION 33 – UTILITIES

- 33 05 05 Installation of Water Pipe
- 33 05 05.11 Installation of Sanitary Sewer Pipe (PVC-SDR26)
- 33 05 05.31 Hydrostatic Testing of Pressure System
- 33 05 19 Ductile-Iron Utility Pipe
- 33 05 31.16 Polyvinyl Chloride Pipe and Fittings for Water Lines (C-900 & C-905)
- 33 05 31.29 Polyvinyl Chloride Pipe and Fittings (SCH 40) for Duct
- 33 05 76 Sanitary Sewer Manholes (Fiberglass)
- 33 05 97.10 Existing Utilities
- 33 14 19 Gate Valves
- 33 14 19.13 Fire Hydrants
- 33 31 11 Polyvinyl Chloride Pipe and Fittings for Sewer Lines (SDR 26)

**WATER FOR CONSTRUCTION
SECTION 01 51 36.10**

**PART 1- GENERAL
1.1 DESCRIPTION**

A. POTABLE WATER

Where the Contractor desires or is required to use City (potable) water in connection with any construction work, he shall make complete and satisfactory arrangements with the City of Port Aransas and make all necessary connections at his own expense.

END OF SECTION 01 51 36.10

01 89 30 – TECHNICAL SPECIAL PROVISIONS

PART 1 – GENERAL

These Technical Special Provisions amend or supplement the Technical Specifications and other provisions of the Contract Documents. All provisions which are not so amended or supplemented remain in full force and effect.

PART 2 – PRODUCTS

2.1 ARTICLE TS-1 DEFINITIONS

- A. Design Specification - Whenever the term "Design Specification" is used, it shall be understood that the performance of the completed work is as designed by the ENGINEER, and the CONTRACTOR must follow the requirements of the drawings and specifications; followed the manufacturer's recommendations (material and equipment); followed industry standard procedures and provided top quality workmanship.
- B. Performance Specification - Whenever the term "Performance Specification" is used, it shall be understood that the performance of the completed work is the responsibility of the CONTRACTOR, provided the OWNER has faithfully followed all written operational and maintenance instructions supplied by the CONTRACTOR. (The CONTRACTOR is not relieved of the responsibility for improper performance of the completed work even if there was improper operation and/or maintenance by the OWNER but it obviously was not the cause of improper performance.) In a performance specification, the CONTRACTOR is responsible for the design of the item furnished and installed by him. It is intended that the item function properly without excessive operation and maintenance being required by the OWNER. The item furnished must incorporate the features specified but still perform as intended. The materials specified are to set a minimum standard but shall not be considered a design. If the design furnished by the CONTRACTOR requires higher quality material in order to perform as intended, it shall be furnished at no increase in cost to the Contract amount. When minimum dimensions are specified, they shall not be considered a design. If the design furnished by the CONTRACTOR requires larger dimensions in order to perform as intended, it shall be furnished at no increase in cost to the Contract amount.

PART 3 – EXECUTION

3.3 ARTICLE TS-2 LAYOUT OF THE WORK

- A. The Contractor shall layout the work from the existing facilities. If, for whatever reason, it is necessary to deviate from proposed line and grade to properly execute the work, the Contractor shall obtain approval of the Engineer prior to deviation. If, in the opinion of the Engineer, the required deviation would necessitate a revision to the Drawings, the Contractor shall provide supporting measurements as required by the Engineer.

END OF SECTION 01 89 30

CONCRETE FORMWORK (CIVIL SITEWORK)
SECTION 03 10 01

PART 1 - GENERAL

1.1 SCOPE:

- A. This specification shall govern for all work necessary for designing, providing and installing concrete forms for any concrete structure (including curb and gutter, inlets, sidewalk and driveways) required to complete the project. With the exception of slabs, flatwork, and curb and gutter, concrete form work systems shall be designed for a minimum rate of concrete placement in the forms of ten (10) vertical feet per hour. This specification is a performance specification as defined in Art. TS-1 of the Technical Special Provisions.

PART 2 - PRODUCTS:

2.1 WOOD FORMS:

- A. Form lumber shall be seasoned, of good quality, free from loose or unsound knots, knot holes, twists, shakes, decay or other imperfections which would affect its strength or impair the finished surface of the concrete. Lumber used for facing or sheathing shall be surfaced on at least one side and two edges. All exposed concrete edges shall be chamfered. Molding used for chamfer strips shall be of redwood, cypress or pine of quality that will not split when nailed and which can be maintained to true lines. Chamfer strips to pre-determined elevations just prior to placing final lift.

2.2 STEEL FORMS:

- A. Metal forms shall provide a smooth straight surface and shall line up properly. Rivets and bolt heads in contact with concrete will be countersunk, level with surrounding surface. Metal surfaces in contact with concrete will be free from rust, paint or other foreign material that will disfigure or discolor concrete. Mount chamfer strip by Engineer approved methods and maintain as to grade and alignment.

2.3 FORM LINING:

- A. Surfaces to be given a rubbed finish are to have form surfaces or form lining surfaces free of irregularities. Lining is to be of plywood made with waterproof adhesive, of 1/4 inch minimum thickness, preferably oiled at the mill and then re-oiled or lacquered on the job before using. An alternate to the plywood lining is tempered masonite concrete form presswood having a minimum 3/16 inch thickness. Keep presswood moist at least 12 hours before applying to sheathing. Use smooth hard face as concrete contact surface. Facing may be constructed of 3/4 inch plywood made with waterproof adhesive, backed by adequate studs and wales; and, in this case, form lining will not be required. Carefully align edges and faces of adjacent panels.

2.4 FORM TIES:

- A. Form ties shall be threaded rod or coil tie type designed and of such length to provide a cone shaped formed "setback" of 3/4" on each wall face. After removal of forms, the cone shaped void shall be grouted. All form ties shall incorporate a waterstop manufactured as an integral feature of the tie. Form ties shall be part of the form system design and shall be adequate for all aspects of said system including a minimum rate of concrete placement in the forms of ten (10) vertical feet per hour. The use of wire ties, "snap ties" or similar products will not be permitted, except that Engineer will consider Contractor proposals to utilize such products on a case by case basis.

Temporary form spreaders will be removed as concrete is placed. Engineer will consider details of permanent form spreaders that Contractor may propose to use.

PART 3 - EXECUTION:

3.1 FALSEWORK:

- A. Falsework shall be of rigid construction to prevent excessive settlement or deformation under imposed loading and to insure the safety of the workmen and the structure. Only sound timber shall be used for falsework. Falsework shall be designed using 150 pounds per square foot of horizontal surface of form.

3.2 FORMS - GENERAL:

- A. Forms are to be constructed and placed in such a manner as to insure mortar tightness, rigidity to prevent excessive settlement or deformation under imposed loading and to insure the safety of the workmen and the structure. Forms shall be constructed in such a manner as to allow cleanout before placing of concrete; adequate access by tremies and vibrators; and removal without damage to concrete. Adequate cleanout openings shall be provided as directed by the Engineer. If excessive settlement or deformation occur, remove the concrete and steel, reset forms, replace the steel and pour fresh concrete. If existing steel is to be reused, Section 03 20 01 (2.6) must be met.

3.3 FORMS - CURB AND GUTTER, SIDEWALKS AND DRIVEWAYS:

- A. Form shall be straight durable and have a depth equal to the required concrete depth; they shall be securely staked to line and grade in such manner that there will be no movement when the concrete is placed.

3.4 FORMS - DESIGN:

- A. Forms shall be designed for a fluid pressure of 150 pounds per cubic foot and a live load of 50 pounds per square foot on horizontal surfaces with maximum unit stress of 125% of allowable stresses.

3.5 OILING FORMS:

- A. All surfaces of forms that will be in contact with concrete will be treated with an approved form oil before concrete is placed. The Contractor shall apply form oil in such a manner so as to insure that no excess oil accumulates on the reinforcing or previously placed concrete. Immediately prior to placing concrete, the Contractor shall wet forms which will come in contact with concrete.

3.6 REMOVAL OF FORMS FROM SURFACES TO BE RUBBED:

- A. Forms shall be removed when concrete has attained adequate strength to prevent damage and only as rapidly as rubbing operation progresses. Forms left in place longer than 24 hours will be rewet to keep moist.

3.7 REMOVAL OF FORMS AND FALSEWORK FROM SURFACES NOT TO BE RUBBED:

- A. Forms and falsework shall be removed after concrete has aged the following number of curing days.
 - a. Slabs, Beams, or Girders - 7 curing days.
 - b. Walls, Columns and Piers - 2 curing days.

3.8 SETTING FORMS OR FALSEWORK ON SUBSTRUCTURES:

- A. Forms or falsework shall not be erected on a concrete structure until the concrete in the substructure has cured at least four curing days.

3.9 SETTING FORMS OR FALSEWORK ON FOOTINGS:

- A. Forms or falsework shall not be erected on a concrete footing until the concrete in the footing has cured at least 3 curing days.

3.10 CURING DAY:

- A. A curing day is any calendar day on which the temperature near the structure is above 50 degree F for at least 19 hours.

END OF SECTION 03 10 01

CONCRETE STRUCTURES
SECTION 03 11 13

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This specification shall govern for all work necessary to construct all structures required to complete the project. This specification is a performance specification as defined in Art. TS-1 of the Technical Special Provisions.

PART 2 - PRODUCTS

2.1 CONCRETE

- A. Concrete shall have a minimum compressive strength of 3000 psi at 28 days (unless specifically specified otherwise) and shall be in accordance with Section 03 30 02 "Normal Weight Aggregate Concrete".

2.2 REINFORCING STEEL: See Section 03 20 01 "Concrete Reinforcement".

2.3 PREMOLDED EXPANSION JOINT FILLER

- A. Premolded expansion joint filler shall conform to ASTM Specification D-544, Type I.

2.4 NON-SHRINKAGE GROUT

- A. Shall be "Embeco 636" or "Masterflow 713" as manufactured by Master Builders Company, or "Ferrolith G" as manufactured by Sonneborn-Contech or approved equal.

2.5 WATERSTOPS

- A. Waterstops shall be premolded polyvinyl chloride being "Durajoint" No. 5 as manufactured by Electrovert, Inc., or "Sealtight" No. 6380 as manufactured by W.R. Meadows, Inc., or "Synko-flex" plastic (Bitumen) continuous waterstop or approved equal unless otherwise designated on plans. The "Synko-flex" type water stop shall be used only in horizontal construction joints. The premolded PVC type water stop shall be used in vertical construction joints and may be used in horizontal construction joints (Contractor's option).

2.6 MEMBRANE CURING COMPOUND

- A. Membrane curing compound shall be a resin base compound in accordance with ASTM Specification C-309, Type I, with light red tint of fugitive dye.

2.7 COTTON MATS FOR CURING

- A. Cotton mats for curing shall be mats which uniformly contain a minimum of 3/4 pound of cotton per square yard, with Osnaburg covering cloth being a weight of not less than 6 ounces per square yard. The mats shall be a size which may be easily handled and having 6 inch wide flap for overlaps.

2.8 FLOOR HARDENER

- A. Where drawings specify a floor hardener, liquid floor hardener shall be "Lapidoloth" as manufactured by Sonneborn-Contech, or "Kemplate" metallic surface hardener as manufactured by Chem-Masters Corp., or an approved equal.

2.9 INTEGRAL CONCRETE COLORING

- A. Where drawings call for integral concrete coloring, "Sonobrite" as manufactured by Sonneborn-Contech, or "Staybrite" as manufactured by A.C. Horn Company, or an approved equal shall be used.

PART 3 – EXECUTION

3.1 REQUIRED APPROVAL

- A. Prior to starting work, the Engineer may require the Contractor to furnish for approval any or all of the following:
 - a. Methods of construction.
 - b. Drawings for all form and falsework.
 - c. Amount and type of equipment to be used on the project.
 - d. The concrete placing schedule which take into account concrete shrinkage.
 - e. A schedule showing all surfaces to receive a rubbed finish.

The Engineer's approval of the above listed items does not relieve the Contractor of any responsibility for safety or correctness of methods, adequacy of equipment, or for carrying out work in accordance with his contractual obligations.

3.2 TIME SEQUENCE OF OPERATION

- a. All substructure concrete work shall be cured for a minimum of four days before erecting forms or placing structural steel thereon.
- b. All substructure concrete work shall cure for a minimum of 7 days before pouring superstructure concrete thereon.
- c. All wall footings shall cure for a minimum of 3 days before placing wall forms thereon.
- d. All superstructure shall cure for a minimum of 10 days before being used.

3.3 EXPANSION JOINTS

- A. The Contractor shall remove forms as soon as possible to permit free expansion of concrete. Premolded expansion joint fillers shall be anchored to concrete on side of joint by means of copper wire No. 12 B and C gauge or heavier or copper nails of approved size. Concrete sections are to be completely separated by open joint or by joint material.

3.4 CONSTRUCTION JOINTS

- A. General:

"Construction Joint" is defined as a contact surface between plastic concrete and concrete that has attained initial set. "Monolithic" means concrete placed without construction joints. Waterstops shall be provided in all construction joints in structures containing liquids up to a point one foot above the maximum water surface elevation and in all construction joints in structures with walls adjacent to soil, below a point one foot above the finished grade. The Contractor shall obtain written authorization of the Engineer to permit construction joints other than those indicated. Where such authorization is obtained, make additional construction joints with details and waterstops equivalent to those shown for similar joints.

B. Construction:

The Contractor shall leave surfaces rough with aggregate surface prior to placing of new concrete. Immediately prior to placing concrete on horizontal joint surfaces, slush surface with mortar coating. Mortar is to consist of regular concrete mix less coarse aggregate. On vertical surface, mortar is to be brushed on and worked into irregularities on surface. Keyways are to be formed so as to permit easy removal of forms without damaging the concrete. Waterstops are to extend into both old and new pour an equal distance, or according to manufacturer's recommendations as approved by the Engineer.

3.5 CONCRETE FORM WORK: See Section 03 10 01 - "Concrete Form Work".

3.6 PLACING REINFORCEMENT: See Section 03 20 01 - "Concrete Reinforcement".

3.7 SEAL SLABS

A. Seal slabs shall be placed in all excavations for structures which require reinforcing steel in base slab. Excavate below bottom of structural slab to the thickness shown on the drawings (min. 2 inches) and pour seal slab concrete to structural slab bottom elevation. Rough float finish seal slab. No direct payment will be made for seal slab concrete. Seal slab is not required for building on grade slab and grade beams unless shown otherwise on the drawings.

3.8 AUTHORIZATION TO PLACE CONCRETE

A. The Contractor shall notify the Engineer at least 48 hours in advance of a scheduled concrete placement. The Contractor shall not begin mixing concrete (or place an order for concrete) until the Engineer has inspected the forms, reinforcing steel, and given his approval. Before concrete is placed, all embedded items shall be accurately and securely fastened in place. The Contractor shall not place any concrete until he has at least three (3) mechanical vibrators, of an approved type, on the project site that are in good operating order.

3.9 SCHEDULING OF CONCRETE PLACEMENT

A. The Contractor shall schedule the concrete placement to insure completion during the hours of daylight. If it is necessary to continue pouring during hours of darkness, light the site in such a manner as to insure competent and safe operation. The Engineer can order postponement of placing operations when impending weather conditions threaten to impair the quality of the finished work. Should rainfall occur after placing operations have started, provide covering to protect work. If conditions occur which would be detrimental to placement and setting of concrete, such as pile driving or other vibration, stop the cause of such condition when concrete is being placed and until concrete has aged 12 hours.

3.10 HANDLING AND TRANSPORTING CONCRETE

A. The Contractor shall use metal or metal lined chutes, troughs, and/or pipes in placing concrete to prevent separation of concrete ingredients. When pouring down steep slopes, chutes shall be equipped with baffles to reverse lateral direction of movement. Downpipe shall be provided at end of chute. A maximum slope of one vertical to two horizontals shall be used. Chutes and troughs shall be kept free from coatings of hardened concrete or other harmful material. Chutes in excess of 35 feet in length may be used by authorization of the Engineer only. Pumping of concrete may be done by authorization of Engineer only.

3.11 PLACING CONCRETE

- A. Free fall of concrete shall be limited to a maximum of 4 feet. The Contractor shall place concrete in walls and other inaccessible places by use of tremies. Concrete shall be placed as close as possible to its final location. Vibrators shall not be used to work concrete along the forms. Concrete, reinforcing steel or forms shall not be jarred, moved, or otherwise disturbed after concrete has taken initial set. Concrete shall be placed in continuous horizontal layers approximately 12 inches thick. Each successive layer shall be placed while the layer below is still plastic. If excessive water forms on the surface of the concrete, use concrete to a point approximately 1 foot below finish elevation and allow to settle. To avoid cold joint, resume placement of concrete after partial stiffening. Retempering of concrete or mortar which has partially hardened will not be permitted.

3.12 CONSOLIDATING CONCRETE

- A. Consolidation of concrete shall be done by means of spading implements and mechanical vibrators of approved type. Use of vibrators of the type which operate by attachment to forms shall be by authorization of the Engineer only. Vibration of concrete shall begin immediately after placement and shall go completely through to next layer below to insure mixture of both layers. Vibration shall not be used for flowing concrete laterally.

3.13 PLACING CONCRETE ON THE GROUND

- A. The Contractor shall prepare the subgrade in accordance with the applicable earthwork specifications. Apply membrane waterproofing if called for on the drawings and/or specified elsewhere. If membrane waterproofing is not required, moisten subgrade just prior to placing concrete, to decrease absorption of moisture from the concrete. If necessary, pump or bail during placing operations from suitable sump located outside of forms. Pumping will be continued until concrete has attained initial set. Side forms may be omitted when authorized by the Engineer.

3.14 PLACING CONCRETE IN WATER

- A. The Contractor shall place concrete in water only by specific authorization of the Engineer. Concrete placed in or under water will contain a minimum of 6-1/2 sacks of cement per cubic yard of concrete. The Contractor shall insure that there is no movement or flow of water in which concrete is being placed for at least 36 hours after placement. Do not disturb concrete after placement and maintain approximately horizontal surfaces at all times. Placement will be by use of watertight tremies of a maximum of 10 inches in diameter. When concrete is placed in tremies, raise tremie slightly, but not out of concrete until batch discharges to bottom of hopper. Stop flow by lowering tremie. Placement will be continuous.

3.15 CURING CONCRETE

- A. General:
The Contractor shall have the option of using curing compound or cotton mats with the exception of the following: Membrane curing compound shall not be used on surfaces to be rubbed, painted or to which waterproofing material or liquid floor hardener is to be applied. Membrane curing compound shall not be used on concrete which will have additional concrete placed on it later. Membrane curing shall be used for curing surfaces which cannot be satisfactorily cured with mats. Curing mats shall be kept moist and in contact with concrete for 7 consecutive days. High early strength concrete shall be cured for 3 consecutive curing days.

- B. Use of Membrane Curing Compound:
Membrane curing compound shall be delivered on job site in original containers, labeled to show name of compound, manufacturer, and batch number. Compound shall be kept thoroughly mixed and sprayed on the structure using pressure-tank type spraying equipment. The Contractor shall apply curing compound to the concrete immediately upon removing forms at a rate of one gallon per 200 square feet. Apply compound to slabs or other exposed surfaces immediately after finishing or after excess moisture has disappeared. Membrane shall be kept intact and protected from abrasive action for 14 days to obtain equivalent to 7-day moist curing. Protect against traffic and apply protective coating no sooner than 24 hours after application of membrane. Damage to membrane during 14-day period shall be repaired immediately.

3.16 REMOVAL OF FORMS AND FALSEWORK: See Section 03 10 01 Concrete Form Work.

3.17 DEFECTIVE WORK

- A. All work which is deemed by the Engineer to be defective will be repaired immediately by the Contractor in accordance with the Engineer's instructions.

3.18 MONOLITHIC SLAB FINISH

- A. Unless otherwise specified, slabs, platforms, and steps shall be finished monolithically. Unless otherwise specified, slabs **shall** be level. The Contractor shall place screeds accurately and rigidly prior to placement of concrete. Concrete shall be tamped to force coarse aggregate away from surface; then float finish and steel trowel to finish building floors. "Dusting" of floor surfaces with dry materials **shall** not be permitted. Edges of all expansion joints shall be rounded at all expansion joints with suitable jointing or edging tool.

3.19 CONCRETE FLOOR TOPPING AND FINISH

- A. Where specified, concrete floor topping shall be applied by the Contractor to structural slabs after equipment has been set. Topping may be placed without Engineer's authorization. Structural slab will be broomed to expose aggregate when concrete is green. Structural slab will be cleaned and kept moist 12 hours prior to placing topping. Immediately before placing concrete topping, broom in slush coat of cement and water mixed to consistency of thick paint. Use 1 part Portland Cement, 1 part sand, and 1-1/2 parts pea gravel for concrete topping. Use no more than 5 gallons of water per sack of cement. Add 5 pounds of non-shrinking grout aggregate per sack of cement in mix. Steel trowel finish will be provided. If specified, the Contractor shall apply liquid floor hardener in accordance with manufacturer's recommendations. If specified, the Contractor shall apply integral concrete coloring in accordance with manufacturer's recommendations.

3.20 FILLING FOR TIE AND BOLT HOLES

- A. The Contractor shall fill holes solid with cement mortar. Add white cement to mortar so that patches will not appear darker than adjacent concrete surface. Mortar shall be placed into holes as dry as possible. Holes passing entirely through concrete shall be filled from inside of structure with pressure gun or other device that will force mortar through to outside face. Strike off excess mortar flush with surface and finish to make hole as inconspicuous as possible.

3.21 PATCHING

- A. Slight honey-comb and other minor defects in concrete surfaces **shall** be patched with cement mortar mixed 1 part cement to 2 parts fine aggregate. The Contractor shall repair by cutting out unsatisfactory material and replacing it with new concrete, securely keyed and bonded to old concrete and finish so as to make joints as inconspicuous as possible. Mixture shall be as stiff

and dry as possible. For hydraulic structures, repair areas in which honeycomb occurs to prohibit leakage through concrete, using mortar to which non-shrinking grout aggregate has been added at the rate of 5 pounds per sack of cement.

3.22 RUB-FINISH SURFACES

A. Extent Required:

Exposed vertical and battered surfaces shall be rub-finished from 6 inches below surface or from below water level to the top, except for small structures which extend 12 inches or less above finished grade.

B. Procedure:

The Contractor shall start the rubbing operations immediately after form removal. Do necessary pointing as forms are removed. Remove forms only as rubbing progresses in No. 16 Carborundum Stone or equal. Rub sufficiently to bring to surface paste and to produce smooth dense surface without irregularities. Add no cement to form surface paste. Spread or brush material which has been ground to paste uniformly over surface and allow to take reset. Do not rub chamfered corners in first surface rubbing. First rubbing shall be completed within 36 hours after completion of concrete placement. In preparation for final finish, rub with No. 30 Carborundum Stone or equal. After rubbing, strip surface with brush and allow mortar on surface to take reset; then wash surface with clean water. Leave structure with clean, neat, and uniform appearing finish.

3.23 ROUGH FINISH

- A. For concrete having no special finish indicated, remove ties, fill holes, and remove fins and rough edges.

3.24 WATERSTOPS

- A. Waterstop material will be completely embedded in concrete and shall extend an equal distance into both the old and the new concrete. Waterstops shall be continuous. Splices will be made in accordance with manufacturer's recommendations and approved by the Engineer.

3.25 GROUTING

A. Mixture:

The Contractor shall mix grout (proportion by weight) as follows:

- (1) For Setting New Equipment: Where clearance is 1 inch or less in thickness, the Contractor shall use 1 part Portland Cement, 1 part clean sharp sand, 7/10 part non-shrinking grout aggregate. No more than 5-1/2 gallons water per sack of cement. Where clearance is over 1 inch in thickness, the Contractor shall use 1 part Portland Cement, 1 part clean sharp sand, and 1-1/2 parts 1/4 inch pea gravel, 7/10 part non-shrinking grout aggregate. No more than 6 gallons of water per sack of cement.
- (2) Other: For general purpose grouting, the Contractor shall use 1 part Portland Cement and 2 parts sand. When space to be grouted is less than 1 inch, and it is impossible to tamp grout, use 1 to 1 mixture. Use stiff mixture for grout to be tamped. To obtain stiff grout mix mortar using amount of water required to thoroughly mix ingredients, then continue mixing without additional water until grout is stiff enough to be compacted by tamping when placed. For grouting blockouts for embedded pipes and similar items, use grout to which 5 pounds of non-shrinking grout aggregate per sack of cement has been added.

B. Procedure for Grouting Equipment:

The surfaces of foundations that are to receive grout shall be free of all laitance, grease, oil, organic matter and loose particles. Bolt holes shall be cleaned of all extraneous matter. Concrete shall be chipped in order to obtain a firmer bond as directed by the Engineer. Forms for the grout shall be set true, level, and tight, and shall be well braced. All equipment to be grouted shall be assembled at the grouting site before grouting operations begin. Base plates and items to be embedded shall be cleaned and set in their final positions prior to the start of grouting operations. All equipment shall be so shimmed as to facilitate the removal of the shims. Shims shall be removed only after the grout has attained its full strength. The areas to receive grout shall be kept wet for a minimum of 12 hours prior to grouting. Neat cement mortar slush coat shall be applied with a stiff brush, and shall be scrubbed into the concrete foundation and applied to the sides and bottom of the base plate or other item to be set. The mortar shall be thoroughly mixed and an excess of water in the mixture shall be avoided. The grout shall be continuously worked and rodded while it is being placed in the forms. All grout destroyed in the removal of shims shall be replaced with grout of the exact same composition and consistency. All grout containing non-shrinkage grout aggregate shall be cut off vertically below the outside edge of the base plate or the base of the embedded equipment, and normal cement mortar shall be used to cover the edge of the grout. All exposed surfaces of the grout shall be steel troweled. All exposed areas shall be protected against rapid drying out. Items embedded in grout shall not be stressed. The machinery embedded in the grout shall not be operated for 36 hours.

END OF SECTION 03 11 13

CONCRETE REINFORCEMENT (CIVIL SITEWORK)
SECTION 03 20 01

PART 1 - GENERAL

1.1 SCOPE

- A. This specifications shall govern for all work necessary for furnishing reinforcing steel, bar supports, welding, tools, supplies, equipment and services, and placing of concrete reinforcement of the shape and dimensions shown on the contract drawings, and as called for by these specifications required to complete the project.

PART 2 - PRODUCTS

2.1 REINFORCING STEEL

- A. All reinforcing bars, except column, shall be deformed as defined in ASTM Specifications. All reinforcing bars, unless noted on the structural drawings, shall be Grade 60 as defined by the American Society for Testing and Materials. "Standard Specifications for Rail-Steel and Axie-Steel Deformed Bars for Concrete Reinforcement" (A615 A996). Spiral reinforcing steel shall be fabricated from cold drawn with (ASTM A106) or hot rolled plain or deformed bars conforming to ASTM A625, Grade 60. Welded smooth wire fabric shall conform to ASTM A1064 "Welded Steel Wire Fabric for Concrete Reinforcement" (ACI 318 limits the wire spacing to 12 inches maximum). Welded deformed wire fabric shall conform to ASTM A1064 "Welded Deformed Steel Wire Fabric for Concrete Reinforcement" (ACI 318-71 limits the wire spacing to 16 inches max.).

2.2 TIE WIRE

- A. The tie wire used shall be black annealed wire, 16 gauge or heavier.

2.3 REINFORCING BAR SUPPORTS

- A. Bar supports shall conform to the "Bar Supports Specifications" contained in "Manual of Standard Practice", as published by the Concrete Reinforcing Steel Institute and the Western Concrete Reinforcing Steel Institute. The Contractor shall provide such accessories as plastic spacers, plastic bar supports (chairs), and other approved devices necessary for proper assembly, spacing and supporting the reinforcing steel.

2.4 REINFORCEMENT ACCESSORIES

- A. All accessories for reinforcement spacing and support shall be the size and type to accurately conform to the required spacing and concrete clear cover as shown on Construction Drawings.

2.5 MILL CERTIFICATES

- A. Two certified copies of mill tests on each grade of reinforcing steel delivered showing physical and chemical analysis shall be provided, upon request, at the time of shipment.

2.6 SURFACE CONDITION

- A. Metal reinforcement at the time concrete is placed shall be free from mud, oil, or other non-metallic coatings that adversely affect bonding capacity. Metal reinforcement, except pre-stressing steel, with rust, mill scale, or a combination of both shall be considered as satisfactory, provided the minimum dimensions, including height of deformations and weight

of a hand wire brushed test specimen, are not less than the applicable ASTM specification requirements.

2.7 REINFORCING STEEL OF FOREIGN MANUFACTURER

- A. No reinforcing steel of foreign manufacture shall be allowed on the project site. Any foreign steel accidentally delivered to the project site must be removed immediately.

PART 3 EXECUTION:

3.1 STORAGE

- A. The Contractor shall store all reinforcement above the surface of the ground on platforms, skids or other suitable supports.

3.2 PROTECTION

- A. The Contractor shall protect all reinforcement from mechanical injury, from surface deterioration caused by exposure to conditions producing rust, and from non-metallic coatings that adversely affect bonding capacity.

3.3 STANDARD PRACTICE

- A. All requirements of concrete reinforcement not covered in these specifications or on the structural drawings shall be in accordance with "Manual of Standard Practice", as published by the Concrete Reinforcing Steel Institute and the Western Concrete Reinforcing Steel Institute. All hooks shall conform to bend dimensions defined as "ACI Standard Hooks" in "Manual of Standard Practice", as published by the Concrete Reinforcing Steel Institute and the Western Concrete Reinforcing Steel Institute, unless otherwise shown on the structural drawings. All reinforcing bars shall be bent cold. Reinforcing bars shall not be bent or straightened in a manner that will injure the material. Reinforcing bars shall conform accurately to the dimensions shown on the structural drawings and within the fabricating tolerances shown in "Manual of Standard Practice", as published by the Concrete Reinforcing Steel Institute and the Western Concrete Reinforcing Steel Institute.

3.4 PLACING REINFORCING STEEL

- A. The placement of bars should conform to the recommended practices in "Placing Reinforcing Bars", as published by the Concrete Reinforcing Steel Institute. Bars should be securely tied to prevent displacement during the concreting operation and all dowels must be wired in place before depositing concrete. All splicing of bars, concrete cover, placing tolerances and bar spacing shall conform to "Building Code Requirements for Structural Concrete" (ACI318), as published by the American Concrete Institute, and to recommended practices in "Reinforcing Bar Splices" by the Concrete Reinforcing Steel Institute. All reinforcing steel splices shall be Class C, unless shown otherwise on the drawings.

3.5 SHOP DRAWINGS

- A. The Contractor shall furnish, 6 copies of the placing drawings and bar lists in accordance with the latest revision of "Manual of Standard Practice for Detailing Concrete Structures" (ACI315), as published by the American Concrete Institute. Reinforcing steel shall not be fabricated until shop drawings have been approved by the Engineer.

END OF SECTION 03 20 01

NORMAL WEIGHT AGGREGATE CONCRETE (CIVIL SITEWORK)
SECTION 03 30 02

PART 1 – GENERAL

1.1 SCOPE

- A. This specification shall govern for all work necessary for providing all Portland Cement Concrete with normal weight coarse aggregate required to complete the project.

PART 2 - PRODUCTS

2.1 PORTLAND CEMENT

- A. Portland Cement shall conform to ASTM I-150 and shall be Type I. Other types of cement shall be used only when approved by the Engineer.

2.2 WATER

- A. Water shall be reasonably clean and free from injurious amounts of oils, acid, salt, alkali, organic matter or other deleterious substances. Questionable water shall be tested by a testing laboratory in accordance with ASTM C-94. The cost of testing will be borne by the Contractor. Potable water need not be tested.

2.3 FINE AGGREGATE

- A. Fine Aggregate shall consist of natural sand, or sand prepared from product obtained by crushing stone or gravel. Sampling of fine aggregate shall be in conformance with ASTM D-75. Sieve analysis shall be in accordance with ASTM C-136.
- B. Fine aggregate shall conform to the following grading requirements:
- | | |
|--|--------------|
| Retained on 3/8" screen | 0.0% |
| Retained on 1/4" screen | 0 to 5.0% |
| Retained on 20 mesh sieve | 15 to 50.0% |
| Retained on 100 mesh sieve | 85 to 100.0% |
| Deleterious substances shall not be present in excess of following percentage by weight. | |
| Material removed by decantation | 3.0% |
| Clay Lumps | 0.5% |
| Other substances such as coal, shale and friable particles | 2.0% |
- C. Fine aggregate shall be of such quality that when made into mortar and tested in accordance with ASTM C-87 the mortar shall develop a compressive strength at 7 days and 28 days of not less than 95 percent of that developed by the mortar specified as the basis for comparison. Sand shall not contain organic impurities in amounts that, when the sand is tested in accordance with ASTM C-40, would cause it to show a color darker than the standard color. Fine aggregate shall have a fineness modulus conforming to the following:
- | | |
|--------------------------------------|--------------------|
| All strength concrete | not less than 2.0 |
| 2,000 psi concrete and less | not more than 3.25 |
| 2,500 psi concrete and greater | not more than 3.50 |
- D. The fineness modulus shall be determined by adding total percentages retained on the following U.S. Standard sieves and dividing by 100:
3 in., 1-1/2 in., No. 4, No. 8, No. 16, No. 30, No. 50 and No. 100.

2.4 NORMAL WEIGHT COARSE AGGREGATE

- A. Coarse aggregate shall consist of crushed stone or gravel. Sampling of coarse aggregate shall be in conformance with ASTM D-75. Sieve analysis shall be in accordance with ASTM C-136. Coarse aggregate shall conform to the following grading requirements:
- B. Retained on 2" screen 0.0%
Retained on 1-1/2" screen 0 to 5.0%
Retained on 3/4" screen 25 to 60.0%
Retained on 1/4" screen 95 to 100.0%
Deleterious substances shall not be present in excess of following percentages by weight:
Material removed by decantation 1.00%
Shale or slate 1.00%
Clay lumps 0.25%
Soft fragments 3.00%
- C. Sum of all deleterious ingredients, exclusive of material removed by decantation, shall not exceed 4% by weight.
- D. Coarse aggregate shall not exceed the following:
- E. Soundness test (Sodium sulfate) weighted average loss at 5 cycles 15.0%
Absorption test 3.0%
- F. Coarse aggregate shall not have a wear equivalent of more than 40 when tested for abrasion in conformance with ASTM C-131.

2.5 RETARDER – DENSIFIER

- A. When a retarder-densifier is required it shall be Sika's "Plastiment", Sonneborn's "Sonotar" or an approved equal. Mixing shall be done in strict conformance with manufacturer's recommendations.

2.6 AIR-ENTRAINMENT AGENT

- A. The use of air-entrainment admixture is required for all concrete. Air-entrainment shall be at least 3% but shall not exceed 5%. Mixing shall be done in strict conformance with manufacturer's recommendation. ASTM C-138, C-173 or C-231 shall govern.

2.7 WATER REDUCING ADMIXTURE

- A. A high range water reducing admixture shall be used on all vertical concrete pours (such as walls) and a mid-range reducing admixture shall be used for all horizontal flatwork. A high range water reducing admixture shall meet the requirements for ASTM C494, Type G. Water reducing dosage rates shall be in accordance with manufacturer's recommendations. Maximum slump prior to addition of the high range water reducer shall be 2". Slump after addition of the high range water reducer will be 4" minimum to 8" maximum. Approved high range water reducing admixtures include Daracem 100 manufactured by W. R. Grace or Rheobuild 1000 manufactured by Masterbuilders. Mid-range water reducing admixtures shall also be manufactured by W. R. Grace, Masterbuilders or approved equivalent.

2.8 FLY ASH

- A. Fly ash may be used if the following criteria are met:
 - a. Meets the requirements of ASTM C618, Class F.
 - b. Provide a Certificate of Compliance for the fly ash.
 - c. Mix design shall not contain more than 25% by mass of the cementitious material.

PART 3 – EXECUTION

3.1 PROPORTIONING OF CONCRETE

- A. It is the intent of this specification to obtain concrete of a homogeneous structure that will be of such consistency and composition that it can be worked readily into corners and angles of forms and around the reinforcement without permitting materials to segregate or free water to collect on the surface. The concrete when it hardens will have a resistance to weathering and the required compressive strength. The general requirements for different compressive strength concrete are as follows:

<u>Min. 28-day Compressive Strength</u>	<u>Max Allowable Water-Cement Content Gal. per sack of Cement*</u>	<u>Min. Cement Content-Sacks per Cubic Yard</u>	<u>Slump Range</u>
1500 psi (Class E)	10.5	3.0	2"-6"
Seal Slab (Class D)		4.0	6"-8"
2000 psi (Class C)	7.5	4.0	2"-5"
2500 psi (Class B)	6.75	4.5	2"-5"
3000 psi (Class A)	6.25	5.25	2"-5"
4000 psi (Class 2-A)	5.0	6.5	2"-5"
5000 psi (Class 3-A)	4.0	7.0	2"-5"

* Maximum water/cement ratio for watertight structures shall be less than or equal to 0.35. For non-watertight structures, the maximum water/cement ratio shall be less than or equal to 0.45. Maximum allowable net water content will be the amount added to the mixer, plus free water in the aggregate based on the thirty minute absorption period. No allowance will be made for evaporation of water after batching.

3.2 MIX DESIGN

A. General

It is the intent of these specifications that the Contractor is responsible for providing a mix design that will produce a concrete meeting the requirements of this specification.

B. Mix Design Report

The Contractor shall submit to the Engineer for approval six (6) copies of a mix design prepared by a reputable testing laboratory. The cost of the mix design shall be as set out in 02020 - Sitework Laboratory Testing Schedule. The mix design shall include mix proportions, water cement ratio, slump and workability characteristics required to produce the specified compressive strength concrete. The mix design shall be established by making, curing and testing a minimum of 5 standard size test cylinders for each strength concrete. Cylinders shall be made, cured and tested in conformance with ASTM C-192 and C-39. The mix design does not have to be prepared especially for this project, but it must apply to the materials being furnished. The mix design must be delivered to the Engineer four (4) days prior to the first pour. The Contractor shall have written notice from the Engineer approving the mix design before placing any concrete. If, during progress of the work, it is found impossible to secure concrete of required workability and strength with material being furnished by Contractor, the Engineer may order such changes as may be necessary to secure desired properties, subject to limiting requirements shown in Paragraph 3C1.3. Any changes so ordered shall be made at the Contractor's expense, and no extra compensation will be allowed by reason of such change.

3.3 CONSISTENCY

A. General

The quantity of water to be used shall be determined by the Engineer and shall be such as to give a mixture containing the minimum of water consistent with the required workability. The

quantity of water shall be varied only by the Engineer. The Contractor shall provide a concrete that has a consistency that conforms to the following:

- a. The mortar will cling to the coarse aggregate.
- b. The concrete is not sufficiently fluid to segregate to the place of deposit.
- c. The concrete, when dropped directly from the discharge chute of the mixer, will flatten out at the center of the pile, but the edges of the pile will stand up and not flow.
- d. The mortar will show no free water when removed from the mixer.
- e. The concrete will settle into place when deposited in the forms; and when transported in metal chutes at an angle of 30 degrees with the horizontal, it will slide and not flow into place.
- f. The surface of the finished concrete will be free from laitance or a surface film of free water

B. Concrete Failing To Meet Consistency Requirements

Any concrete mix failing to meet the above outlined consistency requirements, although meeting the slump requirements, will be considered unsatisfactory; and the mix shall be changed to correct such unsatisfactory conditions. The slump test will be made by the Engineer in accordance with the methods outlined in ASTM C-143.

3.4 MIXING

A. General

The Contractor shall procure concrete from a "transit-mixed" concrete plant. Aggregates shall be proportioned by weight unless a satisfactory volumetric method of measurement is approved by the Engineer. The use of fractional sacks of cement will not be permitted unless the cement is proportioned by weight. Water shall be measured by an accurate measuring device which can be adjusted to compensate for variations in the free moisture content of the aggregate. The concrete shall be mixed in quantities required for immediate use, and any concrete which is not in place within one hour after start to mixing shall not be used unless otherwise authorized by the Engineer. In threatening weather, which in the opinion of the Engineer may result in conditions that will adversely affect the quality of the concrete to be placed, the Engineer may order postponement of the work. Where work has been started and changes in weather conditions require protective measures to be used, the Contractor shall furnish adequate shelter to protect the concrete against damage from rainfall or damage due to freezing temperatures. In case it is necessary to continue mixing operations during rainfall, the Contractor shall provide protective covering for the material stockpiles as well as for the concrete being placed. The covering for aggregate stockpiles will be required only to the extent as may be necessary to control the moisture conditions in the aggregate so that adequate control of the consistency of the concrete mix may be maintained. No concrete shall be mixed without the approval of the Engineer when the air temperature is at or below 40°F. (taken in the shade away from artificial heat) and falling. If authorized for concrete placement during cold weather, the concrete will be placed in accordance with the PCA "Design and Control of Concrete Mixtures". The maximum temperature of cast-in-place concrete (Type I, Portland Cement and Type K, Shrinkage Compensating Cement) shall not exceed 98°F. If adjustments of the mixture for temperature control are required, then the procedure for hot-weather mixing, placing and curing shall be in accordance with ACI 305 Recommended Practice for Hot Weather Concreting.

B. "Transit-Mixed" Concrete

The mixing and the transporting operations shall conform with ASTM C-94. Mixing water shall not be added after a truck has left the plant except by permission of the Engineer or his representative. No concrete shall be used in the work which has been held longer than 1 hour in a mixer truck, unless approved by the Engineer. If dry batched to the job site, the batching plant operations shall conform with ASTM C-94. Transportation of the dry materials shall be performed in such a manner as to prevent loss, segregation or contamination of ingredients.

3.5 LABORATORY TESTING OF CONCRETE

- A. Moisture content check will be made at sufficient intervals to maintain accurate batching and proportioning. All sampling will be done in accordance with ASTM sampling and testing procedures. See Section 02020 Sitework Laboratory Testing Schedule for test cylinder requirements. A set of test cylinders shall consist of 3 test cylinders. One cylinder shall be tested for strength at the age of 7 days, one cylinder at the age of 28 days, and one cylinder shall be held in reserve to be tested for strength when directed by the Engineer. The cylinders shall be made and cured in conformance with ASTM C-192. Curing facilities shall be provided in accordance with ASTM C-31. Cylinders shall be tested in conformance with ASTM C-39. Air content shall be tested in accordance with ASTM C173. Slump tested in accordance with ASTM C143.

3.6 FAILURES TO MEET STRENGTH REQUIREMENTS

- A. Should the strength shown by the test specimens made and tested fall below the values required, the Engineer shall have the right to require changes in proportions, or to require additional curing on those portions of the structure represented by the test specimens which failed. If additional curing does not give the strength required, the Contractor will be responsible for removal and replacement of those portions which fail to develop required strength. Specimens will be considered to have failed when average strength for any period of placing is less than values indicated in the following table:

No. Days Consecutive Placing of Any One Class Of Concrete	Percent of Strength Specified
1	85
2	95
3	95
5 or more	100

When additional curing of portions of the structure is ordered by the Engineer, it shall be done at Contractor's expense and no claim for extra compensation for such additional curing shall be allowed. In no case shall the Contractor be required to provide such additional curing beyond a total of 21 days, except where average strengths of specimens, representing concrete placed on any three consecutive days, fall below 80% of the value specified in Part 3 "Proportioning of Concrete". In this case, curing shall be continued until cores drilled from portions of the structure involved show an average strength equal to that specified in Part 3 "Proportioning of Concrete". Cores shall have diameter of approximately three times the maximum size of aggregate and shall be tested in accordance with ASTM C-42.

3.7 STORAGE OF MATERIALS

- A. Cement shall be stored off the ground in a well-ventilated, weatherproof building. Aggregate shall be stored in a manner that will prevent the mixing of foreign materials and in a manner to prevent segregation of the aggregate.

3.8 MEASUREMENT OF MATERIALS

- A. The measurement of materials, except water, used in the batches of concrete shall be by weight. The different grades of aggregate shall be weighed separately. Cement may be measured by the bag. Water may be measured by volume. Allowance will be made for water content where moist aggregates are used.

END OF SECTION 03 30 03

CLEARING, GRUBBING AND STRIPPING
SECTION 31 10 00

PART 1 – DESCRIPTION

1.1 SCOPE

- A. This specification shall govern for all work necessary to complete the clearing, grubbing and stripping as indicated by the drawings and as specified herein and shall include removing and disposing of all trees, stumps, brush, roots, logs, vegetation, rubbish and other objectionable matter from the project area.

PART 2 – PRODUCTS

PART 3 – EXECUTION

3.1 CLEARING

- A. Clear the project site of all trees, stumps, brush, roots, logs, vegetation, rubbish, and objectionable material.

3.2 GRUBBING

- A. Grub all stumps and roots to a depth of two and one half feet below natural ground.

3.3 STRIPPING

- A. Stripping all area, which underlie compacted fill, of all humus, vegetation or other unsuitable materials encountered within the top 6 inches of soil.

3.4 DISPOSAL

- A. Remove all materials from the clearing, grubbing, and stripping operation from the site when no disposal area is shown on the drawings. Burning will be allowed when not in violation with local ordinances; however, Contractor shall be held responsible for any fires or accidents resulting from this operation.

END OF SECTION 31 10 00

**SITE EXCAVATION AND FILL
SECTION 31 20 00**

PART 1 – DESCRIPTION

1.1 SCOPE

- A. This specification shall govern for all work necessary for excavation and fill required to obtain the finished site grades shown on the drawings necessary to complete the project.

PART 2 - PRODUCTS

- 2.1 No excavated asphalt, base material, concrete, masonry, rock, trees, stumps and roots shall be used for fill unless authorized in writing by the Engineer. Only excavated material suitable for the purpose shall be used as fill.

2.2 BALANCE OF CUT AND FILL

- A. The excavation (of suitable material) and fill does not balance. The Contractor shall haul in or off material as is necessary to provide the grades shown on the drawings.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall accomplish all site excavation as required to conform to the grades and sections shown on the drawings. The Contractor shall use suitable material taken from the site excavation, street excavation and excess ditch excavation to fill the site as required to conform to the grades and sections shown on the drawings.

3.2 TOP SOIL

- A. The Contractor shall schedule his operation so that the majority of the top soil excavated will be spread as the top layer of fill.

- 3.3 COMPACTION OF FILL: See Section 31 23 23 "Compacted Embankment".

- 3.4 SHAPING AND GRADING: See Section 31 22 13 "Site Grading".

END OF SECTION 31 20 00

**SITE GRADING
SECTION 31 22 13**

PART 1 – DESCRIPTION

1.1 SCOPE

- A. This specification shall govern for all work necessary to accomplish shaping and grading indicated on the drawings and specified herein and shall include maintaining surface drainage during construction, finish grading and all phases of the cleanup operation. This specification is a performance specification as defined in Section 00 72 00 General Conditions, Subsection "Supplemental General Conditions", Art. SC-1 Definitions.

PART 2 – PRODUCTS

2.1 GENERAL

- A. The Contractor shall uniformly grade the entire project site to provide a pleasing appearance.

PART 3 – EXECUTION

3.1 FINISHING SLOPES AND SURFACES

- A. The Contractor shall shape and grade the project site to conform to the proposed grade and/or sections shown on the drawings, and as directed by the Engineer. In any case, the Contractor shall grade the site to provide positive drainage away from buildings and towards roads and drainage facilities. The finished appearance shall be reasonably smooth and even (abrupt changes in slope shall not be used). The degree of finish for grading slopes shall be that ordinarily obtainable either from blade-grader operations, or by hand-shovel operations, as the Contractor may elect, subject to the approval of the Engineer.

Adjust any existing or new valve boxes, manhole rims, etc. to new final grades and pour concrete pads as shown in details provided in drawings.

3.2 CLEAN-UP

- A. The Contractor shall keep the site and structures free from accumulations of waste materials, debris, etc. caused by the work or his employees. Upon completion of the project and before requesting final inspection, the site and his work shall be "broom clean" or its equivalent.

END OF SECTION 31 22 13

STRUCTURAL EXCAVATION AND BACKFILL
SECTION 31 23 00

PART 1 – DESCRIPTION

1.1 SCOPE

- A. This specification shall govern for all work necessary to accomplish the structural excavation required to complete the project.

PART 2 – PRODUCTS

- 2.1 Structural excavation shall include all material encountered including earth, asphalt, base material, concrete, masonry, rock, trees, stumps, and roots.

2.2 STRUCTURAL EXCAVATION EXCEEDING 5 FEET IN DEPTH

- A. Excavation Safety:
The Contractor's excavation safety procedures shall, in all respects, meet the current standards established by the U. S. Department of Labor, Occupational Safety and Health Administration (OSHA) on excavation, trenching and shoring.
- B. Responsibility:
Contractor has the sole and exclusive responsibility for the sufficiency of the trench excavation safety systems utilized. The Contractor shall specifically agree that neither the Owner nor the Engineer has such responsibility, and Contractor will not rely on the Owner or the Engineer or any of their representatives for inspection, design, supervision, construction or any other aspect of trench excavation safety protection. Contractor shall fully indemnify, save and hold harmless Owner and Engineer, their employees and agents (hereinafter the Indemnities) against any and all liability, damage, loss, claims, demands and actions of any nature whatsoever on account of personal injuries (including, without limitation on the foregoing, workers' compensation and death claims), or property loss or damage of any kind whatsoever, which arise out of or are in any manner connected with, or are claimed to arise out of or be in any way connected with, the negligence of the Contractor in the inspection, design, engineering, supervision, construction, safety devices or other activity connected with the trench excavation safety protection under this Agreement. Contractor shall, at his own expense, investigate all such claims and demands, attend to their settlement or other disposition, defend all actions based thereon and pay all charges of attorneys and all other costs and expenses of any kind arising from any such liability, damage, loss, claims demands, and actions.

2.3 STRUCTURAL EXCAVATION 5 FEET OR LESS IN DEPTH

- A. General:
The limit of excavation shall be such to allow for placing and removing forms, installing sheeting, shoring, bracing, etc. The Contractor shall pile excavated material in a manner that will not endanger the work and will avoid obstructing sidewalks and driveways. Gutters shall be kept clear.
- B. Vertical Sides:
When necessary to protect existing or proposed structures or other improvements, the Contractor shall maintain vertical sides of the excavation. The limit shall not exceed three feet outside the footing on a vertical plane parallel to the footing except where specifically approved otherwise by the Engineer. The Contractor shall provide and install any sheeting, shoring and bracing as necessary to provide a safe work area as required to protect workmen, structures, equipment, trees, etc. The Contractor shall be responsible for the design and adequacy of all sheeting, shoring, and bracing. The sheeting, shoring, and bracing shall be removed as the excavation is backfilled in such a manner as to prevent injurious caving.

C. Sloping Sides:

Where sufficient space is available, the Contractor shall be allowed to back slope the sides of the excavation. The back slope shall be such that the excavation shall be safe from caving. The type of material being excavated shall govern the back slope used. The Contractor shall be responsible for determining the back slope used, but in any case the back slope shall be no steeper than 1 foot horizontal to 1 foot vertical.

PART 3 – EXECUTION

3.1 DEWATERING

- A. The Contractor shall keep the excavation free from water by use of cofferdams, bailing, pumping, well point, or any combination as the particular situation may warrant. All dewatering devices shall be installed in such a manner as to provide clearance for construction, removal of forms, and inspection of exterior of form work. It is the intent of these specifications that the foundation be placed on a firm dry bed. The foundation bed shall be kept in a dewatered condition a sufficient period of time to insure the safety of the structure, but in no case shall dewatering be terminated sooner than 7 days after placing concrete. All dewatering methods and procedures are subject to the approval of the Engineer. The excavation shall be protected from excessive rainfall and drying. The excavation shall be inspected and approved by the Engineer before work on the structure is started. It is the intent of these specifications that the Contractor provide a relatively smooth, firm foundation bed for footings and slabs that bear directly on the undisturbed earth without additional cost to the Owner, regardless of the soil conditions encountered. The Engineer will be the judge as to whether these conditions have been met. The Contractor shall pile excavated material in a manner that will not endanger the work.

3.2 UNAUTHORIZED OVER- EXCAVATION

- A. Excavation for slabs, footings, etc., that bear on earth shall not be carried below the elevation shown on the drawings. In the event the excavation is carried on below the indicated elevation, the Contractor shall bring the slab, footing, etc., to the required grade by filling with concrete having a minimum compressive strength of at least 3000 psi. at 28 days. See Subsection 03 30 02 Normal Weight Aggregate Concrete.

3.3 BACKFILL MATERIAL

- A. General:
Suitable material chosen from the excavation shall be used for backfill. The material chosen shall be free of large lumps or clods, which will not readily break down under compaction. This material will be subject to approval by the Engineer. Backfill material shall be free of vegetation or other extraneous material. Excavated materials which are to be used for fill or backfill may be stockpiled on the site. Location of stockpiles shall be approved by the Engineer. Top soil should be stockpiled separately and used for finish grading around structure.
- B. Fiberglass Manholes and Wet Wells:
Sand shall be used for backfill around manholes and/or wet wells for a distance of 2 feet from the outside surface and extending from the bottom of the excavation to the bottom of the top slab. Suitable material (as set out above) chosen from the excavation may be used for the remainder of the backfill. Location of stockpiles shall be approved by the Engineer.

3.4 SCHEDULE OF BACKFILLING

- A. Concrete and Masonry Structures:

The Contractor shall begin backfilling of concrete structures no sooner than 7 days but no later than 14 days, after they are cast. The Contractor shall backfill brick and mortar structures after they have been in place at least 3 days.

B. Fiberglass Manholes and Wet Wells:

The Contractor may begin backfilling of manholes and/or wet wells as soon as the concrete has been allowed to cure and any forms are removed.

3.5 BACKFILL

A. General:

Backfill shall be placed in layers of not more than 9 inches (loose measure) and mechanically tamped to at least 95% Standard Proctor Density - A.S.T.M. Specification D-698. Flooding will not be permitted. Backfill shall be placed in such a manner as to prevent any wedging action against the structure.

B. Fiberglass Manholes and Wet Wells:

Backfill shall be placed in layers of not more than 6 inches (loose measure) and mechanically tamped to at least 95% Standard Proctor Density. Flooding will not be permitted. Backfill shall be placed in such a manner as to prevent any wedging action against the structure.

3.6 EXCESS AND UNSUITABLE MATERIAL

A. All excess and/or unsuitable excavated material shall be loaded and hauled off the Contractor.

END OF SECTION 31 23 00

**PIPE TRENCH EXCAVATION AND BACKFILL
SECTION 31 23 16.13**

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This specification shall govern for all work necessary to accomplish the pipe trench excavation for all piping required to complete the project. This specification is a performance specification as defined in Art. TS-1 of the Technical Special Provisions.

PART 2- PRODUCTS

2.1 MATERIAL

- A. Trench excavation shall include all material encountered including dirt, asphalt, base material, concrete, masonry, rock, trees, stumps and roots. Trench excavation will not be measured.

2.2 TRENCHES EXCEEDING 5 FEET IN DEPTH

- A. Trench Excavation Safety
The Contractor's trench excavation safety procedures shall, in all respects, meet the current standards established by the U. S. Department of Labor, Occupational Safety and Health Administration (OSHA) on excavation, trenching and shoring.
- B. Responsibility
Contractor has the sole and exclusive responsibility for the sufficiency of the trench excavation safety systems utilized. The Contractor shall specifically agree that neither the Owner nor the Engineer has such responsibility, and Contractor will not rely on the Owner or the Engineer or any of their representatives for inspection, design, supervision, construction or any other aspect of trench excavation safety protection. Contractor shall fully indemnify, save and hold harmless Owner and Engineer, their employees and agents (hereinafter the Indemnities) against any and all liability, damage, loss, claims, demands and actions of any nature whatsoever on account of personal injuries (including, without limitation on the foregoing, workers' compensation and death claims), or property loss or damage of any kind whatsoever, which arise out of or are in any manner connected with, or are claimed to arise out of or be in any way connected with, the negligence of the Contractor in the inspection, design, engineering, supervision, construction, safety devices or other activity connected with the trench excavation safety protection under this Agreement. Contractor shall, at his own expense, investigate all such claims and demands, attend to their settlement or other disposition, defend all actions based thereon and pay all charges of attorneys and all other costs and expenses of any kind arising from any such liability, damage, loss, claims demands, and actions.

2.3 TRENCHES 5 FEET OR LESS IN DEPTH

- A. The Contractor shall maintain vertical sides of the trench. The minimum and maximum width of trench is set out on the Drawings. The Contractor shall provide and install any sheeting, shoring and bracing as necessary to provide a safe work area as required to protect workmen, structures, equipment, trees, etc. The Contractor shall be responsible for the design and adequacy of all shoring, bracing and sheeting. The Contractor shall remove shoring, bracing and sheeting, as the excavation is backfilled, in such a manner as to prevent injurious caving.

PART 3 – EXECUTION

3.1 GENERAL

- A. The Contractor shall schedule the excavation of pipe trenches at such times and in such sequence as to present the least interference with other items of the work and the operation of the existing facilities. The Contractor shall pile excavated material in a manner that will not endanger the work, and will avoid obstructing sidewalks and driveways. Gutters shall be kept clear.

3.2 UNAUTHORIZED OVER-EXCAVATION

- A. If the Contractor should excavate below the proposed trench grade (without authorization of the Engineer) the Contractor shall correct the grade by filling in with sand and tamping thoroughly as directed by the Engineer.

3.3 TREES, STUMPS, OR ROOTS

- A. Where trees, stumps or roots are encountered, they shall be removed and disposed of by the Contractor. Roots shall be cut off flush with the sides of the trench.

3.4 ROCKS, BOULDERS, EXISTING STRUCTURES, ETC

- A. Where rocks, boulders, existing structures, or other unsuitable soil conditions are encountered, they shall be removed by the Contractor to a depth of 12 inches below the grade line for the full width of the trench and refilled with sand and tamped thoroughly as directed by the Engineer.

3.5 MAINTENANCE OF FLOW IN SEWERS AND DRAINS

- A. The Contractor shall make adequate provision for maintaining the flow of sewers and drains encountered during construction.

3.6 DEWATERING

- A. The Contractor shall keep the pipe trench free from water by use of bailing, pumping, well points or any combination as the particular situation may warrant. It is the intent of these specifications to install pipe on a firm dry bed. All dewatering methods and procedures are subject to the approval of the Engineer. The cessation of the dewatering operation will be accomplished during a sufficient period of time to insure that there is no displacement of the pipe due to unequal hydrostatic pressure.

3.7 UNSTABLE TRENCH BOTTOM

- A. When the soil encountered at the established bedding grade is a quicksand, muck or similar unsuitable material, the Contractor shall proceed as follows: All unstable soil shall be removed to a depth of 2 feet below bottom of pipe for pipe 2 feet or more in diameter, and to a depth equal to the diameter of pipe for pipe less than 2 feet in diameter. Such excavation shall be carried at least one foot beyond the horizontal limits of the structure on all sides. All unstable soil so removed shall be replaced with suitable stable material, placed in uniform layers of suitable depth as directed by the Engineer, and each layer shall be wetted, if necessary, and compacted by tamping as required to provide a stable foundation for the structure. Soil which is considered to be of sufficient stability to sustain properly the adjacent sections of the roadway embankment will be considered a suitable foundation material for the pipe.

3.8 UNYIELDING TRENCH BOTTOM

- A. When the soil encountered at the established bedding grade is ledge rock, rocky or gravelly soil, hard pan or other unyielding material, such materials shall be removed prior to bedding the pipe. These materials shall be excavated for a minimum of 6 inches below the bottom of the pipe and shall be replaced with sand.

3.9 SHAPING TRENCH BOTTOM

- A. The bottom of the trench shall be shaped to support the bottom quadrant uniformly and for its entire length. Provide bell holes for couplings. The pipe shall be bedded in a foundation of stable material accurately shaped to fit the lower part of the pipe exterior.

3.10 SAND FOR ENCASEMENT, EMBEDMENT, AND/OR HAUNCHING

- A. When the drawings require sand for encasement, haunching and/or embedment, the material shall be screened, free of foreign material and be a finely divided sand as follows:

Sand Specifications:

Passing 7/8" Sieve:.....	100% by weight
Passing No. 4 Sieve:	80% by weight
Clay Lumps not to Exceed:.....	20% by weight
Plasticity Index:.....	NP-10 max.

3.11 CRUSHED STONE FOR HAUNCHING AND/OR EMBEDMENT

- A. When the drawings require crushed stone for haunching and/or embedment, the material used shall be angular crushed stone, in the general size range of 3/4" to 1/16" which has good stability. Crushed stone shall be graded in accordance with Size #67 or #68 of AASHTO M 43, ASTM D 448.

3.12 CONCRETE EMBEDMENT

- A. When concrete embedment is required on the drawings, the concrete shall conform to Section 03 30 02 "Normal Weight Aggregate Concrete". Concrete embedment shall be allowed to cure for at least 24 hours before placing initial backfill and at least 48 hours before placing final backfill unless approved otherwise by the Engineer.

3.13 BACKFILL MATERIAL

- A. General:

Unless shown otherwise on the drawings, suitable material chosen from the excavation shall be used for backfill. The material chosen shall be free of large lumps, or clods, which will not readily break down under compaction. Backfill material shall be free of vegetation or other extraneous material. Material will be subject to approval by the Engineer. In areas not under existing or proposed pavement, the last 6 inches of backfill shall be topsoil.

B. Select Backfill Material:

When "select" backfill material is shown on the drawings, it shall be granular in nature, free of large clods, and have a plasticity index (P.I.) of less than 15.

3.14 INITIAL BACKFILL

- A. Initial backfill is defined as that backfill from the bottom of the trench (or from the top of the haunching when shown on the drawings) to 1 foot above the top of the pipe. The Contractor shall place initial backfill in maximum 8-inch layers (loose measure) and mechanically compact it to a density between 90% and 95% of the maximum density as determined by ASTM D-698 with a moisture content near optimum. Backfill below the top of the pipe shall be placed and compacted along the sides of the pipe equally to prevent strain on or displacement of the pipe.

3.15 FINAL BACKFILL

A. General:

Final backfill is defined as that backfill from 1 foot above the top of the pipe to finished subgrade or ground line. See the drawings for locations where final backfill is mechanically tamped or water tamped.

B. Mechanically Tamped:

The Contractor shall place final backfill in maximum 8-inch layers (loose measure) and mechanically compact it to a density between 90% and 95% of the maximum density ASTM D-698 with a moisture content near optimum.

C. Water Tamped:

The Contractor shall place final backfill to a level of 18 inches below the surface of the ground. Backfill will be consolidated by jetting. When jetting, selected excavated material shall be placed in layers of not more than 6 to 8 feet in depth and jetted until all settlement ceases. Water jets shall be long enough to reach through the material being tamped. It is the intent of these specifications that water tamping shall continue until all cavities have been eliminated and the material is completely consolidated. After the jetting is completed to the satisfaction of the Engineer, the remaining 18 inches shall be placed in two equal layers and mechanically tamped to at least 90% Standard Proctor Density ASTM D-698.

3.16 EXCESS AND UNSUITABLE MATERIAL

- A. All excess and/or unsuitable excavated material shall be loaded and hauled from the project site by the Contractor.

END OF SECTION 31 23 16.13

**COMPACTED EMBANKMENT
SECTION 31 23 23**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This specification shall govern for all work necessary to place and compact all suitable materials obtained from street, storm sewer, channel and structural excavation for utilization in the construction of street or roadway embankments, dikes, levees, backfill of structures and retaining walls as required to complete the project. This specification is a performance specification as defined in Art. TS-1 of the Technical Special Provisions.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Material used for embankment shall be free from muck, trees, stumps, brush, roots, rubbish and in all ways be suitable for embankment.

PART - 3 EXECUTION

3.1 GENERAL

- A. Prior to placing any embankment, the surface of the ground, including plowed, loosened ground, or surface roughened by small washes or otherwise, shall be restored to approximately its original slope by blading or other methods and where indicated on plans or required by the Engineer the ground surface thus prepared shall be compacted by sprinkling and rolling. Where indicated on plans or directed by the Engineer, the surface of hillsides to receive embankment shall be loosened by scarifying or plowing to a depth of not less than 4 inches, or cut into steps before embankment materials are placed. The embankment shall then be placed in layers, as hereinafter specified, beginning at the low side in part width layers and increasing the widths as the embankment is raised. The materials which have been loosened shall be recompacted simultaneously with the embankment material placed at the same elevation. Where embankments are to be placed adjacent to or over existing roadbeds, the roadbed slopes shall be plowed or scarified to a depth of not less than 4 inches and the embankment built up in successive layers, as hereinafter specified, to the level of the old roadbed shall before its height is increased. Then, if directed, the top of the old roadbed shall be scarified and recompacted with the next layer of the new embankment. The total depth of the scarified and added material shall not exceed the permissible depth of layer. Trees, stumps, roots, vegetation, or other unsuitable materials shall not be placed in embankment. Embankments shall be constructed to the grades shown on the drawings. After completion, it shall be continuously maintained at its finished section and grade until the project is accepted. Except as otherwise specified, earth embankments shall be constructed in successive layers for the full width of the cross section and in such lengths as are suited to the sprinkling and compaction methods utilized. Prior to compaction, the layers shall not exceed 6 inches in depth. Layers of embankment may be formed by utilizing equipment which will spread the material as it is dumped, or they may be formed by being spread by blading or other acceptable methods from piles of windrows dumped from excavating or hauling equipment in such amounts that material is evenly distributed. Each layer of embankment shall be uniform as to material, density and moisture content before beginning compaction. Where non-uniform layers abut each other, each layer shall be feather-edged for at least 100 feet or the material shall be so mixed as to prevent abrupt changes in the soil. No material placed in the embankment by dumping in a pile or windrow shall be incorporated in a layer in that position, but all such piles or windrows shall be broken and the

embankment material mixed by blading, harrowing or similar methods to the end that a uniform material or uniform density is secured in each layer. Water required for sprinkling to bring the material to the moisture content necessary for maximum compaction shall be evenly applied, and it shall be the responsibility of the Contractor to secure a uniform moisture content throughout the layer by such methods as may be necessary. In order to facilitate uniform wetting of the embankment material, the Contractor may apply water at the material source. Such procedure shall be subject to the approval of the Engineer. Each layer of embankment shall be compacted by approved power drawn rollers to the density specified. All earth cuts, full width or part width cuts in side hill, which are not required to be excavated below subgrade elevation for base and backfilled, shall be scarified to a uniform depth of at least 6" below grade, and the material shall be mixed and reshaped by blading and then sprinkled and rolled in accordance with the requirement outlined above for earth embankments and to the same density as that required for the adjacent embankment.

3.2 RETAINING WALLS, STORM SEWERS, AND BRIDGES

- A. Embankments or backfill placed adjacent to and over pipes, culverts, retaining walls, storm sewers and bridges shall be of suitable material and shall be placed in successive layers approximately parallel to the finished grade. Special care shall be taken to prevent any wedging action against the structure. For such distances along embankments adjacent to structures where it is impractical to employ the compaction methods above specified, the embankment material shall be placed in layers not exceeding 6" depth of loose material, thoroughly mixed and wetted uniformly to the moisture content directed, and shall be compacted by approved methods, maintaining the required moisture content by additional sprinkling, if necessary, until each layer has been uniformly compacted to the density specified. Embankments placed around spill-through type abutments shall be constructed in 6" loose layers of uniform suitable material placed in such manner as to maintain approximately the same elevation on each side of the abutment, and all materials shall be mixed, wetted and compacted as specified above.

3.3 DENSITY

- A. For each layer of embankment, backfill and selected material, it is the intent of this specification to provide an apparent dry density of the minus 1/4 inch material of not less than **95 percent Standard Proctor Density** as prescribed by A.A.S.H.O. Standard Method T-99, latest revision. It is also the intent of this specification that the sequence of work in constructing embankments or backfill shall be such that no compacted layer will be allowed to lose either the moisture or density specified. In case work on any partially completed embankment or backfill is suspended, the top 6 inches shall be brought to the moisture and density specified for subgrade, before placing the next layer of embankment or backfill. After each layer of earth embankment or select material is completed, tests as necessary will be made. See Special Conditions. If the material fails to meet the density specified, it shall be reworked as necessary to obtain that density. The moisture content and density shall be maintained so as to pass the above compaction test until the base material is placed.

END OF SECTION 31 23 23

SECTION 31 25 13 - STORM WATER POLLUTION PREVENTION PLAN

PART 1 SCOPE:

This specification shall govern for all work under the contract related to storm water pollution prevention. This specification is a performance specification as defined in Art. TS-1 of the Technical Special Provisions.

PART 2 REQUIREMENTS:

2.1 General:

The intent of storm water management is to improve water quality by reducing the pollutants in storm water discharges from the site. Storm water means storm water runoff, surface runoff and drainage from the construction site. The Contractor must implement the Best Management Practices (BMP) for the construction activities as outlined in the Storm Water Pollution Prevention Plan (SWPPP). Attached to and a part of this specification is the following item:

- a. Storm Water Pollution Prevention Plan (SWPPP)

2.2 Storm Water Pollution Prevention Plan (SWPPP):

a. General:

A SWPPP has been prepared for this project and is included with this specification. The SWPPP identifies potential sources of pollution that may be expected to affect the quality of storm water discharges from the construction site and includes a site description, erosion and sediment controls, storm water management, other controls, maintenance procedures and inspection procedures. The Contractor shall implement, maintain and inspect the control techniques required by the SWPPP.

b. Inspection and Maintenance:

Inspection and maintenance is required for all areas disturbed by construction activity and for all erosion and sediment controls that are used. Inspection shall be performed at least once a week, and within 24 hours of a storm event of 0.5 inches or greater for as long as a portion of the site is disturbed. The Contractor should select one individual who will be responsible for the inspection and maintenance of the system. The inspector will look at the control measures and determine if they are performing correctly and effectively. A report form is provided in the SWPPP for the inspector to use. Additional information and requirements are detailed in Section 3.5 - Maintenance/Inspection Procedures of the SWPPP.

c. Storm Water Pollution Prevention Plan:

The SWPPP is included on the following pages. After award of the project, copies of the document will be bound in the executed contract documents. Two copies of the contract documents that contain the SWPPP will be provided to the Contractor and one copy must be kept at the site of the construction activities at all times.

PART 3 STORM WATER POLLUTION PREVENTION PLAN:

3.1 Project Description:

a. General:

The project consists of installing 10,235 SF of concrete pavement, 14,651 SF building, miscellaneous site utilities and miscellaneous site grading and other related items of work. The installation will disturb approximately 0.34 acres.

b. Project Location:

The project is located on the south est corner of Ninth and Avenue C in Port Aransas, Texas.

c. Owner: City of Port Aransas

- d. Construction Contractor: _____
- e. Name of Receiving Waters: Corpus Christi Bay
- f. Site Map: N/A

3.2

Best Management Practices (BMP)

a. Erosion Controls:

The existing vegetation must be preserved to the greatest extent possible. The areas disturbed by construction will be seeded to provide stabilization and prevent erosion. The stabilization measures shall be implemented as soon as practicable in portions of the site where construction activities have ceased. Stabilization practices must be implemented no later than 14 days after the construction activities in any portion of the site have ceased. The above timing for stabilization practices does not apply to the following; areas where construction activity will resume in the area within 21 days, or in arid, semi arid or drought stricken areas. In these areas the stabilization measures will take place as soon as practicable. Other erosion control measures which may be implemented include:

- Temporary Vegetation
- Blankets/Matting
- Mulch
- Sod
- Interceptor Swale
- Diversion Dike
- Erosion Control Compost
- Mulch Filter Berms and Socks
- Compost Filter Berms and Socks

b. Sedimentation Controls:

Sedimentation controls will be implemented to retain sediment onsite and minimize offsite transport to the extent practicable. Silt fence will be installed on the slopes to prevent sediment from entering the un-named tributaries of the Nueces River and the Choke Canyon Reservoir during construction. Sediment must be removed no later than the time that the capacity of the control is reduced by 50%. If sediment escapes from the site the accumulations must be removed at a frequency so as to minimize further negative effects and whenever feasible prior to the next rain. Other sedimentation controls which may also be used include:

- Sand Bag Berm
- Rock Berm
- Brush Berms
- Mulch Filter Berms and Socks
- Compost Filter Berms and Socks
- Silt Fence

- Hay Bale Dike
- Triangular Filter Dike
- Stone Outlet Sediment Traps
- Sediment Basins
- Erosion Control Compost

c. Post-Construction TSS Control:

A sod filter strip will be placed along the toe of slope of the disturbed areas in the vicinity of the un-named tributaries of the Nueces River and Choke Canyon Reservoir to reduce the total suspended solids load in the storm water runoff. Other post-construction TSS control measures which may be implemented include:

- Retention/Irrigation
- Constructed Wetlands
- Extended Detention Basin
- Wet Basins
- Vegetative Filter Strips
- Vegetation Lined Drainage Ditches
- Grassy Swales
- Sand Filter Systems
- Erosion Control Compost
- Mulch Filter Berms and Socks
- Compost Filter Berms and Socks

3.3

Other Controls:

a. Waste Disposal:

(1) Waste Materials:

All waste materials will be collected and stored in a securely lidded metal Dumpster rented from a reputable disposal company licensed for solid waste disposal. The Dumpster will meet all local, State and Federal solid waste management regulations. All trash and construction debris from the site will be disposed in the Dumpster. The Dumpster will be emptied as necessary and the trash hauled to a permitted waste disposal site. No construction waste materials will be buried on site. All personnel will be instructed regarding the correct procedure for waste disposal. The Pollution Prevention Plan will be posted in the office trailer and the Construction Superintendent will be responsible for seeing that these procedures are followed.

(2) Hazardous Waste:

All hazardous waste materials will be disposed of in the manner as required by City, State or Federal regulations or by the materials manufacturer. All personnel will be instructed regarding the correct procedure for handling hazardous waste and the Construction Superintendent will be responsible for seeing that these procedures are followed.

(3) Sanitary Waste:

All sanitary waste will be collected from portable units as necessary and/or required by governing regulations. Collection will be by a licensed or permitted Disposal Company and the waste properly disposed of.

b. Offsite Vehicle Tracking:

Stabilized construction entrances will be provided to help reduce vehicle tracking of sediments. The paved street adjacent to the site entrance will be swept daily to remove any excess mud, dirt or rock tracked from the site.

c. Sprinkling for Dust Control:

The Contractor shall provide water as needed to sprinkle areas in order to control and minimize the generation of dust.

3.4 Demonstration of Compliance with Federal, State and Local Regulations:

This plan follows the outline provided to meet the requirements of State regulations concerning storm water management.

3.5 Maintenance/Inspection Procedures:

a. General:

All erosion, sedimentation, post-construction TSS and other protective measures identified in the SWPPP must be maintained in effective operating condition. If during the regular inspections the permittee notes that the measures are not performing as intended then maintenance must be performed before the next storm event. Any measure that has been rendered ineffective due to construction activity must be replaced or corrected immediately.

b. Maintenance and Inspection Practices for Erosion, Sedimentation and Post-Construction TSS Controls:

These are the maintenance and inspection practices that will be used to maintain erosion and sedimentation and post-construction TSS controls.

- (1) Where possible, the site work will be performed in phases leaving certain areas undisturbed as the work progresses.
- (2) All control measures will be inspected at least once each week and within 24 hours of any storm event of 0.5 inches or greater.
- (3) All measures will be maintained in good working order; if a repair is necessary, it will be initiated within 24 hours of report.
- (4) Built up sediment will be removed from silt fence when it has reached one-third the height of the fence.
- (5) Silt fence will be inspected for depth of sediment, tears, to see if the fabric is securely attached to the fence posts, and to see that the fence posts are firmly in the ground.
- (6) Earthen dikes, sediment traps and check dams will be inspected to verify they are functioning as originally constructed.
- (7) Temporary and permanent seeding, planting, mulching, sod stabilization and sod filter strips will be inspected for bare spots, washouts and healthy growth.
- (8) A maintenance inspection report will be made after each inspection. A copy of the report form to be completed by the inspector is shown at the end of this section.
- (9) The Construction Superintendent will select one individual who will be responsible for inspections, maintenance and repair activities, and filling out the inspection and maintenance report.
- (10) Personnel selected for inspection and maintenance responsibilities will receive training from the Construction Superintendent. They will be trained in all the inspection and maintenance practices necessary for keeping the erosion and sediment controls used on site in good working order.
- (11) Inspection report with certification for compliance should be retained for at least Three years.

3.6

Inventory For Pollution Prevention Plan:

The materials or substances listed below are expected to be present onsite during construction:

- a. Lumber
- b. PVC pipe
- c. Ductile iron Pipe Fittings
- d. Concrete materials and reinforcing steel
- e. Polyethylene pipe and products
- f. Petroleum and asphalt products
- g. Paint
- h. Fertilizer
- i. Herbicides

3.7

Management Practice To Prevent Spills:

a. General Material Management Practices:

The following are the material management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances to storm water runoff. The following good housekeeping practices will be followed onsite during the construction project.

- (1) An effort will be made to store only enough product required to do the job.
- (2) All materials stored onsite will be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.
- (3) Products will be kept in their original containers with the original manufacturer's label.
- (4) Substances will not be mixed with one another unless recommended by the manufacturer.
- (5) Whenever possible, all of a product will be used up before disposing of the container.
- (6) Manufacturers' recommendations for proper use and disposal will be followed.
- (7) The site superintendent will inspect daily to ensure proper use and disposal of materials onsite.

b. Hazardous Products Management Practices:

These practices are used to reduce the risks associated with hazardous materials.

- (1) Products will be kept in original containers unless they are not resealable.
- (2) Original labels and material safety data will be retained; they contain important product information.
- (3) If surplus product must be disposed of, manufacturers' or local and State recommended methods for proper disposal would be followed.

c. Product Specific Practices

The following product specific practices will be followed onsite.

(1) Petroleum Product:

All onsite vehicles will be monitored for leaks and receive regular preventive maintenance to reduce the chance of leakage. Petroleum products will be stored in tightly sealed containers, which are clearly labeled. Any asphalt substances used onsite will be applied according to the manufacturer's recommendations.

(2) Fertilizers:

Fertilizers used will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be worked in the soil to limit exposure to storm water. Storage will be in a covered shed. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to avoid spills.

(3) Herbicides:

Herbicides used will be applied only in the minimum amounts recommended by the manufacturer. Applications shall be accomplished only at times when wind will not cause over spray. Storage will be in a covered shed. Partially used containers of herbicides will be tightly resealed.

(4) Paints:

All containers will be tightly sealed and stored when not required for use. Excess paint will not be discharged to the storm sewer system but will be properly disposed of according to manufacturer's instructions or State and local regulations.

(5) Concrete Trucks:

Concrete trucks will wash out or discharge surplus concrete or drum wash water only in specific areas selected and maintained by the Contractor. The Contractor will remove this waste material at the completion of the project.

3.8

Spill Prevention And Cleanup:

In addition to the management practices discussed in the previous sections of this plan, the following practices will be followed for spill prevention and cleanup:

- a. Manufacturers' recommended methods for spill cleanup will be clearly posted and site personnel will be made aware of the procedures and location of the information and cleanup supplies.
- b. Materials and equipment necessary for spill cleanup will be kept in the material storage area onsite. Equipment and materials will include but not be limited to brooms, dust pans, mops, rags, gloves, goggles, kitty litter, sand, sawdust, and plastic and metal trash containers specifically for this purpose.
- c. All spills will be cleaned up immediately after discovery.
- d. The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.
- e. Spills of toxic or hazardous material will be reported to the appropriate State or local government agency, regardless of the size.
- f. The spill prevention plan will be adjusted to include measures to prevent this type of spill from reoccurring and how to clean up the spill if there is another one. A description of the spill, what caused it, and the cleanup measures will also be included.
- g. The Construction Superintendent responsible for the day-to-day site operations will be the spill prevention and cleanup coordinator. He will designate at least one other site personnel who will receive spill prevention and cleanup training; this individual will become responsible for a particular phase of prevention and cleanup. The names of responsible spill personnel will be posted in the material storage area and in the office trailer onsite.

**STORM WATER POLLUTION PREVENTION PLAN
INSPECTION AND MAINTENANCE REPORT**

1.) LOCATION OF BMP'S THAT NEED TO BE MAINTAINED:

2.) LOCATION OF BMP'S THAT FAILED TO OPERATE AS DESIGNED:

3.) LOCATIONS WHERE ADDITIONAL BMP'S ARE NEEDED:

4.) CHANGES REQUIRED TO THE POLLUTION PREVENTION PLAN:

5.) REASONS FOR CHANGES:

INSPECTORS SIGNATURE:_____

DATE:_____

STORM WATER POLLUTION PREVENTION PLAN
INSPECTION AND MAINTENANCE REPORT
STRUCTURAL CONTROLS

DATE: _____

INSPECTORS INITIALS: _____

SILT FENCE:

IS THE BOTTOM OF THE FABRIC STILL BURIED?	IS THE FABRIC TORN OR SAGGING?	ARE THE POSTS TIPPED OVER?	HOW DEEP IS THE SEDIMENT?

MAINTENANCE REQUIRED FOR SILT FENCE:

TO BE PERFORMED BY: _____

ON OR BEFORE: _____

Note: Inspections and reports to be performed at least once each week and following any storm event of ½ inch or greater.



SMALL CONSTRUCTION SITE NOTICE: LOW POTENTIAL FOR EROSION

FOR THE
Texas Commission on Environmental Quality (TCEQ)
Stormwater Program
TPDES GENERAL PERMIT TXR150000

The following information is posted in compliance with **Part II.E.1.** of the TCEQ General Permit Number TXR150000 for discharges of stormwater runoff from small construction sites automatically authorized based on low rainfall erosivity. Additional information regarding the TCEQ stormwater permit program may be found on the internet at:

<https://www.tceq.texas.gov/permitting/stormwater/construction>

Operator Name:	
Contact Name and Phone Number:	
Project Description: (Physical address or description of the site's location, estimated start date and projected end date, or date that disturbed soils will be stabilized)	

For Small Construction Sites Authorized Under Part II.E.1., the following certification must be completed:

I _____ (Typed or Printed Name Person Completing This Certification) certify under penalty of law that I have read and understand the eligibility requirements for claiming an automatic authorization based on low rainfall erosivity under Part II.E.1. of TPDES General Permit TXR150000 and agree to comply with the terms of this permit. Construction activities at this site shall occur within a time period listed in Appendix A of the TPDES general permit for this county, that period beginning on _____ and ending on _____. I understand that if construction activities continue past this period, all stormwater runoff must be authorized under a separate provision of the general permit. A copy of this signed notice is supplied to the operator of the MS4 if discharges enter an MS4. I am aware there are significant penalties for providing false information or for conducting unauthorized discharges, including the possibility of fine and imprisonment for knowing violations.

Signature and Title _____ Date _____

_____ Date Notice Removed

_____ MS4 operator notified per Part II.F.3.

**LABORATORY TESTING
SECTION 31 32 16**

PART 1 - GENERAL

The following shall govern for testing on this project:

1.1 LABORATORY TESTING

- A. All material to be used in subdivision construction shall be subject to testing if warranted. The preponderance of testing to be performed in subdivisions is directly related to street construction and a series of laboratory tests normally associated with road and street construction will be required in subdivisions, said being performed by an independent testing laboratory using qualified personnel. The testing laboratory will be selected by the Owner and the Owner will pay all testing fees for materials directly to said laboratory.

PART 2 –PRODUCT

2.0 RATIO OF TESTING

2.1 Densities

- a. Pipe Trench Backfill..... Not Required unless specifically requested
b. Existing Subgrade Density under concrete pavement.....1 per 5,000 SF (min 1 per pour)

2.2 Proctors (Moisture-Density Relationship):

- a. Subgrade (RAW) 1 per Project unless material changes
b. One Point Proctor 1 per day

2.3 Concrete Cylinders:

- a. Curb and Gutter 1 Set (3) per 2 inlets/per 750' of curb/per pour
b. Concrete Pavement 1 Set (3) per pour Min. 1 every 500' of street

2.4 Hydrostatic Testing of Water Systems: (See Subsection 33 05 05.31)

- a. Laboratory Testing: None Required
b. Contractor Testing: (See Subsection 33 05 05.31)

2.5 Testing of Gravity Sanitary Sewer Lines: (See Subsection 33 05 05)

- a. Laboratory Testing: None Required
b. Contractor Testing: (See Subsection 33 05 05)

2.6 Testing of Fiberglass Manholes: (See Subsection 33 05 76)

- a. Laboratory Testing: None Required
b. Contractor Testing: (See Subsection 33 05 76)

2.7 Pressure Testing of Gas System: (See Port Aransas Gas Installation Specs and Subsection 2G26.5).

2.8 Retesting

- A. The above schedule is a minimum schedule for testing, failures not included. In the event of failures, additional tests will be taken. If excessive rain occurs on a previously testing section, the City of Port Aransas shall have the right to order retests as necessary.

PART 3 – EXECUTION

3.1 TESTING PROCEDURE

- A. The contractor shall coordinate with and notify the testing lab when tests are to be taken. The Contractor shall also coordinate with the City of Port Aransas to let them know testing is being scheduled. The contractor shall also contact the Engineer or his Representative and relay the testing is scheduled. Except as otherwise provided above, it is the intent of the City of Port Aransas that the Contractor not contact the lab for the purpose of requesting routine tests. The scope of testing of materials incorporated in the project construction is not necessarily limited to those tests outlined above. In the event of unusual conditions or other factors which may give the City of Port Aransas reason to question the quality of the materials in any portion of the project, the City of Port Aransas will have the right to order such additional tests as are necessary at the City of Port Aransas expense. However, the City of Port Aransas will consult with the Engineer on reasons for such additional tests before a testing lab will be asked to conduct such tests. All testing in accordance with these requirements will be performed in accordance with the American Society of Testing Materials (ASTM) latest revision, and/or as elsewhere provided in approved plans and specifications for the subdivision. The City of Port Aransas will require all test reports to be certified by a Registered Professional Engineer (Texas Registration) and will further require that the City of Port Aransas be furnished a minimum of two (2) copies of testing reports. Further, the Engineer shall provide the City of Port Aransas for the testing laboratory, a set of plans and specifications as well as a tabulation showing the estimate of quantities of material in the subdivision.

3.2 RETESTING

- A. The cost of all retesting due to failures shall be borne by the Contractor by reimbursing the Owner or as a deduction from the final payment.

END OF SECTION 31 32 16

**PORTLAND CEMENT CONCRETE PAVEMENT
SECTION 32 11 33.13**

Part 1 - GENERAL

1.1 DESCRIPTION

A.

This specification shall govern for all work necessary to construct the Portland cement concrete pavement required to complete the project.

Part 2 – PRODUCTS

2.1 CONCRETE

- A. Concrete shall be specified in Subsection 03 30 02 "Normal Weight Aggregate Concrete", Class A (4000 PSI @ 28 days), with the following exceptions. The slump range shall be maintained between 1" and 3". Air entrainment shall be 5% by volume and be maintained between 6% max. and 4% minimum.

2.2 REINFORCING STEEL AND DOWEL BARS

- A. Reinforcing steel shall be as specified in Section 03 20 01 "Concrete Reinforcement".

2.3 LOAD TRANSISSION DEVICES

- A. Smooth steel bar dowels, ASTM A615, Grade 40. The free end of the dowel bars shall be free of shearing burrs. The free end of each dowel bar shall be encased in an approved cap having an inside diameter of 1/16 inch greater than the diameter of the bar. The end of the cap shall be void to permit free movement of the bar for a distance of 150 percent of the width of the expansion joint used.

2.4 EXPANSION JOINT MATERIAL

- A. Expansion joint material shall be 3/4 inch thick fiberboard or asphalt impregnated preformed filler conforming to the requirements of AASHTO M33 or M213; ASTM D994 or D1751 as specified, and shall be punched to admit dowels where called for in the plans. The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint unless otherwise authorized by the engineer. When the use of more than one piece is authorized for a joint, the abutting ends shall be fastened securely and held accurately to shape by stapling or other positive fastening satisfactory to the engineer.

2.5 EXPANSION JOINT SEALING MATERIAL (New Concrete to New Concrete)

- A. Expansion joint seal shall be a continuous flexible, modified PVC cap seal, G-Seal #605 as manufactured by Greenstreak or equivalent. Cap seal is attached to the top of the expansion board.

2.6 EXPANSION JOINT SEALING MATERIAL (New Concrete to Existing Concrete)

- A. Where new concrete is poured against existing concrete, expansion joint material shall be mounted against existing and this joint sealed with polyurethane joint sealant. Joint sealant shall be Bostik 950, or approved equal, polyurethane joint sealant and shall meet the requirements of

ASTM C920-87, Type S or M, Grade P, Class 25 Uses T, M, A and O. Where grade is greater than a 3% slope, use Bostik 900 sealant.

2.7 CONTRACTION JOINT SEALING MATERIAL

- A. Contraction joint sealant shall be Bostik 950, or approved equal, polyurethane joint sealant and shall meet the requirements of ASTM C920-87, Type S or M, Grade P, Class 25 Uses T, M, A and O. Where grade is greater than a 3% slope, use Bostik 900 sealant.

2.8 EQUIPMENT

- A. Equipment shall conform to Item 360.4 "Equipment", of the Standard Specification for Construction of Highways, Streets and Bridges, 1993 Edition; of the Texas Department of Transportation.

PART 3 – EXECUTION

3.1 EXCAVATION

- A. Excavation and Subgrade Preparation shall be as specified on the drawings, and Section 31 20 00. The bottom of the excavation or top of the fill shall be known as the pavement subgrade and shall conform to the line, grade, and cross sections shown in the plans. All soft and yielding material and portions of the subgrade that will not compact readily when rolled or tamped shall be removed and replaced with suitable material. The subgrade shall be brought to a firm and unyielding condition by compacting it to density as specified at or slightly above standard optimum moisture. All utility trenches and structure excavations shall be backfilled to natural or finished grade with soils like those surrounding the trench as soon as conditions permit. All backfill shall be compacted with mechanical tampers in layers of not over 6 inches in compacted thickness. Concrete shall not be placed on a soft, spongy, frozen or otherwise unsuitable subgrade. The subgrade shall be moist when the concrete is placed. Before placing concrete, the subgrade shall be tested for conformity with the plan section which requires compaction to 95% STD, Proctor Density. If necessary, material shall be removed per Texas Highway Department Specification (1982) Item 360.5. If additional material is to be added, the subgrade shall be scarified, reshaped, recompacted and tested again to ensure that optimum moisture and density are obtained. The surface of the subgrade shall be kept wet at all times after testing and before placement of the concrete paving.

3.2 FORMS

- A. Form work shall be as specified in Section 03 10 01 "Concrete Formwork". The following additional data shall apply to concrete street construction.
 - a. General:

Forms shall be of such cross section and strength and so secured as to resist the pressure of the concrete when placed and the impact and vibration of any equipment they support, without springing or settlement. The method of connection between sections shall be such that the joints shall not move in any direction. The maximum deviation of the top surface shall not exceed 1/8 inch in 10 ft. or the inside face not more than 1/4 inch in 10 ft. from a straight line. Flexible or curved forms of proper radius shall be used for curves of 100 ft. radius or less.
 - b. Setting Forms:

The subgrade under the forms shall be compacted and cut to grade so that the form when set will be uniformly supported for its entire length at the specified elevation. All forms shall be cleaned and oiled each time they are used.

- c. Grade and Alignment:
The Contractor shall check and correct alignment and grade elevations of the forms immediately before placing the concrete. When any form has been disturbed or any grade has become unstable, the form shall be reset and rechecked.
- d. Curbs and Gutters as Forms:
In lieu of setting forms, the edge of a previously placed concrete gutter section may be used as a form.

3.3 REINFORCING STEEL

- A. Reinforcing Steel, load transfer devices, longitudinal joint dowels, and curb reinforcement shall be located and accomplished in accordance with the drawings. When not shown on the drawings, provide expansion joint at changes of direction and at a maximum 40 feet spacing. Concrete reinforcement shall be further specified in Section 03 20 01 "Concrete Reinforcement".

3.4 CONCRETE MIXING AND PLACING

- A. Concrete mixing shall be specified in Subsection 03 30 02 "Normal Weight Aggregate Concrete". Concrete placement shall be governed by Texas Highway Department of Transportation Specification (1993) Item 360.8 - Construction Joints.

3.5 SPREADING AND FINISHING

- A. Texas Highway Department of Transportation Specification (1993) Item 360.10 shall govern.

3.6 JOINTS

- A. General:
Contraction joints, expansion joints, and all longitudinal joints shall be placed as indicated in the plans. Transverse joints shall extend continuously through the pavement and curb.
- B. Transverse Contraction Joints:
Transverse contraction joints shall consist of planes of weakness created by forming or cutting grooves in the surface of the pavement. They shall be equal to at least 1/4 the depth of the slab.
 - (1) Transverse slip contraction joints shall be formed by installing a parting strip to be left in place.
 - (2) Formed grooves shall be made by depressing an approved tool or device into the plastic concrete. The tool or device shall remain in place until the concrete has attained its initial set and shall then be removed without disturbing adjacent concrete.
 - (3) Sawed contraction joints shall be created by sawing grooves in the surface of the pavement with an approved concrete saw. After each joint is sawed, the saw cut and adjacent concrete surface shall be thoroughly cleaned. Sawing of the joints shall begin as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling, usually 4 to 16 hours. All joints shall be sawed before uncontrolled shrinkage cracking occurs, but in no case in excess of 16 hours. If necessary, the sawing operations shall be carried on both day and night, regardless of weather conditions. A standby saw shall be available in the event of breakdown. The sawing of any joint shall be omitted if a crack occurs at or near the joint location before the time of sawing. Sawing shall be discontinued if a crack develops ahead of the saw. In general, all joints shall be sawed in sequence. All contraction joints in lanes adjacent to previously constructed lanes shall be sawed before uncontrolled cracking occurs. If extreme conditions make it impracticable to prevent erratic cracking by early sawing, the contraction joint groove shall be formed before initial set of concrete as provided above.

- (4) Transverse formed contraction joints shall consist of a groove or cleft extending downward from and normal to the surface of the pavement. These joints shall be made while the concrete is plastic by an approved mechanically or manually operated device to the dimensions indicated by the plans.
- C. Transverse Construction Joints:
Transverse construction joints shall be placed whenever the placing of concrete is suspended for more than 30 minutes. A butt joint with dowels or a thickened edge joint shall be used if the joint occurs at the location of a contraction joint. Keyed joints with tiebars shall be used if the joint occurs at any other location.
- D. Transverse Expansion Joints:
Transverse expansion joints shall consist of a vertical expansion joint filler placed in a butt-type joint with or without dowel bars as shown in the plans. The expansion joint filler shall be continuous from form to form. Preformed joint filler shall be furnished in lengths equal to the pavement width or equal to the width of one lane. Damaged or repaired joint filler shall not be used unless approved by the engineer. The expansion joint filler shall be held in a vertical position. An approved installing bar or other device shall be used if necessary to ensure proper grade and alignment during placing and finishing of the concrete. Finished joints shall not deviate in horizontal alignment more than 1/4 inch from a straight line. If joint fillers are assembled in sections, there shall be no offsets between adjacent units. No plugs of concrete shall be permitted anywhere within the expansion space.
- E. Longitudinal Joints:
Longitudinal joints shall consist of planes of weakness created by forming or cutting grooves in the surface of the pavement. They shall be equal to at least one-quarter the depth of the slab plus 1/2 inch.
- (1) Sawed longitudinal joints shall be created by sawing grooves in the surface of the pavement with an approved concrete saw. After each joint is sawed, the saw cut and adjacent concrete surface shall be thoroughly cleaned. Sawing of the joints shall begin as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling, usually 4 to 16 hours. All joints shall be sawed before uncontrolled shrinkage cracking occurs, but in no case in excess of 16 hours. If necessary, the sawing operations shall be carried on both day and night, regardless of weather conditions.
- (2) Longitudinal groove joints are formed in the same manner as transverse formed groove joints (Subparagraph d of these specifications)
- (3) Longitudinal strip joints are formed in the same manner as transverse strip joints (Subparagraph "B" of these specifications).
- (4) Longitudinal construction joints shall be of the dimensions shown in the plans. Where a key is required, it shall be constructed by forming when the first lane adjacent to the joint is placed. These joints shall be finished with an edger of the radius shown in the plans. When placing the second slab, concrete must not be left overhanging the lip formed in the first slab by the edging tool.
- F. Sealing Joints:
Joints to be sealed shall be filled with joint-sealing material before the pavement is opened to traffic and as soon after completion of the curing period as is feasible. Just before sealing, each joint shall be thoroughly cleaned of all foreign material, including membrane curing compound, and joint faces shall be clean and surface-dry when seal is applied. Material for seal applied hot shall be stirred during heating to prevent localized over- heating. The sealing material shall be applied to each joint opening in accordance with the details shown in the plans or as directed by the engineer. The joint filling shall be done without spilling material on the exposed surfaces of the concrete. Any excess material on the surface of the concrete pavement shall be removed immediately and the pavement surface cleaned. The use of sand or similar material to cover the seal shall not be permitted. Joint sealing material shall not be placed when the air temperature in the shade is less than 50 deg. F., unless approved by the engineer.

3.7 CURING

- A. Texas Highway Department of Transportation Specification (1993) Item 360.11 shall govern.

3.8 REMOVING FORMS

- A. Forms shall be carefully removed so that the pavement and/ or concrete is not damaged. All honey combed areas shall be pointed up with approved mortar. Forms shall remain in place a minimum of 8 hours after the concrete has been placed.

3.9 DETERMINATION OF ACCEPTABLE PAVEMENT THICKNESS

- A. To determine that the finished pavement is in conformity with the thickness and typical sections shown on the drawings or specified herein, the pavement will be core drilled; one core shall be taken for each 2500 square yards of pavement. Drill sites shall be chosen that will well represent each particular 2500 square yard unit. When the measurement of the core from any unit is not deficient more than 1/2 inch from the plan thickness, full payment will be made. When the measurement of the core is deficient more than 1/2 inch, two additional cores shall be drilled. If the average pavement thickness deficiency of the three cores is determined to be greater than 1/2 inch from the plan thickness, the engineer shall evaluate the deficiency and if, in the judgment of the Engineer an area should be removed and replaced, it shall be done at the Contractor's entire expense. The Contractor shall grout closed all core drill holes immediately upon completion of the test.

3.10 PROTECTION OF PAVEMENT AND OPENING TO TRAFFIC

- A. Protection of Pavement:
Barricades shall be placed so as to prohibit all traffic on newly placed pavement for a minimum of 14 days or as specified below.

3.11 OPENING TO TRAFFIC

- A. The engineer shall decide when the pavement shall be opened to traffic. It shall not be opened to traffic until the field-cured concrete has attained a flexural strength of 500 P.S.I., or a compressive strength of 3,000 PSI. If such tests are not conducted, the pavement shall not be opened to traffic until 14 days after concrete placement. Before opening to construction traffic, the pavement shall be cleaned, backfill shall be placed and compacted behind curbs and against the edge of pavement, and joints shall be sealed.

END OF SECTION 32 11 33.13

CONCRETE CURB, GUTTER, AND CONCRETE VALLEY GUTTER
SECTION 32 16 13.13

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This specification shall govern for all work necessary to provide the concrete curb and gutter and/or concrete valley gutter required to complete the project. This specification is a performance specification as defined in Art. TS-1 of the Technical Special Provisions.

PART 2 – PRODUCTS

2.1 REINFORCING STEEL AND DOWEL BARS

Billet steel, ASTM A615 Grade 60. When not shown on the drawings, provide:

- a. Reinforcing Steel 3 - No. 4 bars (deformed bars).
- b. Dowels 2 - No 5. bars (smooth bars).

A. Concrete:

Concrete shall be specified in Subsection 3C4 "Concrete Structures" and Subsection 03 30 02 "Normal Weight Aggregate Concrete," Class A - 3000 PSI @ 28 days.

B. Expansion Joint Material:

Expansion joint material shall be 3/4" wood fiber asphalt - impregnated expansion board.

C. Paving Cap Seal:

Paving cap seal shall be Greenstreak #610 or approved equal stapled or nailed to expansion board.

D. Curing Compound:

Resin Base ASTM C309 Type 1, with light red tint of fugitive dye.

E. Mortar Topping:

- a. Cement: ASTM C-150, Type I.
- b. Water: ASTM C-94. Potable water need not be tested.
- c. Sand: ASTM C-33
- d. Mix: 1 part cement and 2 parts sand

PART 3 – EXECUTION

3.1 EXCAVATION

- A. Excavation, preparation of subgrade and backfill shall be in conformance with the section of these specifications entitled "Street Excavation and Backfill", Subsection 31 20 00.

3.2 SUBGRADE

- A. The subgrade under the curb and gutter shall be lime stabilized and compacted to the density shown on the drawings. When a density is not shown on the drawings, compaction shall be **95% Standard Proctor Density** (ASTM D698).

3.3 FORMS

- A. The forms shall be straight, durable and have a depth equal to the required concrete depth. The forms shall be securely staked to line and grade in such a manner that there shall be no movement when the concrete is placed. The subgrade shall be free of loose material and wet down before placing concrete. Concrete shall not be placed until forms have been approved by the Engineer.

3.4 REINFORCING STEEL

- A. Reinforcing steel, expansion joints with dowels and transverse marking shall be located and accomplished in accordance with the drawings.

3.5 CONCRETE PLACEMENT

- A. The concrete shall be placed in such a manner so that segregation does not occur. The concrete shall be thoroughly tamped with a "jitter- bug" or other approved tool.

3.6 SHAPING

- A. The curb and gutter shall be shaped using a "mule" approved by the Engineer.

3.7 MORTAR TOPPING

- A. The mortar topping shall be placed no longer than one hour after the initial set of the concrete. The mortar topping shall be smoothed with an approved "mule", all joints and edges shall be tooled, then the topping shall be lightly broomed with a hair broom.

3.8 CURING

- A. Immediately after the brooming has been completed, curing compound shall be evenly applied. The quantity applied shall be as directed by the Engineer.

3.9 REMOVAL OF FORMS

- A. Back forms and lip forms shall be left in place for at least 24 hours. All honey comb shall be plastered before backfilling is accomplished.

3.10 BACKFILLING

- A. The concrete curb and gutter shall be carefully backfilled with material taken from the excavation. Backfill shall be placed and completed against the back of the curb and gutter before placing material for pavement section (concrete or caliche) between curbs and gutters. All excess material shall be hauled off the site by the Contactor. The area adjacent to the curb and gutter shall be uniformly graded so as to provide positive drainage towards the street.

END OF SECTION 32 16 13.13

CONCRETE SIDEWALK AND CONCRETE DRIVEWAYS
SECTION 32 16 23

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This specification shall govern for all work necessary to provide the concrete sidewalk and/or concrete driveways required to complete the project. This specification is a Performance specification as defined in Art. TS-1 of the Technical Special Provisions.

PART 2 – PRODUCTS

2.1 STEEL REINFORCING AND DOWEL BARS

- A. Billet Steel, ASTM A615 Grade 60.

- a. Steel reinforcing:
Provide 4" x 4" - W2.9 x W2.9 welded wire fabric or as shown on drawings.
- b. Dowels:
Provide 1/2" diameter smooth bars as follows:

<u>Width of Walk</u>	<u>No. of Dowels per Joint</u>	<u>Width of Drive</u>	<u>No. of Dowels per Joint</u>
2 ft.	2	8 ft.	6
3 ft.	2	10 ft.	7
4 ft.	3	12 ft.	8
5 ft.	4	16 ft.	11
6 ft.	5	18 ft.	12
		20 ft.	13
		24 ft.	16

2.2 CONCRETE

- A. Concrete shall be Class A, 3000 PSI @ 28 days as specified in Subsection 03 30 02 "Normal Weight Aggregate Concrete".

2.3 EXPANSION JOINT MATERIAL

- A. Expansion joint material shall be 3/4" wood fiber asphalt - impregnated expansion board.

2.4 PAVING CAP SEAL

- A. Paving cap seal shall be Greenstreak #610 or approved equal stapled or nailed to expansion board.

2.5 CURING COMPOUND

- A. Resin base ASTM C309 Type I, with light red tint of fugitive dye.

PART 3 – EXECUTION

3.1 EXCAVATION

- A. Excavation shall include all classes of material, including old concrete.

3.2 SUBGRADE

- A. Subgrade under the sidewalk and/or driveway shall be thoroughly compacted and shall be true to line and grade. The subgrade shall be free from soft spots and loose material. Compaction under concrete driveways shall be **95%** Standard Proctor Density (ASTM D-698) unless shown otherwise on the drawings.

3.3 FORMS

- A. Forms shall be straight, durable and have a depth equal to the required concrete depth (Commercial size lumber may be used provided full depth of concrete is obtained). The forms shall be securely staked to line and grade in such a manner that there shall be no movement when the concrete is placed. The subgrade shall be wet down before placing concrete. The forms shall be cleaned and oiled before placing concrete. Concrete shall not be placed until forms have been approved by the Engineer.

3.4 REINFORCING STEEL

- A. Wire mesh shall be supported to insure that it is covered with a minimum of 1-1/2" of concrete.

3.5 EXPANSION JOINTS AND TRANSVERSE MARKINGS

- A. Expansion joints and transverse markings shall be square with the sidewalk and/or concrete driveway. Expansion joints with dowels and transverse marking shall be located and accomplished in accordance with the drawings. When not shown on the drawings, provide doweled expansion joints at changes of direction and at maximum 40 feet spacing and provide transverse markings (1/8 inch wide and 1/2 inch minimum depth) at maximum 10 feet spacing.

3.6 CONCRETE PLACEMENT

- A. The concrete shall be placed in such a manner so that segregation does not occur. The concrete shall be thoroughly tamped with a "jitterbug" or other approved tool.

3.7 JOINTING AND TOOLING

- A. All joints and edges shall be tooled and the finished surface shall be lightly broomed (with a hair broom) to provide a non-skid surface. When directed by the Engineer, the Contractor shall apply an approved sand-cement mixture to the surface just before the final floating and troweling.

3.8 CURING

- A. Immediately after the brooming has been completed, curing compound shall be evenly applied. The quantity applied shall be as directed by the Engineer.

3.9 REMOVING FORMS

- A. Forms shall be carefully removed so that the sidewalk and/or concrete driveway is not damaged. All "honey comb" shall be plastered before backfilling is accomplished.

3.10 JOINING NEW AND OLD CONCRETE

- A. When joining new and old concrete, the old concrete shall be cut with a concrete saw for a depth of 1/2", then the remaining depth shall be neatly broke using an approved method, then the exposed edges shall be thoroughly cleaned and then painted with an epoxy bonding agent before placing the new concrete. The epoxy bonding agent shall be applied in strict conformance with manufacturer's recommendations. When expansion joints are provided utilize 3/4" wood fiber expansion board and Greenstreak #628 paving cap seal at interface with existing and new concrete.

3.11 BACKFILLING

- A. The concrete sidewalk and/or driveway shall be carefully backfilled with material taken from the excavation. The Contractor shall neatly spread all excess material as directed by the Engineer. The area adjacent to the sidewalk and/or driveway shall be uniformly graded to provide positive drainage towards the street.

END OF SECTION 32 16 23

CHAIN-LINK FENCE
(HEAVY-DUTY)
SECTION 32 31 13

PART 1 – DESCRIPTION

1.1 SCOPE

- A. This specification shall govern for all work necessary for providing and installing the 8' chain-link fence (7' high fabric and 3 strands of barbed wire), gates and signage required to complete the project. This specification is a performance specification as defined in Art. TS-1 of the Technical Special Provisions.

PART 2 – PRODUCTS

2.1 GENERAL

- A. All materials used for fencing shall be new and shall be First Class. The use of re-rolled, open seam tubing, or any used material will not be allowed. Posts, gate frames, braces, rails, stretcher bars, and truss rods shall be of steel; reinforcing wires shall be of high carbon steel; and gate hinges, post caps, stretcher bar bands, and other parts shall be of steel, malleable iron, ductile iron or equal except that ties and clips may be of aluminum.

2.2 POSTS, GATE FRAMES, RAILS, AND BRACES

Posts, gate frames, rails, and braces shall conform to the dimensions and weights shown in the following table.

Use	Section	Outside Diameter or Dimensions, Nominal (Inches)	Weight Per Foot (Pounds)
End, corner, and pull posts (tubular):			
	Round	2.875	5.79
	Square	2.50	5.70
Gate posts for nominal width of gate, single, or one leaf of double 6 feet and less:			
	Round	2.875	5.79
	Square	2.50	5.70
Gate width 13 feet and less:			
	Round	4.00	9.10
	Square	3.00	9.10
Gate width over 13 feet to 18 feet, incl.:			
	Round	6.625	18.97
Gate width over 18 feet:			
	Round	8.625	24.70
Gates: exterior frames:			
	Round	1.90	2.72
	Square	1.50	2.10
Internal gate bracing:			
	Round	1.66	1.806
	Square	2.00	1.90
Rails and post braces (tubular):			
Intermediate posts:			
	Tubular, Round	2.375	3.65
	H-Section	2.25 x1.95 x 1.43	4.10

All steel and iron parts shall be zinc-coated after fabrication, using zinc grade "E" in accordance with Federal Specification QQ-Z-351. The weight of the zinc coating per square foot of actual surface area shall average not less than 1.2 ounces and no individual specimen shall show less than 1.0 ounces.

2.3 BARBED WIRE

- A. Barbed wire shall consist of 3 strands of 12-1/2-gauge wire with 14 gauge 4-point barbs spaced approximately 5 inches apart. All wire shall be zinc coated with a minimum coating of .80 ounces per square foot of surface area on 12-1/2 gauge wire and .60 ounces per square foot of surface area on 14-gauge wire.

2.4 FABRIC

A. Definitions:

(1) Chain link fence fabric:

Chain link fence fabric is a fencing material made from wire helically wound and interwoven in such a manner as to provide a continuous mesh without knots or ties except in the form of knuckling or of twisting and barbing the ends of the wires to form the selvage of the fabric.

(2) Knuckling:

Knuckling is the term used to describe the type of selvage obtained by interlocking adjacent pairs of wire ends and binding the wire ends back into a closed loop.

B. Base Metal:

The base metal of the fabric shall be a good commercial quality of steel wire. The wire shall withstand a breaking load of 1,290 lbs.

C. Zinc-coating:

The fabric shall be zinc-coated by the hot-dip process after fabrication, or shall be fabricated from wire zinc coating by the electrolytic or hot dip process. The weight of zinc coating shall be not less than 1.2 ounces per square foot of actual surface covered. The zinc used for the coating shall conform to the grades specified in ASTM Designation B6 Standard Specifications for Slab Zinc.

D. Fabric Sizes:

(1) General:

The height, size of mesh, and wire diameters of chain link fence shall be 84-inch high by 2-inch mesh by 0.1483-inch diameter (No. 9 gauge).

(2) Height of fabric:

The height of fabric shall be the overall dimension from ends of barbs or knuckles. The tolerance on the nominal height shall be plus or minus one inch.

(3) Mesh sizes:

The size of mesh shall be determined by measuring the minimum clear distance between the wires forming the parallel sides of the mesh, measured in either direction. The tolerance in the size of 1-3/4 and 2-inch mesh shall be plus or minus 1/8 inch; for 1-inch mesh, plus or minus 1/16-inch.

(4) Wire diameter:

The diameter of the coated wire shall be determined, as the average of two readings measured to the nearest 0.001-inch taken at right angles to each other on the straight portion of the parallel sides of the mesh. The tolerance in the diameter of the coated wire shall be plus or minus 0.005-inch.

E. Selvage:

Fabric shall be furnished with twisting and barbing on both selvages.

F. Workmanship:

The chain link fence fabric shall be made of high-grade materials and with good workmanship. The zinc coating shall be applied in a continuous process and shall not be applied to the fabric in roll form. Excessive roughness, blisters, salammoniac spots, bruises and flaking shall be noted. These and other obvious defects, if present to any considerable extent, may provide a basis for rejection.

2.5 CONCRETE

- A. Concrete shall have a minimum compressive strength of 2000 p.s.i. at 28 days and shall be in accordance with Subsection 03 30 02 - "Normal Weight Aggregate Concrete".

2.6 FEATURES

A. Gates:

Gates shall be swing type complete with latches, stops, keepers, hinges, and provisions for padlocking.

a. Gate Frames:

Gate frames shall be constructed of tubular members (round or square) welded at all corners or assembled with fittings. On steel, welds shall be painted with aluminum based or zinc based paint. Where corner fittings are used gates shall have truss rods of 3/8-inch nominal diameter to prevent sag or twist. Gate leaves shall have vertical intermediate bracing as required, spaced so that no members are more than 8 feet apart. Gate leaves 10 feet or over shall have a horizontal brace or one 3/8-inch, diagonal truss rod. Dimensions and weights of gate frames shall be as shown in Table above. Gate filler shall be of the same fabric as specified for fence and shall be attached securely to gate frame at intervals of 15 inches.

b. Fabric:

Fabric shall be the same type as used in the fence construction. The fabric shall be attached securely to the gate frame at intervals not exceeding 15-inches.

c. Hinges:

Hinges shall be of adequate strength for gate, and with large bearing surfaces for clamping in position. The hinges shall not twist or turn under the action of the gate. The gates shall be capable of being opened and closed easily by one person.

d. Latches, Stops, and Keepers:

Latches, stops and keepers shall be provided for all gates. Latches shall have a plunger-bar arranged to engage the center stop, except that for single gates of openings less than 10 feet wide a forked latch may be provided. Latches shall be arranged for locking. Center stops shall consist of a device arranged to be set in concrete and to engage a plunger bar of the latch of double gates. No stop is required for single gates. Keepers shall consist of a mechanical device for securing the free end of the gate when in the full open position.

2.7 POSTS

- A. Posts shall be of the lengths specified and shall be tubular, except that line posts may be H-beam.

2.8 POST BRACES

- A. Post braces shall be provided for each gate corner, pull, and end post and shall consist of a round tubular brace extending to each adjacent line post at approximately mid-height of the fabric, and a truss consisting of a rod not less than 3/8-inch in nominal diameter from the line post back to the gate, corner, pull, or end post, with a turnbuckle or other equivalent provision for adjustment.

2.9 POST TOPS

- A. Post tops shall consist of combination tops with barbed wire supporting arms. The top shall be provided with a hole suitable for the through passage of the top rail. The post tops shall fit over the outside of posts and shall exclude moisture from tubular posts.

2.10 SUPPORTING ARMS

- A. Barbed-wire supporting arms shall be at an angle of approximately 45° and shall be fitted with clips or other means for attaching 3 strands of barbed wire. With 45° arms the top wire shall be approximately 12 inches horizontally from the fence line and the other wires spaced uniformly between the top of the fence fabric and the outside strand. Barbed-wire arm shall be of sufficient strength to withstand a weight of 200 lbs. applied at the outer strand of barbed wire.

2.11 TOP RAILS

- A. Top rails shall be round (tubular), shall be in lengths not less than 18 feet, and shall be fitted with couplings for connecting the lengths into a continuous run. The couplings, shall be not less than 6-inches long, with .070 minimum wall thickness, and shall allow for expansion and contraction of the rail. Open seam outside sleeves shall be permitted only with a minimum wall thickness of .100 inches. Suitable ties or clips shall be provided in sufficient number for attaching the fabric securely to the top rail at intervals not exceeding 2 feet. Means shall be provided for attaching the top rail to each gate, corner, pull, and end post.

2.12 STRETCHER BARS

- A. Stretcher bars shall not be less than 3/16 by 3/4 inch and not be less than 2" shorter than the full height of the fabric with which they are to be used. The stretcher bars shall be arranged for attaching the fabric to all terminal posts by threading through the fabric, by hand, or by other positive mechanical means. One stretcher bar shall be provided for each gate, and end post and two for each corner and pull post.

2.13 TIES OR CLIPS

- A. Ties or clips of adequate strength shall be provided in sufficient number for attaching the fabric to all line posts at intervals not exceeding 15-inches.

2.14 BANDS OR CLIPS

- A. Bands or clips of adequate strength shall be provided in sufficient number for attaching the fabric and stretcher bars to all terminal posts at intervals not exceeding 15-inches. Tension bands and brace bands shall be formed from flat or beveled steel and shall have a minimum thickness of ± 0.115 " after galvanizing with a minimum width of 7/8 of an inch ± 0.015 ".

2.15 SINGNAGE

- A. A facility (such as a Wastewater Treatment Plant or Water Treatment Plant) containing an open tank must shall be provided with signs mounted on the fence stating "DANGER – OPEN TANKS – NO TRESPASSING" within visible sighting of each other and on each gate. Sign shall be white background with black lettering.

PART 3 – EXECUTION

3.1 GENERAL

- A. All materials and workmanship shall be of first class in every respect, shall be done in a neat, workmanlike manner.

3.2 POST SPACING

- A. Line posts shall be spaced at intervals not to exceed 10 feet average when measured from center to center between terminal posts. In general, in determining the post spacing, measurement will be made parallel to the slope of the natural ground, and all posts shall be placed in a vertical position except where designated otherwise by the Owner or the representative of the Owner.

3.3 POST SETTING

- A. All posts shall be set in holes of diameter and depth as indicated below. After the post has been set and plumbed, the hole shall be filled with 2,000 p.s.i. concrete. The exposed surface of the concrete shall be crowned to shed water.

Table of Post Hole Diameter and Depth

TYPE OF POST	HOLE DIA. @ TOP	HOLE DEPTH	POST EMBEDMENT
Line	9"	38"	36"
Corner	12"	38"	36"

3.4 TERMINAL POST

- A. End, corner, gate and pull posts shall be set as shown herein before, and shall be braced to the nearest post with a galvanized pipe horizontal brace used as a compression member, and a galvanized 3/8-inch steel truss rod and truss tightener used as a tension member. All changes in direction of fence line of 30 degrees or more shall be considered as corners. Pull posts shall be used at all abrupt changes in grade.

3.5 CHAIN LINK FABRIC

- A. Fabric shall be placed on the side of the fence as designated by the Owner or his representative. The fabric shall be stretched taut approximately 2-inches above the ground, and securely fastened to the posts. The fabric shall be cut and each span shall be attached independently at all terminal posts. Fastening to terminal posts shall be with stretcher bars and fabric bands spaced at maximum 15-inch intervals. Fastening to line post shall be with tie wire, metal bands, or other approved method, attached at maximum 15-inch intervals. The top edge of the fabric shall be fastened to the top rail with wire ties at intervals not exceeding 24-inches. The bottom edge of fabric shall be fastened to the bottom tension wire with wire ties at intervals not exceeding two feet. Rolls of wire fabric shall be joined by weaving a single strand into the ends of the rolls to form a continuous mesh.

3.6 CANTILEVER GATE

- A. The gate shall be comprised of standard chain link construction adhering to all requirements herein with a galvanized steel frame comprised of 2-3/8" full weight SCH 40 top and bottom members, 2" x 2" square tubing upright members (max 6' spacing) and 1" x 1" square tubing cross bracing members between each upright member. The gate shall utilize vinyl cantilever

rollers above the gate and below the gate at all support posts for support. No rollers shall touch the ground and ground mounted track will be allowed.

- B. Gate shall be operated by a motorized opener – see MEP specifications for compliance.

END OF SECTION 32 31 13

INSTALLATION OF WATER PIPE

SECTION 33 05 05

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This specification shall govern for all work necessary for the installation of all pipe required to complete the potable water lines. This specification is a performance specification as defined in Art. TS-1 of the Technical Special Provisions.

PART 2 - PRODUCTS

2.1 CONCRETE

- A. Concrete shall have a minimum compressive strength of 2000 p.s.i. at 28 days and shall be in accordance with Subsection 03 30 02 Normal Weight Aggregate Concrete.

2.2 ENCASEMENT SAND: See Subsection 31 23 16.13.

2.3 POLYVINYL CHLORIDE PIPE: See Subsection 00 05 31.16 and 33 05 31.29.

2.4 DUCTILE IRON PIPE: See Subsection 33 05 19.

2.5 GATE VALVES FOR WATERLINES: See Subsection 33 14 19.

2.6 FIRE HYDRANTS: See Subsection 33 14 19.13.

2.7 SEPARATION OF WATER AND SEWER LINES

- A. Existing Water And New Sanitary Sewer

<u>CONDITION</u>	<u>LOCATION</u>	<u>MATERIAL</u>		<u>MINIMUM SEPARATION</u>		<u>COMMENTS</u>
		<u>WATER</u>	<u>SEWER</u>	<u>VERT</u>	<u>HORIZ</u>	
New Sewer Parallel Existing Water	Water Above Sewer or Sewer Above Water	Std.	CI-DI-PVC 150 psi	2'	4'	Separate trenches
New Sewer Crossing Existing Water	Water Above Sewer or Sewer Above Water	Std.	CI-DI-PVC 150 psi	6"	N/A	Center one joint of sewer pipe on water line.
New Sewer Crossing Existing Water	Water Above Sewer	Std.	ABS, Clay Conc. Compos.	2'	N/A	Cement stabilize of sand backfill initial zone of sewer for 9' each side of crossing. Center one joint of sewer pipe on water main.

B. New Water And New Sanitary Sewer

<u>CONDITION</u>	<u>LOCATION</u>	<u>MATERIAL</u>		<u>MINIMUM SEPARATION</u>		<u>COMMENTS</u>
		<u>WATER</u>	<u>SEWER</u>	<u>VERT</u>	<u>HORIZ</u>	
Sewer Force Main and Gravity Sanitary Sewer Parallel to Water Main	Water Above Sewer	Std.	CI-DI-PVC 150 psi	2'	4'	Separate trenches
Gravity Sanitary Sewer Crossing Water Main	Water Above Sewer or Sewer Above Water	Std.	CI-DI-PVC 150 psi	6"	N/A	Center one joint of sewer pipe on water main
Gravity Sewer Crossing Water Main	Water Above Sewer	Std.	ABS-Clay-Conc Composite	2'	N/A	Cement stabilized sand backfill initial backfill zone of sewer for 9' each side of crossing. Center one joint of sewer pipe on water main

C. New Water And Existing Sanitary Sewer

<u>CONDITION</u>	<u>LOCATION</u>	<u>MATERIAL</u>		<u>MINIMUM SEPARATION</u>		<u>COMMENTS</u>
		<u>WATER</u>	<u>SEWER</u>	<u>VERT</u>	<u>HORIZ</u>	
New Water Parallel Existing Sewer	Water Above Sewer	Std.	Clay - Conc ABS CI-DI-PVC	2'	4'	If sewer not leaking, leave sewer alone. If sewer leaking repair or replace.
New Water Crossing Existing Sewer	Water Above Sewer	Std.	ABS, Clay Conc Compos.	2'	N/A	If sewer not leaking, leave sewer alone. If sewer leaking repair or replace
New Water Crossing Existing Sewer	Sewer Above Water	Std.	ABS, Clay Conc. Compos.	2'	N/A	Replace existing sewer with one joint CI - DI PVC 150 psi centering over water line.
New Water Parallel to Existing Sewer	Sewer Above Water	Std.	ABS, Clay Conc. Compos.	2'	4'	Replace existing sewer with CI,DI PVC-150 psi or cement stabil. sand backfill in initial backfill zone of sewer where parallel closer than 9' or encase the water in 150 psi pipe two nominal sizes larger.

PART 3 – EXECUTION

3.1 GENERAL

- A. All water system materials and construction shall comply with the Texas Natural Resources Conservation Commission requirements.

3.2 HANDLING OF MATERIAL

- A. Handling and Care:
Pipe and other materials shall be unloaded at the point of delivery, hauled to and distributed at the project site by the Contractor. They shall at all times be handled with care and in conformance with the manufacturer's recommendations. Whether moved by hand, skidways or hoists, material shall not be dropped or bumped against other material or objects already on the ground. Care shall be taken not to scratch the surface of P.V.C. pipe. Excessive scratching shall be considered cause for rejection of P.V.C. pipe.
- B. Distribution at Site of Work:
Material may be unloaded opposite or near the place where it is to be used in construction provided it is to be incorporated into the work within 10 days. The Contractor shall distribute the material in such a manner so as not to cause the public any undue inconvenience. The interior of all pipe and accessories shall be kept free from dirt and foreign matter at all times.
- C. Storing Material:
Any material delivered to the project site that is not to be incorporated into the work within 10 days shall be stored on suitable blocks or platforms off the ground. Stacking of materials shall be done in such a manner that the material is not damaged.

3.3 ALIGNMENT AND GRADE

- A. General:
All pipe shall be laid and maintained to the required lines and grades. Fittings, valves and hydrants shall be at the required locations and with joints centered, spigots home and all valve and hydrant stems plumb.
- B. Depth of cover:

Unless otherwise shown on the construction plans, it is the intent of these specifications that water lines shall have minimum cover as follows:
 - (1) Below surface of proposed or existing paved areas 42 inches
Depth of cover shall be measured from the surface of the existing or proposed pavement to the top of the pipe barrel.
 - (2) Below surface of unpaved areas on T. D. T. R.O.W. 36 inches
Depth of cover shall be measured from the finished surface to the top of the pipe barrel.
 - (3) Below surface of all other unpaved areas 30 inches
Depth of cover shall be measured from the finished surface to the top of the pipe barrel.
 - (4) Below surface of existing area to be filled 18 inches
Depth of cover shall be measured from the existing surface to the top of the pipe barrel before any fill is placed to obtain finished grade.If the established grades violate any of the before stated conditions notify the Engineer immediately so that remedial instructions can be given the Contractor.
- C. Vertical deflection of water pipe:
It is permissible to use vertical deflection when crossing under other utilities or drainage facilities provided the depth of cover from the finished surface does not exceed 48". When the depth of cover will exceed 48" the crossing shall be made by installing four ductile iron

bends with locking joints and retainer glands. All pipe between bends shall be DR 18 Polyvinyl Chloride Pipe (C900).

3.4 PIPE TRENCH EXCAVATION AND BACKFILL: See Subsection 31 23 16.13.

3.5 SAND AND ENCASEMENT

- A. All pipe and fittings which are not enclosed in concrete valve vault or laid in encasement pipe, shall be completely encased with a minimum of 8" of sand. This encasement includes the bottom, sides and top of pipe and fittings including bells, so that all portions will be encased with a minimum of eight inches of sand to insulate the pipe from the natural ground and from the backfill. Sand shall be screened and free of foreign material. Sand shall be placed in a manner that will not injure the polyethylene wrapping and shall be compacted under, around the sides, and over the pipe in a manner that will reduce settlement to a minimum and as approved by the Water Superintendent.

3.6 TRENCH EXCAVATION SAFETY: See Subsection 31 23 16.13.

3.7 LOWERING PIPE AND ACCESSORIES INTO TRENCH

- A. General:
Proper implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and efficient execution of the work. All pipe, fittings, valves, hydrants, and accessories shall be carefully lowered into the trench by means of derrick, ropes or other suitable equipment in such manner as to prevent damage. Under no circumstances shall pipe or accessories be dropped or dumped into the trench. The Contractor shall not lay any pipe in the trench until the bedding and condition of the trench has been approved by the Engineer. The trench shall be free of water and maintained in that condition until pipe has been laid and the joints completed.
- B. Inspection of Pipe and Accessories:
The pipe and accessories shall be inspected for defects prior to lowering into trench. Any defective, damaged or unsound pipe shall be replaced.
- C. Pipe Kept Clean:
All foreign matter or dirt shall be removed from the interior of pipe before lowering into the trench. Pipe shall be kept clean by means approved by the Engineer during and after laying. Contractor shall not leave any trench unmanned until trench is covered, or until barricades are placed and pipe is at least temporarily plugged to prevent varmints from entering.

3.8 JOINTING PIPE

- A. Joints shall be made up in strict conformance with manufacturer's recommendations, including the use of any primer or lubricant.

3.9 CONCRETE THRUST BLOCKING

- A. Concrete thrust blocking shall be provided at the ends of all lines and changes in direction including tees and incomplete crosses and blow-offs. Thrust blocking shall be poured against undisturbed soil solid between ground and the fitting to be anchored. Thrust blocks shall be of sufficient size to keep the pipe in place when subjected to test pressure. The blocking shall be placed so that the pipe and fitting joints will be accessible for repair.

3.10 JOINT RESTRAINT

- A. When soil conditions will not withstand thrust blocking, metal tie rods and clamps or ductile iron bends with locking joints and retainer glands shall be used to prevent movement. Steel rods

and clamps shall be galvanized or otherwise rust proofed or coated with hot coal tar enamel then wrapped with two layers of polyethylene wrapping.

3.11 STERILIZING WATER PIPE

- A. Waterline shall be disinfected prior to use in accordance with the current standard AWWA C651-92. After sterilization period is completed, Contractor will flush lines and thoroughly clean. The City will take a bacteriological sample test 2 hours after refilling. If sample does not pass State Of Texas purification standards, then repeat above procedure. The entire sterilization process shall be coordinated with and under the supervision of the City Water Construction Superintendent.

3.12 HYDROSTATIC TESTING OF PRESSURE SYSTEM: See Section 33 05 05.31.

3.13 WATER CONNECTIONS

- A. All connections to the water mains will be made by the contractor under supervision of CITY WATER DEPARTMENT. The Contractor shall supply all required materials, labor and match grade of the existing water line.

END OF SECTION 33 05 05

**HYDROSTATIC TESTING OF PRESSURE SYSTEM
SECTION 33 05 05.31**

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This specification shall govern for all work necessary for hydrostatically testing the completed sanitary sewer force main and potable water lines. This specification is a performance specification as defined in Art. TS-1 of the Technical Special Provisions.

PART 2 – PRODUCTS

2.1 WATER FOR TESTING

- A. All water for testing will be furnished by the Contractor. The Contractor shall make complete and satisfactory arrangements with the City's Water Department and make all necessary connections at his own expense.

PART 3 – EXECUTION

3.1 CONTRACTOR TESTING

- A. The Contractor shall provide all equipment, materials, (including water, if required) and do all work necessary to conduct the following tests:
- a. Hydrostatic Test Of Water Lines
- B. The tests shall be accomplished by the Contractor in the presence of the Engineer's or Owner's authorized representative. Tests results shall be signed by the Contractor's authorized representative who accomplished the testing and the Engineer's or Owner's authorized representative who witnessed the testing. Before final payment will be made to the Contractor 3 copies of all test results shall be furnished to the Engineer.

3.2 TEST PROCEDURES

- A. After the pipe has been laid and partially backfilled, it shall be subjected to a hydrostatic pressure test. Before applying the specified test pressure, all air shall be expelled from the pipe. If necessary, the Contractor shall provide taps at points of highest elevation to bleed off pockets of air. Any taps made shall be provided with a corporation stop or tightly plugged when the line is full of water. The line may be tested in valved sections.

3.3 TEST PRESSURE, DURATION AND LEAKAGE

All pipes shall be subjected to two hydrostatic tests as follows:

- a. Hydrostatic Test No. 1:
 - (1) Duration: Two hours
 - (2) Test Pressure:
 - (a) Potable water lines:..... 150 P.S.I.
 - (3) Allowable Leakage:
 - (a) Water Lines: The allowable leakage shall be based on the following formula:
$$L = \frac{ND(P)^{1/2}}{7,400}$$

Where L = Allowable leakage in gallons per hour.
N = Number of joints in the length of pipe tested.
D = Nominal Diameter of Pipe in inches.
 $P^{1/2}$ = Square root of pressure within the test section in psi.

Should any test of combined section of pipe laid disclose leakage greater than the specified limit, the Contractor shall, at his own expense, locate and repair the defective joints until the leakage is within the specified allowance. Repairs and tests shall be repeated until the line shows no defects and is accepted by the Engineer.

b. Hydrostatic Test No. 2:

(1) General:

The second hydrostatic test shall be made no less than 48 hours after the successful completion of the first hydrostatic test.

(2) Test Pressure And Duration:

(a) Potable water lines:..... City pressure for 48 hours.

(3) Allowable Leakage:

There will be a zero leakage allowance during this test. During the test, all exposed pipe, fittings, valves, hydrants, and joints shall be carefully examined. If found to be leaking, they shall be corrected immediately by the Contractor. If the leaking is due to cracked or defective material, the defective material shall be removed and replaced by the contractor with sound material. The test then shall be repeated until the pipeline is accepted. No pipe installation will be accepted until the above conditions have been met.

END OF SECTION 33 05 05.31

INSTALLATION OF SANITARY SEWER PIPE (PVC-SDR26)
SECTION 33 05 05.11

PART 1 – DESCRIPTION

1.1 GENERAL

- A. This specification shall govern for all work necessary for the installation of all sanitary sewer pipe (gravity flow) required to complete the project. This specification is a performance specification as defined in Art. TS-1 of the Technical Special Provisions.

PART 2 – PRODUCTS

2.1 CONCRETE

- A. Concrete shall have a minimum compressive strength of 2000 p.s.i. at 28 days and shall be in accordance with Subsection 03 30 02 "Normal Wight Aggregate Concrete".

2.2 PIPE

SDR 26 PVC Pressure Rated Pipe: See Subsection 33 05 31.29.

SDR 26 and SDR 35 PVC Sewer Pipe: See Subsection 33 31 11.

(SDR 35 pipe shall not be used when ditch exceeds 6' in depth).

2.3 WATER AND SANITARY SEWER SEPARATION

- A. New Water And Existing Sanitary Sewer:

<u>CONDITION</u>	<u>LOCATION</u>	<u>MATERIAL</u>		<u>MINIMUM SEPARATION</u>		<u>COMMENTS</u>
		<u>WATER</u>	<u>SEWER</u>	<u>VERT</u>	<u>HORIZ</u>	
New Water Parallel Existing Sewer	Water Above Sewer	Std.	Clay - Conc ABS CI-DI-PVC	2'	4'	If sewer not leaking, leave sewer alone. If sewer leaking repair or replace.
New Water Crossing Existing Sewer	Water Above Sewer	Std.	ABS, Clay Conc Compos.	2'	N/A	If sewer not leaking, leave sewer alone. If sewer leaking repair or replace.
New Water Crossing Existing Sewer	Sewer Above Water	Std.	ABS, Clay Conc. Compos.	2'	N/A	Replace existing sewer with one joint CI - DI PVC 150 psi centering over water line.
New Water Parallel to Existing Sewer	Sewer Above Water	Std.	ABS, Clay Conc. Compos.	2'	4'	Replace existing sewer with CI,DI PVC-150 psi or cement stabil. sand backfill in initial backfill zone of

sewer where parallel closer than 9' or encase the water in 150 psi pipe two nominal sizes larger.

B. New Water And New Sanitary Sewer:

<u>CONDITION</u>	<u>LOCATION</u>	<u>MATERIAL</u>		<u>MINIMUM SEPARATION</u>		<u>COMMENTS</u>
		<u>WATER</u>	<u>SEWER</u>	<u>VERT</u>	<u>HORIZ</u>	
Sewer Force Main and Gravity Sanitary Sewer Parallel to Water Main	Water Above Sewer	Std.	CI-DI-PVC 150 psi	2'	4'	Separate trenches
Gravity Sanitary Sewer Crossing Water Main	Water Above Sewer or Sewer Above Water	Std.	CI-DI-PVC 150 psi	6"	N/A	Center one joint of sewer pipe on water main
Gravity Sewer Crossing Water Main	Water Above Sewer	Std.	ABS-Clay-Conc Composite	2'	N/A	Cement stabilized sand backfill initial backfill zone of sewer for 9' each side of crossing. Center one joint of sewer pipe on water main

C. Existing Water And New Sanitary Sewer:

<u>CONDITION</u>	<u>LOCATION</u>	<u>MATERIAL</u>		<u>MINIMUM SEPARATION</u>		<u>COMMENTS</u>
		<u>WATER</u>	<u>SEWER</u>	<u>VERT</u>	<u>HORIZ</u>	
New Sewer Parallel Existing Water	Water Above Sewer or Sewer Above Water	Std.	CI-DI-PVC 150 psi	2'	4'	Separate trenches
New Sewer Crossing Existing Water	Water Above Sewer or Sewer Above Water	Std.	CI-DI-PVC 150 psi	6"	N/A	Center one joint of sewer pipe on water line.
New Sewer Crossing Existing Water	Water Above Sewer	Std.	ABS, Clay Conc. Compos.	2'	N/A	Cement stabilize sand backfill initial zone of sewer for 9' each side of crossing. Center one joint of sewer pipe on water main.

2.4 ALLOWABLE TRENCH WIDTH

- A. The width of the trench from the bottom of the pipe to 12" above the pipe shall conform to the following:

Table I
Allowable Trench Width

<u>Nominal Pipe Size</u>	<u>Minimum Trench Width - Inches</u>	<u>Maximum Trench Width - Inches</u>
4	18	30
6	18	30
8	24	30
10	30	36
12	30	36

2.5 HORIZONTAL PIPE CURVATURE

- A. Design Criteria Requirements:

When it is not possible for gravity sewers to be laid in straight alignment then the pipe shall be installed to meet the following horizontal curvature requirements.

- B. Horizontal Pipe Curvature:

Pipe deflection for curvature shall be based upon pipe flexure. Joint deflection shall not be used. The minimum radius of curvature shall be 500' for pipe up to 12" in diameter.

- C. Manholes:

Manholes spacing shall not be more than 300 feet.

- D. Trench Excavation:

Excavation shall be parallel to the curvature of the pipe. Placement of the pipe shall be in the center of the trench and properly bedded.

PART 3 – EXECUTION

3.1 HANDLING OF MATERIALS

- A. Handling and Care:

Pipe and other material shall be unloaded at the point of delivery, hauled to and distributed at the project site by the Contractor. They shall at all times be handled with care and in conformance with the manufacturer's recommendations. Whether moved by hand, skidway or hoist, material shall not be dropped or bumped against other material or objects already on the ground.

- B. Distribution at Site of Work:

Material may be unloaded opposite or near the place where it is to be used in the construction, provided it is to be incorporated into the work within 10 days. The Contractor shall distribute the material in such a manner so as not to cause the public any undue inconvenience.

C. Storing Material:

Any material delivered to the project site that is not to be incorporated into the work within 10 days shall be stored on suitable blocks or platforms off the ground. Stacking of material shall be done in such a manner that the material is not damaged. Particular care shall be taken to keep the preformed joint material on the spigot end of the pipe from becoming dented or damaged.

3.2 ALIGNMENT AND GRADE

A. General:

All pipe shall be laid and maintained to the required lines and grades.

B. Deviations With Engineer's Consent:

No deviation shall be made from the required line or grade except with the written consent of the Engineer.

C. Batter Boards:

The Contractor shall furnish and place in position as directed by the Engineer all the necessary batter boards for controlling the work. The batter boards shall be of such size timber as the Engineer directs and shall be substantially supported. The boards and all location stakes must be protected from damage or change of location. The Contractor shall also furnish good sound twilled lines for use in giving lines and grades, and the necessary plummets and graduated poles of a form approved by the Engineer.

D. Laser Equipment:

The Contractor may use laser equipment to maintain proper grade for laying pipe in lieu of batter boards as described above.

3.3 PIPE TRENCH EXCAVATION AND BACKFILL: See Subsection 31 23 16.13.

3.4 TRENCH EXCAVATION SAFETY: See Subsection 31 23 16.13.

3.5 LOWERING PIPE INTO TRENCH

A. General:

Proper implements, tools and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and efficient execution of the work. All pipes shall be carefully lowered into the trench by means of derrick, ropes, or other suitable equipment in such manner as to prevent damage. Under no circumstances shall pipe be dropped or dumped into the trench. The Contractor shall not lay any pipe into the trench until the bedding and condition of the trench has been approved by the Engineer. The trench shall be free of water and maintained in that condition until the pipe has been laid and the joints have been completed.

B. Inspection of Pipe:

The pipe shall be inspected for defects prior to lowering into trench. Any defective or unsound pipe shall be removed and replaced.

C. Pipe Kept Clean:

All foreign matter or dirt shall be removed from the interior of pipe before lowering into trench. Pipe shall be kept clean by means approved by the Engineer during and after laying.

3.6 BEDDING AND HAUNCHING FOR PVC SEWER PIPE

PVC sewer pipe shall have a minimum cover of 4'. As a minimum bedding and haunching shall conform to the following:

**TABLE II
MINIMUM BEDDING AND HAUNCHING**

Bedding and Haunching Material	Method of Compaction for Bedding & Haunching	Height of Cover (Feet)									
		4	6	8	10	12	14	16	18	20	
Crushed Stone To Spring Line of Pipe 3/4" to 1/16" Graded in Accord. With Size #67 or 68 AASHTO M43 or ASTM D448.	Crushed Rock Compacted with a Vibratory Plate Tamper-Bedding to Start a Min. of 4" Below Pipe.										
Sand to Spring Line of Pipe Passing 7/8" - 100%, Passing No. 4 - 80% Clay Lumps Not to Exceed 20% P.I. NP-10 Max.	Sand Compacted with A Vibratory Plate Tamper. Bedding to Start a Min. of 4" Below Pipe										
Excavated Material Used for Haunching P.I. NP-15 Max. L.L. Max. 35 Passing 200< 50%	Excavated Material Hand Tamped to Spring Line of Pipe Bottom of Ditch Shaped to Provide 90°<) of Contact										

Note: Bedding is material from the bottom of the pipe to the bottom of the trench.
Haunching is material from the bottom of the pipe to the spring line of the pipe.

3.7 LAYING PIPE

- A. Unless otherwise authorized by the Engineer, the laying of pipe on the prepared bedding shall be started at the outlet end with the spigot end pointing downstream and shall proceed toward the inlet end with the abutting sections properly matched, true to the required lines and grades. The pipe shall be fitted and matched so that when laid on the bed it shall form a smooth uniform conduit.

3.8 JOINTING POLYVINYL CHLORIDE PIPE

- A. The bell and spigot mating surfaces shall be wiped free of dirt or other foreign matter. A lubricant recommended by the coupling manufacturer shall be applied to the bell and spigot mating surfaces just before they are joined together. The spigot end shall then be centered on grade into the bell end of the pipe previously laid and shall be shoved home to compress the joint and to assure a tight fit between the inner surfaces. When the pipe being thusly installed, bell holes shall be excavated in the bedding material. When the joint has been made, the bell hole shall be carefully filled with bedding material to provide for adequate support of the pipe.

3.9 STOPPERS OR BULKHEADS

- A. The Contractor shall furnish and install suitable stoppers at the dead end of all pipes, wyes, tees, etc. Stoppers shall be water tight. At the end of each day or when temporary stopping of construction for more than 4 hours, a tight fitting bulkhead shall be placed across the open end of all pipe. Bulkheads do not need to be water tight.

3.10 TESTING COMPLETED SANITARY SEWER LINES

A. Contractor Testing:

The Contractor shall provide all equipment, materials, (including water, if required) and do all work necessary to conduct the following tests:

- a. Test for the deflection of flexible pipe.
- b. Test for infiltration when pipe is below the ground water table.
- c. Test for exfiltration or air testing when pipe is above the ground water table.

The tests shall be accomplished by the Contractor in the presence of the Engineer's or Owner's authorized representative. Tests results shall be signed by the Contractor's authorized representative who accomplished the testing and the Engineer's or Owner's authorized representative who witnessed the testing. Before final payment will be made to the Contractor 3 copies of all test results shall be furnished to the Engineer.

B. Deflection Testing:

a. General:

Deflection tests shall be performed on all flexible pipes. For pipelines with inside diameters less than 27 inches, a rigid mandrel shall be used to measure deflection. For pipe lines with an inside diameter 27 inches and greater, a method approved by the Engineer shall be used to test for vertical deflections. Other methods shall provide a precision of 0.2% deflection. The test shall be conducted after the final backfill has been in place at least 30 days. No pipe shall exceed a deflection of 5.0%. If a pipe should fail to pass the deflection test, the problem shall be corrected and a second test shall be conducted after the final backfill has been in place an additional 30 days. The tests shall be performed without mechanical pulling devices.

b. Mandrel Sizing:

The rigid mandrel shall have an outside diameter (O.D.) equal to 95% of the inside diameter (I.D.) of the pipe. The inside diameter of the pipe, for the purpose of determining the outside diameter of the mandrel, shall be the average outside diameter minus two minimum wall thicknesses for O.D. controlled pipe and the average inside diameter for I.D. controlled pipe, all dimensions shall be per appropriate standard. Statistical or other 'tolerance packages' shall not be considered in mandrel sizing.

c. Mandrel Design:

The rigid mandrel shall be constructed of a metal or a 'rigid plastic material that can withstand 200 psi without being deformed. The mandrel shall have nine or more "runners" or "legs" as long as the total number of legs is an odd number. The barrel section of the mandrel shall have a length of at least 75% of the inside diameter of the pipe. A proving ring shall be provided and used for each size mandrel in use.

d. Method Options:

Adjustable or flexible mandrels are prohibited. A television inspection is not a substitute for the deflection test. A deflectometer may be approved for use on a case-by-case basis. Mandrels with removable legs or runners may be accepted on a case-by-case basis.

3.11 TELEVISIONING THE LINE

- A. The Owner or the City reserves the right to "televise" the entire length of gravity sewer line installed to insure that the line is clear of debris and free from visible defects, loose joints, improperly seated gaskets, or excessive deviations from grade. Excessive deviation from grade will be judged during this inspection as any misalignment which causes water to stand two (2) inches deep or more at any point inside the pipe. If repairs are required, affected areas shall be retelevised at Contractor's expense to determine final acceptability.

3.12 INFILTRATION OR EXFILTRATION TESTS

- A. When pipes are installed below the ground water level an infiltration test shall be used in lieu of the exfiltration test. The total exfiltration as determined by a hydrostatic head test, shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours at a minimum test head of two feet above the crown of the pipe at the upstream manhole. For pipes installed with a horizontal curvature the exfiltration shall not exceed 10 gallons per inch diameter of pipe per mile for 24 hours. The total infiltration, as determined by a hydrostatic head test, shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours at a minimum test head of two feet above the crown of the pipe at the upstream manhole, or at least two feet above existing ground water level, whichever is greater. For construction within the 25-year flood plain, the infiltration or exfiltration shall not exceed ten gallons per inch diameter per mile of pipe per 24 hours at the same minimum test head. If the quantity of infiltration or exfiltration exceeds the maximum quantity specified, remedial action shall be undertaken in order to reduce the infiltration or exfiltration to an amount within the limits specified.

3.13 LOW PRESSURE AIR TEST

- A. The procedure for the low pressure air test shall conform to the procedures described in ASTM C-828, ASTM C-924, ASTM F-1417 or other appropriate procedures, except for testing times. The test times shall be as outlined in this section. For sections of pipe less than 36-inch average inside diameter, the following procedure shall apply unless the pipe is to be joint tested. The pipe shall be pressurized to 3.5 psi greater than the pressure exerted by ground water above the pipe. Once the pressure is stabilized, the minimum time allowable for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be computed from the following equation:

ALLOWABLE TIME FORMULA

$$\text{Time (Seconds)} = \frac{0.085 (D) (K)(Q)}{1}$$

T = time for pressure to drop 1.0 pound per square inch gauge in seconds

K = $0.000419(D)(L)$ **but not less than 1.0**

D = average inside diameter of pipe (inches)

L = length of line of same pipe size being tested, in feet

Q = rate of loss, 0.0015 cubic feet per minute per square foot internal surface shall be used

Since a K value of less than 1.0 shall not be used, there are minimum testing times for each pipe diameter as follows:

Pipe Diameter (inches)	Minimum Time (seconds)	Length for Minimum Time (feet)	Time for Longer Length (seconds)
6	340	398	0.855(L)
8	454	298	1.520(L)
10	567	239	2.374(L)
12	680	199	3.419(L)
15	850	159	5.342(L)
18	1020	133	7.693(L)
21	1190	114	10.471(L)
24	1360	100	13.676(L)
27	1530	88	17.309(L)
30	1700	80	21.369(L)
33	1870	72	25.856(L)

The test may be stopped if no pressure loss has occurred during the first 25% of the calculated testing time. If any pressure loss or leakage has occurred during the first 25% of the testing period, then the test shall continue for the entire test duration as outlined in this subparagraph or until failure. Lines with a 27-inch average inside diameter and larger may be air tested at each joint. Pipe greater than 36-inch diameter must be tested for leakage at each joint. If the joint test is used, a visual inspection of the joint shall be performed immediately after testing. The pipe is to be pressurized to 3.5 psi greater than the pressure exerted by ground water above the pipe. Once the pressure has stabilized, the minimum time allowable for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be ten seconds.

END OF SECTION 33 05 05.11

DUCTILE-IRON UTILITY PIPE & FITTINGS
SECTION 33 05 19

PART 1 – DESCRIPTION

1.1 SCOPE

- A. This specification shall govern for all work necessary for furnishing all ductile iron pipe and fittings required to complete the potable water lines. This specification is a design specification and the performance of the completed work is the responsibility of the Contractor.

PART 2 – PRODUCTS

2.1 DUCTILE IRON PIPE

- A. General:
All ductile pipe shall conform to A.N.S.I. A21.50

2.2 LINING

- A. The interior of the pipe and fittings shall be lined with enameled cement mortar, standard thickness (epoxy coated) as specified in A.N.S.I. A21.4-85/AWWA C-104.

2.3 PIPE

- A. Pipe shall have a minimum thickness as follows:

6" Diameter	0.25 inch	(Class 350)
8" Diameter	0.27 inch	(Class 350)
10" Diameter	0.29 inch	(Class 350)
12" Diameter	0.31 inch	(Class 350)
14" Diameter	0.33 inch	(Class 300)
16" Diameter	0.34 inch	(Class 300)
18" Diameter	0.35 inch	(Class 300)
20" Diameter	0.36 inch	(Class 300)
24" Diameter	0.38 inch	(Class 250)

3.1 FITTINGS

- A. General:
Fittings shall be either cast iron or ductile iron and shall conform to A.N.S.I. A21.10 and A.W.W.A. C-110 and C-153, Latest Edition.
- B. Cast Iron Fittings:
- 6" thru 12": Pressure Class 250 and Iron Strength Class 25.
 - 14": Pressure Class 150 and Iron Strength Class 25.
 - 16" thru 24": Pressure Class 150 and Iron Strength Class 30.
- C. Ductile Iron Fittings:
- 6" thru 24": Pressure Class 350.

3.2 JOINTS

- A. General:
Joints for fittings shall be mechanical joint. Joints for pipe shall be push on joints.

B. Mechanical Joints:

Joints shall conform to A.N.S.I. A21.11. Mechanical joints shall be furnished complete with joint material, rubber, bolts, nuts, glands, and gaskets. Gaskets material shall be synthetic rubber, odor free and containing no natural rubber.

C. Push-On Joints:

Push-on joints shall conform to A.N.S.I. A21.11. Push-on joints shall be complete with lubricant and gasket material. Gasket material shall be synthetic rubber, odor free and containing no natural rubber.

D. Certification:

The manufacturer shall furnish a copy of the manufacturer's affidavit of compliance with specifications and a certified copy of an analysis of the material in each gasket showing the type of synthetic rubber and that no natural rubber is present. Certification shall accompany each order delivered.

3.3 EXTERIOR COATING

- A. Pipe and fittings shall have a bituminous coating approximately 1 mil. thick. Where called for on the drawings, ductile iron pipe and fittings shall be wrapped in polyethylene. The polyethylene material shall have an 8 mil. thickness and may be either clear or black. The wrapping shall be lapped in such a manner that all surfaces of pipe and fittings shall have a minimum 6" lap.

END OF SECTION 33 05 19

POLYVINYL CHLORIDE PIPE AND FITTINGS (C900 & C905)
SECTION 33 05 31.16

PART 1 – DESCRIPTION

1.1 SCOPE

- A. This specification shall govern for all work necessary for furnishing all polyvinyl chloride pipe required to complete the project. This specification is a design specification and the performance of the completed work is the responsibility of the Contractor.

PART 2 – PRODUCTS

2.1 4" THRU 12" P.V.C. PIPE

- A. General:
4" thru 12" P.V.C. pipe shall meet the requirements of AWWA C-900, "Polyvinyl Chloride Pressure Pipe 4" Thru 12" for Water". **4" through 12" Water Line Pipe shall be Class 150 and meet the requirements of DR 18.** The pipe and gaskets shall be approved by the Underwriters Laboratories, Inc. of the American Insurance Association, Factory Mutual and by the National Sanitary Foundation. Pipe shall conform to cast iron pipe outside diameters. All pipe shall be suitable for use as pressure conduit and be furnished with an integral bell containing a locked-in ring and spigot joint for the conveyance of water. Provisions must be made for expansion and contraction at each joint. The bell shall consist of an integral wall section with a locked-in, solid cross section elastomeric ring, which meets the requirements of ASTM F-477. The bell section shall be designed to be at least as hydrostatically strong as the pipe wall and meet the requirements of AWWA C-900. A complete set of joint material shall be furnished with each joint of pipe. The manufacturer shall furnish a copy of the manufacturer's affidavit of compliance with specifications and a certified copy of an analysis of the material in each gasket showing the type of synthetic rubber and that no natural rubber is present. Certification shall accompany each order delivered.

2.2 PIPE STIFFNESS

- A. The pipe stiffness using $F/\Delta EY$ (for Class 150 and Dr. 18) shall be 435 psi.

2.3 QUICK BURST TEST

- A. Randomly selected samples tested in accordance with ASTM D-1599 shall withstand, without failure, 755 psi. (at 73°F) when applied in 60 - 70 seconds.

2.4 DROP IMPACT TEST

- A. Pipe shall withstand, without failure at 73 degree F, an impact of a falling missile, Type C (per ASTM D-2444 and shall show no visible evidence of shattering or splitting) as follows:

6" and 8" - 100 FT/LB

10" and 12" - 120 FT/LB

2.5 STANDARD LAYING LENGTHS AND PHYSICAL REQUIREMENTS

- A. Standard laying lengths shall be 20 feet ($\pm 1"$) for 6" through 12" pipe. At least 85% of the total footage of pipe shall be furnished in standard lengths. The remaining 15% may be furnished in random lengths not less than 10 feet long. Each standard and random length of pipe shall be tested to 600 psi. for a minimum of 5 seconds. The integral bell shall be tested with the pipe.

PART 3 – EXECUTION

3.1 14" THRU 24" P.V.C. PIPE

A. General:

14" thru 24" P.V.C. pipe shall meet the requirements of AWWA C-905, "Polyvinyl Chloride Water Transmission Pipe 14" Thru 36". **14" through 24' Water Line Pipe shall be Class 165 and meet the requirements of DR 25.** The pipe and gaskets shall be approved by the Underwriters Laboratories, Inc. of the American Insurance Association, Factory Mutual and by the National Sanitation Foundation. Pipe shall conform to cast iron pipe outside diameters. All pipe shall be suitable for use as pressure conduit and be furnished with an integral bell containing a bonded-in, solid ring and spigot joint for the conveyance of water. Provisions must be made for expansion and contraction at each joint. The bell shall consist of an integral wall section with a bonded-in, solid cross section elastomeric ring which meets the requirements of ASTM F-477.

The bell section shall be designed to be at least as hydrostatically strong as the pipe wall and meet the requirements of C-905. A complete set of joint material shall be furnished with each joint of pipe. The manufacturer shall furnish a copy of the manufacturer's affidavit of compliance with specifications and a certified copy of an analysis of the material in each gasket showing the type of synthetic rubber and that no natural rubber is present. Certification shall accompany each order delivered.

3.2 STANDARD LAYING LENGTHS AND PHYSICAL REQUIREMENTS

- A. Standard laying lengths shall be 20 feet ($\pm 1"$) for all sizes. At least 85% of the total footage of pipe shall be furnished in standard lengths. The remaining 15% may be furnished in random lengths not less than 10 feet long. Each standard and random length of pipe shall be tested to 330 psi. for a minimum of 5 seconds. The integral bell shall be tested with the pipe.

3.3 FITTINGS

- A. All fittings 6" and larger as listed in A.W.W.A. specification C-110 and C-153 shall be compact ductile iron and in accordance with A.W.W.A. Specifications C-104, C-110, C-111, and C-153, latest editions.

3.4 CAST IRON FITTINGS

- A. 6" thru 12": Pressure Class 250 and Iron Strength Class 25.
- B. 14": Pressure Class 150 and Iron Strength Class 25.
- C. 16" thru 24": Pressure Class 150 and Iron Strength Class 30.

3.5 DUCTILE IRON FITTINGS

- A. 6" thru 24": Pressure Class 350.

3.6 JOINTS

- A. Fittings shall be furnished with mechanical joints.

3.7 WRAPPING FITTINGS

- A. All fittings shall be wrapped with polyethylene in accordance with A.W.W.A. Specification C-105, latest edition.

3.8 MARKING

- A. Each length of pipe shall be marked to indicate Pressure Class, DR, UL and AWWA C-900 approval.

END OF SECTION 33 05 31.16

**POLYVINYL CHLORIDE PIPE AND FITTINGS (SCH. 40) FOR DUCT
SECTION 33 05 31.29**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This specification shall govern for all work necessary for furnishing polyvinyl chloride pipe and fittings required to complete water lines 2" diameter and less. This specification is a design specification as defined in Art. TS-1 of the Technical Special Provisions.

PART 2 – PRODUCTS

2.1 FITTINGS

- A. All Fittings shall be Schedule 40 PVC fittings.

2.2 PIPING

- A. All Piping shall be Schedule 40 PVC pressure pipe with bell ends.

PART 3 – EXECUTION

3.1 SCHEDULE 40 PVC PRESSURE PIPE

- A. Pipe and fittings shall be manufactured from PVC 1120 which is a Type 1, Grade 1, polyvinyl chloride compound having a design stress rating of 2000 psi at 73° F and conforms to ASTM D-1784. Physical dimensions and tolerances of PVC pipe shall conform to and ASTM D-1785 for Schedule 40. Pipe shall be marked in accordance with ASTM D-2241, i.e., nominal pipe size, type of PVC, schedule, pressure rating, ASTM designation number, manufacturer's name and code and the National Sanitation Foundation Seal.

3.2 PVC PIPE COUPLINGS AND JOINTS

- A. Schedule 40 PVC:
Couplings shall be Schedule 40, Solvent Weld and shall conform to ASTM D-2466.

3.3 PVC FITTINGS

- A. Schedule 40 PVC:
Fitting shall be PVC, shall be solvent weld, and shall conform to ASTM D-2466.

END OF SECTION 33 05 31.29

**SANITARY SEWER MANHOLES
(FIBERGLASS)
SECTION 33 05 76**

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This specification shall govern for all work necessary to construct all sanitary sewer manholes (fiberglass) required to complete the project. This specification is a performance specification as defined in Art. TS-1 of the Technical Special Provisions.

PART 2 – PRODUCTS

2.1 DIAMETER

- A. Manholes shall have an inside diameter of either 48" or 1.5 times the nominal pipe diameter of the largest pipe, whichever gives the larger diameter. A concentric manway reducer over the straight wall section shall have an inside diameter of 23".

2.2 WALL THICKNESS

- A. The minimum wall thickness of the fiberglass manholes shall be 1/2".

2.3 CONCRETE

- A. Concrete shall have a minimum compressive strength of 3000 p.s.i. at 28 days and shall be in accordance with Subsection 03 30 02 Normal Weight Aggregate Concrete.

2.4 REINFORCING STEEL

- A. Reinforcing steel shall be new billet steel conforming to ASTM A-615. Also see Section 03 20 01 Concrete Reinforcement.

2.5 FIBERGLASS STRUCTURE

- A. Fiberglass manholes shall be in accordance with ASTM D-3753 "Glass Fiber-Reinforced Polyester Manholes". Manholes shall be a one-piece unit manufactured by Owens/Corning or approved equal.

2.6 SEALS

- A. Manholes pipe seals shall be made of corrosion resistant plastic. It shall eliminate leaks ground pipe entering manhole wall and shall permit pipe movement without loss of seal integrity. Pipe seals (waterstops) shall be as manufactured by Fernco of Davidson, Michigan, or approved equal. Caulk for interior seal between fiberglass manhole and concrete base shall be Epo-Flex epoxy (gun grade consistency) as manufactured by Dewey Supply of Corpus Christi, or approved equal. Caulk for exterior seal between fiberglass manhole and concrete shall be Ram-Nek flexible plastic gasket material as manufactured by K. T. Snyder Company of Houston, or approved equal.

2.7 MANHOLE RING AND COVER

- A. Manhole rings and covers shall be the round, roadway type, with solid cover and bottom flange. They shall be grey iron castings boldly filleted at angles and the arises shall be sharp and perfect. The castings shall be true to pattern, form and dimensions, free from cracks, sponginess, blow holes or other pouring faults affecting their strength and value for the service

intended. Surfaces of the castings shall be free from burnt-on sand and shall be reasonably smooth. Runners, risers, fins and other cast-on pieces shall be removed from the surfaces. Provide 22-1/2" inside diameter x 5 inch high flange. Manhole ring and cover shall be designed for H-20 loading with machined joints (but for ring and covers in Texas Dept. of Highways R. O. W., cover must weigh 175 lbs.).

2.8 DEFECTS NOT PERMITTED IN FIBERGLASS STRUCTURE

- A. Interior Surfaces:
 - a. Crazing
 - b. Delamination
 - c. Exposed fibers
 - d. Blisters over 1/2 inch in diameter
 - e. Pits and voids directly under surface that can be broken by finger pressure, over 5 per square foot
 - f. Wrinkles over 1/8 inch
- B. Exterior Surfaces:
 - a. Delamination
 - b. Exposed fibers
 - c. Blisters over 1/2 inch in diameter
 - d. Sharp projections; the surface shall be relatively smooth as to allow handling of manholes without the need for gloves or special protection.

2.9 REPAIRS TO FIBERGLASS STRUCTURE

- A. Repairs shall not be permitted unless the required manhole meets all requirements of an undamaged manhole and its components.

2.10 MARKING AND IDENTIFICATION OF FIBERGLASS STRUCTURES

- A. All manholes shall be marked on the inside. The markings shall be permanent and include:
 - a. Manufacturer Identification (Name)
 - b. Manufacturing Serial No. (Number to appear in report for identification)

PART 3 – EXECUTION

3.1 EXCAVATION: See Subsection 31 23 00

3.2 TRENCH EXCAVATION SAFETY: See Subsection 31 23 00.

3.3 MANHOLE PREPARATION

- A. Cutout shall be equal to the outside diameter of pipe to pass through it, plus 1/2 inch. Cuts are to be made using electric or gasoline-powered circular saw with masonry blade. Do not use axe or other impact-type tools.

3.4 HANDLING

- A. Do not drop or impact the manholes. Manholes shall be chocked if stored horizontally. If manholes must be moved by rolling, the ground traversed shall be smooth and free of rocks, debris, etc. When lifting manholes in horizontal position, use two slings with spreader bar. For lifting in vertical position, 3 lift lugs may be provided (recommended by manufacturer) at top of manhole. Only a pliable strap or rope should contact manhole; do not use chains or steel cables.

3.5 HEIGHT ADJUSTMENT

- A. If necessary, position bricks or blocks in excavation to adjust manholes to correct elevation.

3.6 CONCRETE

- A. Pour concrete in excavation to depth specified on Drawings. Concrete shall extend at least 4" above all brick or block height adjustments.

3.7 INSTALLATION

- A. Lower manhole into wet concrete until it rests at proper elevation, and a minimum of 6" into concrete; then move manhole to plumb.

3.8 BACKFILL MATERIAL: See Subsection 31 23 00 Structural Excavation and Backfill.

3.9 SCHEDULE OF BACKFILLING: See Subsection 31 23 00 Structural Excavation and Backfill.

3.10 BACKFILL: See Subsection 31 23 00 Structural Excavation and Backfill.

3.11 TESTING FOR LEAKAGE

- A. Manholes shall be tested for leakage separately and independently of the wastewater lines by hydrostatic exfiltration testing, vacuum testing, or other methods acceptable to the TNRCC. If a manhole fails a leakage test, the manhole must be made water tight and retested. The maximum leakage for hydrostatic testing shall be 0.025 gallons per foot diameter per foot of manhole depth per hour. Alternative test methods must ensure compliance with the above allowable leakage. Hydrostatic exfiltration testing shall be performed as follows: All wastewater lines coming into the manhole shall be sealed with an internal pipe plug, then the manhole shall be filled with water and maintained full for at least one hour. The Contractor shall provide water, labor and materials for testing.

3.12 CERTIFICATION

- A. The Contractor shall submit a written certification before acceptance. This shall consist of a copy of manufacturer's test report or a statement by the supplier, accompanied by a copy of the test results, that the man- hole has been sampled, tested and inspected in accordance with the provisions of ASTM D-3753 and meets all requirements. Each certification so furnished shall be signed by an authorized agent of the supplier or manufacturer.

3.13 MARKING AND IDENTIFICATION

- A. Each manhole shall be marked with the following information:
 - a. Manufacturer's name or trademark
 - b. Manufacturing special number
 - c. Total length and nominal diameter

END OF SECTION 33 05 76

**EXISTING UTILITIES
SECTION 33 05 97.10**

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This specification shall govern for all work necessary to work around existing water lines, sewer lines and other utilities. In addition, it shall govern for connecting to the existing water distribution system and the sanitary collection system. This specification is a performance specification as defined in Art. TS-1 of the Technical Special Provisions.

1.2 LOCATION OF EXISTING UTILITIES

- A. The location of existing water lines, sewer lines and other utilities shown on the drawings is based on as-built information from construction drawings, on the ground survey and other information provided by the owners of those facilities. Depiction of the locations on the drawings is intended as a guide to the Contractor but is not guaranteed. Failure to show existing lines and structures will not be considered sufficient basis for claims for additional compensation for extra work, unless the obstruction encountered is such as to necessitate substantial changes in the lines or grades or requires the building of special work for which no provision is made in the drawings and which is not essentially subsidiary to some item of work for which provision is made. The Contractor shall be responsible for locating and protecting all existing utility lines from damage during construction. The Contractor shall notify the appropriate utility company at least 24 hours before beginning any construction. Adjustment of conflicting water lines, sewer lines and other utilities shall be the responsibility of the Contractor. Adjustment of conflicting utility shall be coordinated with the utility affected. When the adjustment is accomplished by the Contractor, it shall be done in the presence of a representative of the utility affected. There shall be no separate payment for adjustment of utilities unless a bid item is provided on the proposal. The Contractor shall be responsible for scheduling the work so that there is no delay in the completion of the entire project. Should the Contractor damage any utility line, the Contractor shall repair said damage (or pay the utility company for repair) to the satisfaction of the utility company at no cost to the Utility Company, the "District" or the Owner.

1.3 WATER DISTRIBUTION AND SANITARY SEWER COLLECTION SYSTEMS

A. General:

The existing water distribution system and sanitary collection system is owned and operated by the City of Port Aransas, which is herein referred to as the City of Port Aransas.

B. Contact:

The City of Port Aransas may be contacted at their office which is located adjacent to the elevated storage tank in Port Aransas. Their telephone number is 749-5201.

C. Standards, Ordinances And Regulations:

All water distribution system and sanitary sewer collection system improvement shall comply with the standard specifications of the "District", City Of Port Aransas Ordinances, Texas Department Of Health Regulations and Texas Water Commission Regulations.

D. Notification and Connection to Existing Sanitary Sewer System:

The Contractor shall notify the "District" at least 24 hours prior to excavating within 20 feet of any existing water or sewer line. It shall be the Contractor's responsibility to keep the "District's" Office informed at least once each day of his activities while working within said 20 feet. The actual connection to the existing water or sewer system must be observed by a representative of the City of Port Aransas.

E. Failure to Notify and Inform:

If the Contractor does not notify the City of Port Aransas as stated above and/or does not operate in strict conformance with the contract documents and the existing line is found to be damaged (for any reason) the Contractor shall make repairs to the satisfaction of the City of Port Aransas at no cost to the "District".

F. Sterilization of Water Lines:

Contractor shall sterilize all water lines in accordance with Texas Department Of Health regulations. Also see Subsection 33 05 05.

G. Testing Of Water And Sewer Lines:

- a. Contractor shall test all Water Lines as set out in Subsection 33 05 05.31.
- b. Contractor shall test all Sewer Lines as set out in Subsection 33 05 05.1.

1.4 DEVIATIONS OCCASIONED BY EXISTING OBSTRUCTIONS

- A. It is assumed, that as elsewhere provided, the Contractor has thoroughly inspected the site, is informed as to the correct location of surface structures, and has included the cost of such incidental work in the price bid, and has considered and allowed for all foreseeable incidental work due to variable sub-surface conditions, whether such conditions and such work are fully and properly described on the drawings or not. Minor changes and variations of the work specified and shown on the drawings shall be expected by the Contractor and allowed for as incidental to the satisfactory completion of a whole and functioning work or improvement.

1.5 TRENCHING AHEAD

- A. The Contractor is required to conduct trenching operations in a manner which will allow conflicts to be anticipated thereby allowing measures to be taken in certain cases to circumvent the conflict. Specifically the Contractor shall do the following:
 - a. Trenching shall be performed a minimum of 100 feet (or the total length of the trench) ahead of pipe laying operations. Pilot Trenches may be used at the Contractor's option.
 - b. If buried lines are discovered which may cause conflict, Contractor shall stop pipe laying operations and notify Engineer of discovery.

1.6 GRADE/ALIGNMENT OF WATER LINES

- A. If a conflict can be avoided by adjusting grades of water lines by maximum of one foot in any direction and no additional fittings are required, no claim for additional compensation for extra work will be considered. Water lines requiring adjustments greater than 1 foot will be considered for extra compensation on an individual basis.

1.7 GRADE/ALIGNMENT OF SANITARY SEWER LINES

- A. The grade and/or alignment of sanitary sewer lines shall not be changed unless approved by the Engineer. If the Engineer does allow a grade and/or alignment change extra compensation will be considered on an individual basis provided the change requires an adjustment greater than 1 foot.

1.8 ABANDONED LINES

- A. When a line is uncovered that is not in use and is no longer needed, the line shall be cut and plugged. No claim for additional compensation for extra work will be considered for this.

1.9 AVOIDABLE CONFLICTS

- A. Conflicts occurring because of the Contractor's failure to trench ahead and which could have been avoided by grade or alignment will not be considered for extra compensation.

1.10 EXTRA WORK

- A. No work for which extra compensation is to be received shall be performed until approved by the Engineer and the Owner.

END OF SECTION
33 05 97.10

**GATE VALVES
SECTION 33 14 19**

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This specification shall govern for all work necessary to furnish and install the gate valves with box and cover as required to complete the project. This specification is a performance specification as defined in Art. TS-1 of the Technical Special Provisions.

PART 2 – PRODUCTS

2.1 GENERAL

- A. All valves shall comply with the latest requirements of applicable A.W.W.A. Specifications. All valves shall open in a counter-clockwise direction. Valves to provide an unobstructed waterway of a diameter of a circle not less than the full nominal diameter of the valve when the gate is open. All valves shall be installed vertically unless shown specifically otherwise on the drawings.

PART 3 – EXECUTION

3.1 VALVES LESS THAN 4-INCHES

- A. Valves shall be bronze body gate valves designed for a minimum 200 p.s.i. water working pressure service. Valve bodies shall be cast bronze that conforms to A.S.T.M. B-62, Grade 1. Valves shall be of an acceptable manufacture and shall conform to A.W.W.A. C-500, Type 1. Gate valves shall have a rising stem and NPT threaded ends. Gate valves and shall be equipped with handwheels. If valve is installed underground, provide a valve box and if necessary an extension so that valve can be operated from ground level.

3.2 VALVES 4-INCHES THROUGH 12-INCHES

A. General

Valves shall be resilient-seated gate valves, Waterous Series 500 wedge valve or Clow F6100 resilient-seated valve. Resilient-seated valves shall conform to A.W.W.A. C-509, latest edition and be as follows:

- a. The valve body, bonnet and gate castings shall be ductile iron.
- b. The resilient-seated gate valves shall have non-rising stems.
- c. Valve ends shall be mechanical joint type. A complete set of joint materials shall be furnished with each valve.
- d. Stem seals shall be the O-ring type.
- e. Valves shall open left (counter clockwise).
- f. Tapping valves to be used with tapping saddles shall have one end mechanical joint.

B. Protective Coatings

- a. Interior Of Valve:
 - (1) Body And Bonnet: Factory applied epoxy coating conforming to A.W.W.A. C550.
 - (2) Gate: Factory applied rubber encapsulated conforming to A.W.W.A. C509.
- b. Exterior Of Valve: Factory applied epoxy coating conforming to A.W.W.A. C550.

C. Valve Ends

Gate valves shall be furnished with mechanical joint ends. Mechanical joints shall conform to A.N.S.I./A.W.W.A. C111/A21.11.

D. Valve Boxes

Gate valves shall be furnished with wrench nut, an extension to within 6" of top of valve box and cast iron valve box. Valve box shall be an adjustable road type valve box with a minimum opening of 5-inches. Valve box shall be cast iron and shall be complete with base, extension, top section and cover. The base shall be of proper size to fit the valves on which the base is installed. Valve boxes shall be 461S Tyler Or Western U.S.A. made.

3.3 SUBMITTAL DATA

- A. The manufacture shall upon request furnish two (2) certified sets of prints showing complete details, dimensions and materials used. The manufacturer shall also upon request furnish a certified letter of compliance stating that their valve meets these specifications. Also, the manufacturer shall upon request furnish one (1) certified copy of the physical tests of all metals used in the manufacture of the valve.

END OF SECTION 33 14 19

FIRE HYDRANTS
33 14 19.13

PART 1 – GENERAL

1.1 SCOPE

This specification shall govern for all work necessary to provide all fire hydrants required to complete the project. This specification is a performance specification as defined in Art. TS-1 of the Technical Special Provisions.

PART – PRODUCTS

2.1 CONCRETE

A. Concrete shall have a minimum compressive strength of 2000 p.s.i. at 28 days.

2.2 FIRE HYDRANTS

- A. Fire hydrants shall conform to A.W.W.A. C-502, latest revision thereof, unless specified otherwise herein. Hydrants shall be of the traffic model type equipped with a safety flange or collar on both the hydrant barrel and stem. Fire Hydrants shall be Waterous Pacer 100 Type.
- B. Type of Shutoff: The shut off shall be of the compression type only.
- C. Inlet Connection:
The inlet shall be AWWA C-111 latest revision, mechanical joint for six (6") inch, Class 50 ductile iron pipe. A complete set of joint material shall be furnished with each hydrant.
- D. Delivery Classifications:
Each hydrant shall have two hose nozzles and one pumper nozzle. Nozzle shall be threaded into the hydrant.
- E. Bury Length:
The hydrants shall be furnished in the bury length of 42" unless otherwise noted on the drawings.
- F. Diameter (Nominal Inside) of Hose and Pumper Nozzles:
The hose nozzles shall be two and one-half (2-1/2") inches inside diameter and the pumper nozzle shall be four (4") inches inside diameter.
- G. Hose and Pumper Nozzle Threads:
The hose nozzles shall have two and one-half (2-1/2) inch National Standard Thread (7-1/2 threads per inch). The pumper nozzle shall have six (6) threads per inch with an outside diameter of 4.658 inches, pitch diameter of 4.543 inches, and a root diameter of 4.406 inches.
- H. Harnessing Lugs: None required.
- I. Nozzle Cap Gaskets: Required.
- J. Drain Opening:
Drain opening is required. Tapping of the drain opening for pipe threads is not required.
- K. The Valve Seat Ring:
The valve seat ring shall not be made an integral part of the shoe. The valve seat ring shall be bronze and shall thread into a bronze drain ring.
- L. Nozzle Cap Chains: Hydrants shall be furnished with nozzle cap chains.
- M. Direction to Open: The hydrants shall open left (counter clockwise).
- N. Coating:
Fire Hydrants shall be epoxy coated and the portion of the hydrant above the ground line shall be coated the color selected by the Owner.

- O. Shape and Size of Operating and Cap Nuts:
The operating and cap nuts shall be tapered pentagon one and one-fourth (1-1/4") inch point to face at base and one and one-eighth (1-1/8") inch point to face at top of nut.
- P. Size of Fire Hydrant:
The main valve opening shall not be less than five and one-fourth (5-1/4") inches inside diameter.
- Q. Valve Facing:
The main valve facing of the hydrant shall be rubber with 90± one (1) durometer hardness. When the main valve lower washer and stem nut are not an integral casting then the bottom stem threads shall be protected with ductile and/or bronze cap nut and a stainless steel and/or bronze lock nut.
- R. Barrel Sections:
The hydrant shall be made in two or more barrel sections with flanges connecting the barrel to the elbow and to the packing plate.
- S. Breakable Coupling:
Hydrants shall be equipped with a breakable coupling on both the barrel section and the stem. The couplings shall be so designed that in case of traffic collision, the barrel and stem collar will break before any other part of the hydrant breaks. These couplings shall be at least two (2) inches above the finished grade line.
- T. Hydrant Adjustment:
The hydrant shall be designed as to permit its extension without excavating after the hydrant is completely installed.
- U. Breakable Collars, Barrel and Stem:
Weakened steel or weakened cast iron bolts that are used in the breakable barrel couplings will not be acceptable.
- V. Operating Stem:
Stems that have operating threads located in the waterway shall be made of manganese bronze, everdure, or other high quality non-corrodible metal. Stems that do not have operating threads located in the waterway must be sealed by a packing gland or "O" ring seal located between the stem threads and the waterway. Iron or steel stems shall be constructed with a bronze sleeve extending through the packing "O" ring seal area. The sleeve shall be of sufficient length to be in the packing or "O" ring seal in both open and closed positions of the main valve. The sleeve shall be secured to the steel stem so as to prevent water leakage between the two when subjected to 300 pounds hydrostatic test pressure.
- W. Drain Valve Mechanism:
Drain valves operating through springs or gravity are not acceptable.
- X. Operating Stem Nut:
The operating stem nut shall be designed to prevent seepage, rain, or sleet and the accumulation of dust between the operating nut and the hydrant top. The operating stem nut shall be made of bronze.
- Y. Packing Gland or "O" Ring Seal:
Fire hydrants having the threaded part of the stem at the hydrant top shall be equipped with a packing gland or an "O" ring seal immediately below the threaded section of the stem.

PART – 3 EXECUTION

3.1 GENERAL:

Fire hydrants shall be located in accordance with the details shown on the drawings. Fire hydrants shall stand plumb and hose nozzle shall be parallel to curb and street with the pumper nozzle facing the street.

3.2 CONNECTION TO MAIN:

Each hydrant shall be connected to the main with a six (6") inch branch line controlled by an independent six (6") inch gate valve (see 2G8). All pipe from the main tee to the fire hydrant shall be 6 inch DR 18 PVC (C900) pipe (see 2G1). Anchor fittings shall be used to connect the fire hydrant gate valve to the water main.

3.3 THRUST RESTRAINT:

The bowl of each hydrant shall be securely braced against undisturbed earth at the end of the trench with a 3" x 12" x 5'-0" wolmanized timber and all pipe, fitting and hydrant joints shall be provided with retainer glands.

3.4 DRAINAGE PIT:

A drainage pit shall be excavated below each hydrant and filled with 1/2 cubic yard of river rock gravel, under and around the bowl of the hydrant and to a level 6-inches above the waste opening. No hydrant drainage pit shall be connected to a sewer.

3.5 CONCRETE PAD:

The fire hydrant shall be installed on a 3" x 20" x 20" concrete pad.

3.6 POLYETHYLENE WRAP:

The barrel and base of the fire hydrant shall be wrapped in 8 mil polyethylene.

3.7 WASHING AND STERILIZING FITTINGS:

Valves, hydrants and fittings shall be stored on timbers and kept clean. Where soil or other substances have come in contact with the water surfaces of the fittings, the interior shall be washed and sterilized with an approved sterilizing agent.

3.8 CERTIFICATION:

The manufacturer shall upon request furnish two (2) certified sets of prints showing complete details and dimensions of the hydrant. The manufacturer shall upon request furnish one (1) certified copy of the physical tests of all metals used in the manufacture of the fire hydrant that is normally manufactured and that will meet these specifications. The manufacturer shall upon request furnish a certified letter of compliance stating that their fire hydrant meets these specifications.

END OF SECTION 33 14 19.13

POLYVINYL CHLORIDE PIPE AND FITTINGS FOR SEWER LINES (SDR 26)
SECTION 33 31 11

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This specification shall govern for all work necessary for furnishing all polyvinyl chloride pipe and fittings required to complete the PVC sewer pipe for site utilities. This specification is a design specification as defined in Art. TS-1 of the Technical Special Provisions.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION

3.1 MATERIAL

- A. Pipe and fittings shall be manufactured from clean, virgin, Type I, Grade I polyvinyl chloride compound, conforming to ASTM Specification D-1784.

3.2 PIPE

- A. 4" Thru 15" Diameter Pipe: Pipe shall be **SDR 26** and conform to ASTM Specification D3034.

3.3 PIPE STIFFNESS

- A. Minimum pipe stiffness at 5% deflection shall be in accordance with the schedule shown below

Pipe Diameter Inches	Pipe Stiffness	
	kPa	p.s.i.
4	790	115
6 Thru 15	790	115

Minimum pipe stiffness at 5% deflection shall be calculated in accordance with ASTM Specification D-2411.

3.4 FITTINGS

- A. Fittings and accessories shall be manufactured of the same material as specified for pipe, shall be at least **SDR 26** and shall have joint configurations identical to that of the pipe.

3.5 JOINTS

- A. Joints for pipe and fittings shall be compression rubber gasket joints conforming to the material and performance of ASTM Specification D-3212. The pipe joint shall consist of a bell that is an integral part of the pipe wall with compression rubber rings. The joint shall be capable of withstanding an internal hydrostatic pressure of 25 p.s.i. for one (1) hour without any leakage.

3.5 MARKING

- A. Pipe shall be marked to show nominal pipe size, type of PVC, SDR number, ASTM designated number and manufacturer's name and code.

END OF SECTION 33 31 11

COPA LIFEGUARD HEADQUARTERS FACILITY

STRUCTURAL SPECIFICATIONS INDEX

<u>Section</u>	<u>Title</u>
01 41 00	Testing Laboratory Services
03 10 00	Concrete Formwork
03 20 00	Concrete Reinforcement
03 30 00	Cast-In-Place Concrete
03 31 00	Epoxy Related Work
04 23 00	Reinforced Unit Masonry
05 12 00	Structural Steel
05 20 00	Steel Joists
05 31 00	Steel Roof Deck


Robert E. Martinez 5/15/25
THE SEAL APPEARING ON
THIS DOCUMENT WAS AUTHORIZED
BY ROBERT E. MARTINEZ, P.E. # 89387
T.B.P.E. FIRM NO. 6944

SECTION 01 41 00 - TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 PROCEDURE

A. Testing Laboratory:

An independent testing laboratory will be selected and furnished by the Owner to inspect and test the materials and methods of construction as hereinafter specified for compliance with the specification requirements of the Contract Documents and to perform such other specialized technical services as required by the Owner or his representative. All testing lab services shall be paid for by the owner.

1.3 QUALIFICATIONS OF TESTING LABORATORY

- A. The Testing Laboratory selected shall meet the basic requirements of ASTM E329 "Standard of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction", and shall submit to the Contractor, Owner, Architect, and Engineer, a copy of the report of inspection of their facilities made by the Materials Reference Laboratory of the National Bureau of Standards during the most recent tour of such inspections, and shall submit a memorandum stating steps taken to remedy all deficiencies reported by this inspection.
- B. The Testing Laboratory selected shall meet "Recommended Requirements for Independent Laboratory Qualification", latest edition, as published by the American Council of Independent Laboratories.
- C. The Testing Laboratory shall be approved by the local Building Official to perform inspection and certification services as an approved inspector of prefabricated construction.
- D. Testing machines shall be calibrated at intervals not exceeding 12 months by devices of accuracy traceable to the National Bureau of Standards or accepted values of natural physical constants. The Testing Laboratory shall submit a copy of certificate of calibration made by an accredited calibration agency.
- E. Tests and inspections shall be conducted in accordance with specified requirements, and if not specified, in accordance with the applicable standards of the American Society for Testing and Materials or other recognized and accepted authorities in the field.

1.4 AUTHORITIES AND DUTIES OF THE LABORATORY

A. Attending Preconstruction Conferences:

The Testing Laboratory shall obtain and review the project plans and specifications with the Architect and Engineer as soon as possible prior to the start of construction. The Laboratory shall attend preconstruction conferences with the Architect, Engineer, Project Manager, General Contractor, and Material Suppliers as required to coordinate materials inspection and testing requirements with the planned construction schedule. The Laboratory will participate in such conferences throughout the course of the project.

B. Outline Testing Program:

The Testing Laboratory shall be responsible for outlining a written detailed testing program conforming to the requirements as specified in the Contract Documents and in consultation with the Owner, Contractor, Architect, and Engineer. The testing program shall contain an outline of inspections and tests to be performed with reference to applicable sections of the specifications or drawings and a list of personnel assigned to each portion of the work. Such testing program shall be submitted to the Owner, Contractor, Architect, and Engineer five weeks in advance of the start of construction so as not to delay the start of construction. It shall be the Testing Laboratory's responsibility that such program conforms to the requirements of the Specifications and drawings and falls within the budget for testing laboratory services. If the allocated budget is not sufficient to cover the services as outlined in the Specifications, it shall be the responsibility of the Laboratory to notify the Contractor, Architect, Engineer, and Owner so that the Laboratory services can be modified accordingly prior to the start of construction. Furthermore, the Testing Laboratory shall monitor its expenditures throughout the course of the job and notify immediately the Owner, Contractor, Architect, and Engineer, of any significant deviation from the planned testing program and budget.

C. Cost Proposal:

The Testing Laboratory's proposal to the Owner shall contain the outlined testing program based on a unit price basis for tests and inspections and on an hourly basis for personnel. A total estimated price shall also be submitted.

D. Cooperation with Design Team:

The Laboratory shall cooperate with the Architect, Engineer, and Contractor and provide qualified personnel promptly on notice.

E. The Laboratory shall perform the required inspections, sampling, and testing of materials as specified under each section and observe methods of construction for compliance with the requirements of the Contract Documents.

F. Inspections Required by Government Agencies:

The Testing Laboratory shall perform all inspections and submit all reports and certifications as required by all government agencies.

G. Notification of Deficiencies in the Work:

The Laboratory shall notify the Architect, Engineer, and Contractor first by telephone and then in writing of observed irregularities and deficiencies of the work and other conditions not in compliance with the requirements of the Contract Documents.

H. Reports:

1. Information on Reports:

The Laboratory shall submit copies of all reports of inspections and tests promptly and directly to the parties named below. All reports shall contain at least the following information:

- a. Project Name
- b. Date report issued
- c. Testing Laboratory name and address
- d. Name and signature of inspector
- e. Date of inspection and sampling
- f. Date of test
- g. Identification of product and Specification section
- h. Location in the project
- i. Identification of inspection or test
- j. Record of weather conditions and temperature (if applicable)
- k. Results of test regarding compliance with Contract Documents.

2. Copies:

The Laboratory shall send certified copies of test and inspection reports to the following parties:

- a. 2 copies to the Owner or his representative
- b. 2 copies to the General Contractor
- c. 1 copy to the Architect
- d. 1 copy to the Engineer of responsibility
- e. 1 copy to the Supplier of the material tested

3. Certification by Notary Public:

Upon completion of the job, the Testing Laboratory shall furnish to the Owner, Architect, and Engineer of responsibility, a statement certified by a Notary Public that all required tests and inspections were made in accordance with the requirements of the Contract Documents.

I. Accounting:

The Testing Laboratory shall be responsible for separating and billing costs attributed to the Owner and cost attributed to the Contractor.

J. Obtaining Product and Material Certifications:

The Testing Laboratory shall be responsible for obtaining all product and material certifications from manufacturers and suppliers as specified in the Specifications.

K. Limitations of Authority:

The Testing Laboratory is not authorized to revoke, alter, relax, enlarge upon, or release any requirements of the Specifications or to approve or accept any portion of the work or to perform any duties of the General Contractor and his Subcontractors.

1.5 CONTRACTORS RESPONSIBILITY

A. Cooperation with Design Team:

The owner shall pay for all testing lab services. The Contractor shall cooperate with laboratory personnel, provide access to the work, and to manufacturers operations.

B. Furnishing Samples:

The Contractor shall provide to the laboratory representative, samples of materials proposed for use in the work in quantities sufficient for accurate testing as specified.

C. Furnishing Casual Labor, Equipment and Facilities:

The Contractor shall furnish casual labor, equipment, and facilities as required for sampling and testing by the Laboratory and otherwise facilitate all required inspections and tests.

D. Advance Notice:

The Contractor shall be responsible for notifying the Testing Laboratory sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests.

E. Payment for Substitution Testing:

The Contractor shall arrange with the Testing Laboratory and pay for any additional samples and tests above those required by the Contract Documents as requested by the Contractor for his convenience in performing the work.

F. Payment for Retesting:

The Contractor shall pay for any additional inspections, sampling, testing, and retesting as required when initial tests indicate work does not comply with the requirements of the Contract Documents.

G. Payment by Contractor:

The Contractor shall furnish and pay for the following items:

1. Soil survey of the locations of borrow soil materials, samples of existing soil materials, and delivery to the Testing Laboratory.
2. Samples of concrete aggregates and delivery to the Testing Laboratory.
3. Concrete mix designs as prepared by his concrete supplier or by his Testing Laboratory.
4. Concrete coring, tests of below strength concrete, and load tests, if ordered by the Owner, Architect, or Engineer.
5. Certification of reinforcing steel mill order.
6. Certification of structural steel mill order.
7. Certification of Portland cement, lime, and flyash.
8. Certification of welders.
9. Tests, samples and mock-ups of substitute material where the substitution is requested by the Contractor and the tests are necessary in the opinion of the Owner, Architect, or Engineer to establish equality with specified items.
10. Any other tests when such cost are required by the Contract Documents to be paid by the Contractor.

H. Notification of Source Change:

The Contractor shall be responsible for notifying the Owner, Architect, Engineer, and Testing Laboratory when the source of any material is changed after the original tests or inspections have been made.

I. Tests for Suspected Deficient Work:

If in the opinion of the Owner, Architect, or Engineer any of the work of the Contractor is not satisfactory, the Contractor shall make all tests that the Owner, Architect, or Engineer deem advisable to determine its proper construction. The owner shall pay all costs if the tests prove the questioned work to be satisfactory.

1.6 PAYMENT OF TESTING LABORATORY

The Owner will pay for all Laboratory services for testing of materials for compliance with the requirements of the Contract Documents. The Contractor will pay for testing and retesting of materials that do not comply with the requirements of the Contract Documents and all other items as specified in these Specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCOPE OF WORK

The work to be performed by the Testing Laboratory shall be as specified in this Section of the Specification and the contract drawings, and as determined in meetings with the Contractor, Owner, Architect, and Engineer.

3.2 EARTHWORK

A. Tests of Proposed Fill Material:

The Testing Laboratory shall conduct a survey of the Contractor's proposed location of borrow soil materials and shall establish the suitability of any proposed fill material by determining the required engineering properties. Soil tests shall include soil classification by the Atterberg Limit Tests ASTM D4138, and grain size determined by ASTM D422 "Particle Size Analysis of Soils."

B. Moisture Density Relationship for Natural and Fill Materials:

The Testing Laboratory shall provide one optimum moisture density curve for each type of soil, natural, imported fill, or on-site fill, encountered in subgrade and fills under building slabs and paved areas. Curves shall be generated in accordance with ASTM D1557 "Test Methods for Moisture Density Relationships of Soils and Soil Aggregate Mixtures."

C. Quality Control Testing Required During Construction:

1. Inspection of Subgrade and Fill:

The Owner's Testing Laboratory shall inspect and approve the following subgrades and fill layers before further construction work is performed thereon:

- a. Paved Areas and Building Slab Subgrade: Make at least one field density test of the natural subgrade for every 5000 square feet of paved area or building slab but in no case less than three tests. In each compacted fill layer or lift, make one field density test for every 5000 square feet of building slab on paved area but in no case less than three tests.

- b. Foundation Wall Backfill: Make at least one field density test for each 200 lineal feet of wall with a minimum of 4 tests for each basement wall around the perimeter of the building and a minimum of one test for every other type of foundation wall on the site. Tests shall be at random locations and elevations for each wall.

2. Field Density Tests:

Field Density Tests shall be run according to ASTM D1556 "Density of Soil in Place by the Sand Cone Method," ASTM D2167 "Density of Soil in Place by the Rubber Balloon Method" or ASTM D2922 "Density of Soil and Soil Aggregate in Place by Nuclear Methods" or ASTM D698 "Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort" as applicable, unless noted otherwise in the geotechnical investigation report prepared for this project.

3. Acceptance Criteria:

The result of field density tests by the Testing Laboratory will be considered satisfactory if the average of any three consecutive tests has a value not greater than 2 percent below the required density.

4. Report Copies:

The Testing Laboratory shall submit all moisture density curves and results of field density tests to the parties specified earlier in this section.

5. Additional Testing:

If reports by the Testing Laboratory indicate field densities lower than specified above, additional tests will be run by the Testing Laboratory with at least the frequencies scheduled above on recompacted fill and/or natural subgrade. The Testing Laboratory shall notify the Contractor on a timely basis for any required retesting so as not to delay the work. The costs of such tests shall be borne by the Contractor.

3.3 REINFORCING STEEL

A. Visual Inspection:

The Testing Laboratory shall inspect the rebar to determine the following:

- 1. The bars shall be free from injurious defects and shall have a workman-like finish.
- 2. Deformations shall be of the proper sizes, shapes, and spacing as detailed in ASTM A-615.
- 3. The bars shall not have excessive rust and/or pelting.

4. The bars shall not have any unusual twists or bends.

B. Identified Stock:

Where job material is taken from bundles as delivered from the mill, is properly identified as to heat number and is accompanied by mill and analysis test reports, provided an affidavit is given from the Supplier to the Testing Laboratory that the materials conform with the requirements of the ASTM specification as listed on the structural drawings. In case of controversy, the procedure as stipulated below for unidentified stock shall be followed.

C. Unidentified Stock:

For all unidentified stock, the Testing Laboratory shall secure samples of the reinforcing steel bars at the time of inspection. The samples shall confirm to the following:

1. The sample shall include 2 bars for each ten tons or fraction thereof, of each bar size, heat number, and manufacturer being shipped.
2. The sample bars shall be a minimum of 24 inches in length and should be identical to the material being shipped.

The Testing Laboratory shall tag each of the steel bundles with the Laboratory identification tag and appropriately mark the samples corresponding to the steel being inspected and shipped. The fabricator will supply shipping lists showing the weight of each bar size in the shipment.

3.4 CONCRETE MATERIALS AND POURED IN PLACE CONCRETE

A. Tests of Portland Cement:

Portland Cement shall be tested by the Testing Laboratory for compliance with the requirements of ASTM C150.

1. Mill Certificates:

Mill certificates certifying that the cement has been tested and meets the requirements of the Specifications will be acceptable as test results, provided the cement proposed for use can be identified with test lots. Mill certificates shall be submitted by the Contractor prior to use of any such material.

2. Retesting:

Retesting of cement will be required if:

- a. In the opinion of the Owner, Architect, or Engineer, the cement has been damaged in storage or transit or is any way defective.

- b. The cement has been in storage at the mixing site for over 30 days.

B. Test of Aggregates:

- 1. The Contractor's Testing Laboratory shall verify that concrete aggregates proposed for use conform to the following specification:
 - a. ASTM C33 "Specification for Concrete Aggregates"

Suppliers record of tests run on the proposed materials will be adequate provided a written affidavit is furnished as a shop drawing submittal.

C. Concrete Mix Designs:

The Contractor shall submit for approval by the Engineer and Testing Laboratory at least 15 days prior to the start of construction, concrete mix designs for each class of concrete indicated on the structural drawings and in the Specifications. The Contractor shall not begin work until the applicable mix design has been approved.

- 1. The Contractor acting in conjunction with his Concrete Supplier and the Testing Laboratory shall submit in writing with his mix designs, whether the concrete is to be proportioned by either of the following methods as outlined in ACI 318:
 - a. Field Experience Method
 - b. Laboratory Trial Batch Method

When field experience methods are used to select concrete proportions, establish proportions as specified in ACI 301 and ACI 211. When Laboratory trial batches are used to select concrete proportions, the procedure as outlined in ACI 318 shall be followed. Prepare test specimens in accordance with ASTM C192 and conduct strength tests in accordance with ASTM C39.

- 2. Required types of concrete and compressive strengths shall be as indicated on the Structural Drawings and as specified in the various sections of the Specifications.
- 3. All mix designs shall state the following information:
 - a. Mix design number or code designation by which the Contractor shall order the concrete from the Supplier
 - b. Structural member for which the concrete is designed (i.e. columns, piers, etc.)
 - c. Type of concrete (normal weight).
 - d. 28 day compressive strength
 - e. Aggregate type, source, size, gradation, fineness modulus
 - f. Cement type and brand
 - g. Fly ash type and brand (if any)

- h. Admixtures including air entrainment, water reducers, accelerators, and retarders
- i. Slump
- j. Proportions of each material used
- k. Water cement ratio and maximum allowable water content
- l. Method by which the concrete is intended to be placed (bucket, chute, or pump)

4. Concrete Suppliers Record of Quality Control:

The concrete supplier's past record of quality control shall be used in the design of the concrete mixes to determine the amount by which the average concrete strength f_{cr} should exceed the specified strength f'_c as outlined in ACI 318. If a suitable record of test results is not available, the average strength must exceed the design strength by 1200 PSI as specified in ACI 318. After sufficient data becomes available from the job, the statistical methods of ACI 214 may be used to reduce the amount by which the average strength must exceed f'_c as outlined in ACI 318.

5. Admixtures:

- a. Admixtures to be used in concrete shall be subject to the approval of the Engineer and Testing Laboratory.
- b. Quantities of admixtures to be used shall be in strict accordance with the manufacturers instructions.
- c. Admixtures containing chloride ions shall not be used in concrete containing galvanized or aluminum embedments.
- d. Air entraining admixtures shall conform to "Specification for Air Entraining Admixtures for Concrete" ASTM C260.
- e. Water reducing admixtures, retarding admixtures, accelerating admixtures, water reducing and retarding admixtures, and water reducing and accelerating admixtures shall conform to "Specification for Chemical Admixtures for Concrete" ASTM C494.
- f. Fly ash or other pozzolons, used as admixtures, shall conform to "Specification for Fly Ash and Raw or Calcined Natural Pozzolons for use in Portland Cement Concrete" ASTM C618. Obtain mill test reports for approval. Maximum flyash content shall be 20%.
- g. Use amounts of admixtures as recommended by the manufacturer for climatic conditions prevailing at the time of placing. Adjust quantities of admixtures as required to maintain quality control.

6. Slump Limits:

Unless shown otherwise on the structural drawings, proportion and design mixes to result in concrete slump at the point of placement as follows:

- a. Ramps and Sloping surfaces - $3" \pm 1"$
- b. Foundation concrete - $4\text{-}1/2" \pm 1\text{-}1/2"$
- c. All other concrete - $4" \pm 1"$

When increased workability, pumpability, lower water-cement ratio, shrinkage reduction, or permeability reduction is required, then a superplasticizer admixture shall be considered for use. The maximum slump with the use of superplasticizers shall be 8 inches unless approved otherwise by the Architect/Engineer and Testing Laboratory.

Any deviation from these values (such as concrete design to be pumped) shall be submitted to the Engineer and Testing Laboratory for approval.

7. Adjustments of Concrete Mixes:

Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Such mix design adjustments shall be provided at no additional cost to the Owner. Any adjustments in approved mix designs including changes in admixtures shall be submitted in writing to the Engineer and Testing Laboratory for approval prior to field use.

8. Shrinkage:

All concrete shall be proportioned for a maximum allowable unit shrinkage of 0.03% at 28 days as determined by ASTM C 157.

9. Chloride Ion Content:

A written submittal shall be made with each mix design proposed for use on the project that the chloride ion content from all ingredients including admixtures will not exceed the limits specified in the Cast-In-Place section of the Specifications.

D. Concrete Test Cylinders by the Testing Laboratory:

1. Molding and Testing:

Cylinders for strength tests shall be molded and Laboratory cured in accordance with ASTM C31 "Method of Making and Curing Concrete Test Cylinders in the Field" and tested in accordance with ASTM C39 "Method of Testing for Compressive Strength of Cylindrical Concrete Specimens".

2. Field Samples:

Field samples for strength tests shall be taken in accordance with ASTM C172 "Method of Sampling Fresh Concrete".

3. Frequency of Testing:

Each set of test cylinders shall consist of a minimum of four standard test cylinders. A set of test cylinders shall be made according to the following frequency guidelines:

- a. One set for each class of concrete taken not less than once a day.
- b. Mat Foundation: One set for each 250 cubic yards or fraction thereof.
- c. All Other Concrete: A minimum of one set for each 150 cubic yards or fraction thereof.
- d. No more than one set of cylinders at a time shall be made from any single truck.
- e. If the total volume of concrete is such that the frequency of testing as specified above would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.
- f. Frequencies assume one batch plant will be used for each pour. If more than one batch plant is used, the frequencies cited above shall apply for each plant used.

The cylinders shall be numbered, dated, and the point of concrete placement in the building recorded. Of the four cylinders per set break one at seven days, two at 28 days, and one automatically at 56 days only if either 28 day cylinder break is below required strength.

4. Cylinder Storage Box:

The Contractor shall be responsible for providing a protected concrete cylinder storage box at a point on the jobsite mutually agreeable with the Testing Laboratory for the purpose of storing concrete cylinders until they are transported to the Laboratory.

5. Transporting Cylinders:

The Testing Laboratory shall be responsible for transporting the cylinders to the Laboratory in a protected environment such that no damage or ill effect will occur to the concrete cylinders.

6. Information on Concrete Test Reports:

The Testing Laboratory shall make and distribute concrete test reports after each job cylinder is broken. Such reports shall contain the following information:

- a. Truck number and ticket number
- b. Concrete Batch Plant
- c. Mix design number
- d. Accurate location of pour in the structure
- e. Strength requirement
- f. Date cylinders made and broken
- g. Technician making cylinders
- h. Concrete temperature at placing
- i. Air temperature at point of placement in the structure
- j. Amount of water added to the truck at the batch plant and at the site and whether it exceeds the amount allowed by the mix design
- k. Slump
- l. Unit weight
- m. Air content
- n. Cylinder compressive strengths with type of failure if concrete does not meet Specification requirements. Seven day breaks are to be flagged if they are less than 60% of the required 28 day strength. 28 day breaks are to be flagged if either cylinder fails to meet Specification requirements.

E. Other Required Tests of Concrete by the Testing Laboratory (unless noted otherwise):

- 1. Slump Tests:
Slump Tests (ASTM C143) shall be made at the beginning of concrete placement for each batch plant and for each set of test cylinders made.
- 2. Air Entrainment:
Air entrainment (ASTM C233) tests shall be made at the same time slump tests are made as cited above.
- 3. Concrete Temperature:
Concrete temperature at placement shall be measured at the same time slump tests are made as cited above.
- 4. Chloride Ions:

The Contractor shall have the laboratory verify in a written submittal with the mix designs that the chloride ion concentration will not exceed the limits specified.

Tests shall be run for each class of concrete according to AASHTO Designation T 260-82 Sampling and Testing for Total Chloride Ion in Concrete and Concrete Raw Materials to determine that the maximum chloride ion content does not exceed the limits stated in the concrete section of the specifications. One test shall be run for each set of cylinders specified to be taken for each class of concrete.

F. Evaluation and Acceptance of Concrete:

- 1. Strength Test:

A strength test shall be defined as the average strength of two 28 day cylinder breaks from each set of cylinders.

2. Quality Control Charts and Logs:

The Testing Laboratory shall keep the following quality control logs and charts for each class of concrete containing more than 2,000 cubic yards. The records shall be kept for each batch plant and submitted on a weekly basis with cylinder test reports:

- a. Number of 28 day strength tests made to date.
- b. 28 day strength test results containing the average of all strength tests to date, the high test result, the low test result, the standard deviation, and the coefficient of variation.
- c. Number of tests under specified 28 day strength.
- d. A histogram plotting the number of 28 day cylinders versus compressive strength.
- e. Quality control chart plotting compressive strength test results for each test.
- f. Quality control chart plotting moving average for strength where each point plotted is the average strength of three previous test results.
- g. Quality control chart plotting moving average for range where each point plotted is the average of 10 previous ranges.

3. Acceptance Criteria:

The strength level of an individual class of concrete shall be considered satisfactory if both of the following requirements are met:

- a. The average of all sets of three consecutive strength tests equal or exceed the required f'c.
- b. No individual strength test (average of two 28 day cylinder breaks) falls below the required f'c by more than 500 PSI.

If either of the above requirements is not met, the Testing Laboratory shall immediately notify the Engineer by telephone. Steps shall immediately be taken to increase the average of subsequent strength tests.

G. Investigation of Low Strength Concrete Test Results:

1. Contractor Responsibility for Low Strength Concrete:

If any strength test of Laboratory cured cylinders falls below the required f'c by more than 500 psi, the Contractor shall take steps immediately to assure that the load carrying capacity of the structure is not jeopardized.

2. Nondestructive Field Tests:

The Testing Laboratory shall under the direction of the Engineer perform nondestructive field tests of the concrete in question using Swiss Hammer, Windsor Probe, or other appropriate methods as approved by the Engineer and report the results in the same manner as for cylinder test reports.

3. Core Tests:

If the likelihood of low strength concrete is confirmed and computations indicate that the load carrying capacity of the structure has been significantly reduced, tests of cores by the Testing Laboratory, drilled from the area in question under the direction of the Engineer, will be required in accordance with ASTM C42 "Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete". In such case, three cores shall be taken for each strength test more than 500 PSI below required f'_c . If concrete in the structure will be dry under service conditions, cores shall be air dried (temperature 60° to 80°F, relative humidity less than 60 percent) for 7 days before test and shall be tested dry. If concrete in the structure will be more than superficially wet under service conditions, cores shall be immersed in water for at least 48 hours and tested wet. The Contractor shall fill all holes made by drilling cores with an approved drypack concrete.

4. Acceptance Criteria for Core Tests:

Concrete in an area represented by core tests shall be considered structurally adequate if the average of three cores is equal to at least 85% of f'_c and if no single core is less than 75% of f'_c . If approved by the Engineer, locations of erratic core strengths may be retested to check testing accuracy.

5. Load Test:

If the above criteria are not met and the structural adequacy remains in doubt, the Engineer may order a load test as specified in ACI 318 for the questionable portion of the structure.

6. Strengthening of the Structure or Demolition:

If the structural adequacy of the affected portion of the structure remains in doubt, the Engineer may order the structure to be strengthened by an appropriate means or demolished and rebuilt.

7. Cost of Investigations for Low Strength Concrete:

The costs of all investigations of low strength concrete shall be borne by the Contractor.

H. Jobsite Inspection:

The scope of the work to be performed by the inspector on the jobsite shall be as follows:

1. Verify that air temperatures at the point of placement in the structure are within acceptable limits defined above prior to ordering of concrete by the Contractor.
2. Inspect concrete upon arrival to verify that the proper concrete mix number, type of concrete, and concrete strength is being placed at the proper location.
3. Inspect plastic concrete upon arrival at the jobsite to verify proper batching. Observe mix consistency and adding of water as required to achieve target slumps in mix designs. Record the amount of water added and note if it exceeds that allowed in the mix design. The responsibility for adding water to trucks at the jobsite shall rest only with the Contractor's designated representative. The Contractor is responsible that all concrete placed in the field is in conformance to the Contract Documents.
4. Obtain concrete test cylinders.
5. Perform slump tests and air entrainment tests.
6. Record information for concrete test reports.
7. Verify that all concrete being placed meets job Specifications. Report concrete not meeting the specified requirements and immediately notify the Contractor, Batch Plant Inspector, Contractor, Architect, Engineer, and Owner.
8. Pick up and transport to Laboratory, cylinders cast the previous day.
9. Check concrete placing techniques to determine that concrete deposited is uniform and that vertical drop does not exceed six feet.
10. The jobsite inspector shall report any irregularities that occur in the concrete at the jobsite or test results to the Contractor, Architect, Owner, and Engineer.

I. Causes for Rejection of Concrete:

The Contractor shall reject all concrete delivered to the site for any of the following reasons:

1. Wrong class of concrete (incorrect mix design number).
2. Air temperature:

Air temperature limits shall be as follows:

- a. Cold Weather: Air temperature must be 40°F and rising
- b. Hot Weather: Air temperature must be cooler than 100°. Concrete may be placed at other air temperature ranges only with approval of the job inspector for the Testing Laboratory or other duly appointed representative.

3. Concrete with temperatures exceeding 95°F may not be placed in the structure.
4. Air contents outside the limits specified in the mix designs.
5. Slumps outside the limits specified in the mix designs.
6. Excessive Age:
Concrete shall be discharged within 90 minutes of plant departure or before it begins to set if sooner than 90 minutes unless approved by the Laboratory job inspector or other duly appointed representative.

The Contractor is responsible that all concrete placed in the field is in conformance to the Contract Documents.

J. Concrete Batch Trip Tickets:

All concrete batch trip tickets shall be collected and retained by the Contractor. Compressive strength, slump, air, and temperature tests shall be identified by reference to a particular trip ticket. All tickets shall contain the information specified in ASTM C 94. Each ticket shall also show the amount of water that may be added in the field for the entire batch that will not exceed the specified water cement ratio for the design mix. The Contractor and Testing Laboratory shall immediately notify the Architect/Engineer and each other of tickets not meeting the criteria specified.

3.5 STRUCTURAL STEEL

A. Contract Obligations:

1. Owner Responsibility:

The Owner shall pay for all initial field inspections and tests as required during the fabrication and erection of the structural steel.

2. Contractor Responsibility:

The Contractor shall arrange with the Testing Laboratory for the certification of all shop and field welders. Each bolting crew and welder shall be assigned an identifying symbol or mark and all shop and field connections shall be so identified so that the inspector can refer back to the person or crew performing the work. The costs of all retesting of material or workmanship not in conformance with the Contract Documents shall be borne by the Contractor. The Fabricator and Erector shall provide the Laboratory inspector with access to all places where work is being done. A minimum of 24 hours notification shall be given prior to commencement of work. The Contractor shall provide the Testing Laboratory with the following:

- a. A complete set of Architect/Engineer reviewed shop and erection drawings including all revisions and addenda.
- b. Cutting lists, order sheets, material bills, shipping bills, and mill test reports.
- c. Information as to time and place of all rollings and shipment of material to shops.
- d. Representative sample pieces requested for testing.
- e. Full and ample means and assistance for testing all material.
- f. Proper facilities, including scaffolding, temporary work platforms, hoisting facilities, etc., for inspection of the work in the mills, shop and field.

3. Testing Laboratory Responsibility:

Inspection of field work shall be completed promptly so that corrections can be made without delaying the progress of the work. Inspections shall be performed by qualified technicians with a minimum of two years experience in structural steel testing and inspection. All inspection personnel shall be certified in accordance with AWS QC-1. The Testing Laboratory shall provide test reports of all shop and field inspections. Shop test reports shall include shop welders certifications. All test reports shall indicate types and locations of all defects found during inspection, the measures required and performed to correct such defects, statements of final approval of all welding and bolting of shop and field connections, and other fabrication and erection data pertinent to the safe and proper welding and bolting of shop and field connections. In addition to the parties listed in this Specification the Fabricator and Erector shall receive copies of all test reports.

4. Rejection of Material or Workmanship:

The Owner, Architect, Engineer, and Testing Laboratory reserve the right to reject any material or workmanship not in conformance with the

Contract Documents at any time during the progress of the work. However, this provision does not allow waiving the obligation for timely, in sequence inspections.

B. Mill Tests of Structural Steel:

1. Mill Order Steel:

The Fabricator shall furnish certified mill test reports and an affidavit stating that the structural steel furnished meets the requirements of the grade specified on the structural drawings for all mill order steel. In case of controversy, test of the material according to ASTM A6 or A568 as applicable made by the Contractor's Testing Laboratory with certified test reports paid for by the Contractor shall be made to verify conformity with ASTM standards. Tests shall be made for each 10 tons of material used unless approved otherwise by the Engineer.

2. Local Stock Steel:

Materials taken from stock by a Fabricator for use for structural purposes must be of a quality at least equal to that required by the ASTM specifications applicable to the classification covering the intended use. Certified mill test reports shall be accepted as sufficient record of the quality of materials carried in stock by the fabricator provided the stock steel can be identified by heat or melt numbers. In case of controversy, tests by the Contractor's Testing Laboratory with certified reports as specified for mill order steel shall be required.

3. If tests are required, test specimens shall be taken by the Contractor under the direction of the Testing Laboratory and shall be machined by the Testing Laboratory to dimensions as required by the applicable ASTM standards.

C. Field Inspections and Tests:

The Testing Laboratory shall provide inspection in the field for a period of time as determined in consultation with the Architect, Owner, and Engineer prior to the start of erection in a timely manner so as to not delay the start of erection. The following tests and inspections shall be made:

1. Obtain the planned erection procedure, and review with the Erectors supervisory personnel.
2. Verify field welding procedures and obtain welder certificates. (Including welding of cold formed framing.)
3. Check steel as received in the field for possible shipping damage, workmanship, and piece marking.
4. Check plumbness and frame alignment as erection progresses.
5. Check joint preparation and fit up, backing strips, and runout plates for welded moment connections and column splices.
6. Check preheating to assure proper temperature, uniformity, and thoroughness through the full material thickness.
7. Review welding sequence.
8. Visually inspect all field welding for size, length, and quality.
9. Perform nondestructive examination services for various weldments of field erection determined in consultation with the Structural Engineer prior to the start of erection. The Laboratory shall furnish a qualified technician with the necessary equipment to perform radiographic, ultrasonic, magnetic particle, or dye penetrant inspection as required for the item being tested and other duties as outlined for shop inspection in the previous Section. Unless specified otherwise,

check all partial and complete penetration welds in connections of beams, girders, columns, and braces. Check 10% of connections with fillet welds. Visual inspection is required for all welds.

10. Check calibration of impact wrenches used in field bolted connections.
11. Visually inspect the welding of metal deck to the structure.
12. Perform field tests on 10% of completed shear connectors in each beam according to inspection procedures outlined in AWS D1.1

The costs of repairing all defective welds and the costs of retesting by the Testing Laboratory shall be borne by the Contractor. If removal of a backing strip is required by the Testing Laboratory to investigate a suspected weld defect, such cost shall be borne by the Contractor.

3.6 MASONRY:

A. Prism Tests

1. Scope:

Prism tests shall be made for each class of masonry (hollow masonry, grouted masonry) on the project using an assembly of actual masonry units, mortar, and grout as planned in the work.

2. Compressive Strength Test:

Test shall be run according to the requirements of ASTM E447 "Test Methods for Compressive Strength of Masonry Prisms." Each strength test shall be defined as the average of three test prisms from the same class of masonry.

3. Frequency of Testing:

- a. Interior Walls: One strength test shall be run for each 5,000 square feet of wall or fraction thereof.
- b. Exterior Walls: One strength test shall be run for each 5,000 square feet of wall area but not less than one strength test for each day's operation for each class of wall. An additional test should be run whenever there is a change in mortar or grout proportions.

B. Mortar Test:

1. Scope:

Mortar cube test shall be required only for loadbearing masonry construction (hollow or grouted) for the purpose of measuring uniformity of field batching.

2. Compressive Strength Test:

Tests shall be run according to the requirements of ASTM C780 "Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry." Each strength test shall be defined as the average of three cube specimens two inches in dimension tests at 28 days.

3. Frequency of Testing:

One strength test shall be run for each 5,000 square feet of wall but not less than one strength test for each day's operation for each class of wall. An additional test should be run whenever there is a change in mix proportions.

C. Grout Tests:

1. Scope:

Grout prism tests shall be required for all grout used in masonry construction.

2. Compressive Strength Test:

Specimens shall be 3½"x3½"x7" or 3"x3"x6" cast in molds with a flat nonabsorbent base and masonry units having the same moisture condition as those being laid forming the sides of the specimens. Specimens shall be capped according to ASTM C617 and tested according to ASTM C39. Each strength test shall be defined as the average of two 28 day prisms.

3. Frequency of Testing:

Four grout prisms shall be made for each 30 cubic yards of grout but not less than one set for each day's operation. An additional set should be made whenever the grout mix is changed. One prism shall be tested at 7 days, two at 28 days, and one at 56 days only if either 28 day test is low.

D. Experience Requirement:

Field inspection of masonry construction by the Testing Laboratory as herein described shall be performed by qualified technicians with a minimum of ten years experience in masonry testing and inspection.

E. Field Inspection Requirements:

The duties and responsibilities of the Testing Laboratory Inspector in the field shall be as follows:

1. Review and become familiar with project drawings and specifications.

2. Review all masonry materials used in the field for conformance to project specifications. This shall include masonry units, mortar, grout, portland cement, masonry cement, sand, lime, horizontal joint reinforcement, ties, masonry anchoring devices, to the structure, and control joint strips.
3. Review proper horizontal joint reinforcement size and spacing. Review size and spacing of wall ties.
4. Review proper masonry construction practices for mortar including requirements for high and low lift grouting. Check conformance with hot and cold weather construction requirements.
5. Verify proper mortar batching proportions.
6. Confirm clean outs for high lift grouting.
7. Verify construction tolerances.
8. Review and confirm installation of reinforcing steel size, spacing, and splices in all walls, lintels, pilasters, and columns.
9. Confirm number and size of dowels in the foundation to walls and columns.
10. Take mortar, grout, and prism samples as specified.

3.7 OPEN WEB STEEL JOISTS

A. Scope:

The Testing Laboratory shall perform inspection of open web steel joists in the field as herein described.

B. Obtaining Manufacturer's Product Certification:

The Testing Laboratory shall obtain product certification for open web steel joists as required by the Specifications.

C. Inspection in the Field:

The duties of Field Inspector shall be as follows:

1. Inspect joists for damage during shipment.
2. Verify proper bearing of joist supports.
3. Verify camber requirements of joists arriving in the field.
4. Confirm bridging size and location.

5. Confirm attachment of joists to supports (welding or bolting).
6. Confirm bolting of joists to supports at column lines as required by OSHA requirements.
7. Verify that no joists have been damaged during erection.

END OF SECTION 01 41 00

SECTION 03 10 00 - CONCRETE FORMWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

The work of this section includes all labor, materials and equipment required to form all cast-in-place concrete shown on the drawings including but not limited to all slabs, joists, beams, walls, stairs, and equipment pads.

1.3 CODES AND STANDARDS

Comply with the provision of the following codes, specifications and standards except where more stringent requirements are shown or specified:

- A. ACI 301 "Specifications for Structural Concrete for Buildings"
- B. ACI 318 "Building Code Requirements for Reinforced Concrete"
- C. Concrete Reinforcing Steel Institute "Reinforced Concrete, Manual of Standard Practice"
- D. ACI SP-4 "Formwork for Concrete"

In addition, all formwork shall be designed, erected, supported, braced, and maintained as a minimum according to ACI Standard 347 "Guide to Formwork".

1.4 RESPONSIBILITY

The design, construction and safety of all formwork shall be the responsibility of the General Contractor. The Contractor shall also be responsible for determining when temporary supports, shores, backshores, and other bracing may be safely removed.

PART 2 - PRODUCTS

2.1 FORMS FOR EXPOSED FINISH CONCRETE

Unless otherwise specified, formwork for exposed concrete surfaces shall consist of plywood, metal, metal framed plywood, or other acceptable surface. Formwork shall provide a continuous straight and smooth surface conforming to the joint system as specified on the Architect's drawings. Form material shall have sufficient thickness to withstand pressure of concrete without bow or deflection. Plywood shall be overlaid plywood complying with U.S. Product Standard PS-

1 "A-C or B-B High Density Overlaid Concrete Form", Class I, or plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge sealed, with each piece bearing legible inspection trademark.

REFER TO THE ARCHITECTURAL AND STRUCTURAL DRAWINGS FOR AREAS AT THE CONCRETE WALLS AND BEAMS THAT REQUIRE THE USE OF HORIZONTAL BOARD FORMS ON THE EXTERIOR EXPOSED FACES.

2.2 FORMS FOR UNEXPOSED FINISH CONCRETE

Unless otherwise specified, formwork for unexposed concrete surfaces shall be constructed with plywood, lumber, metal or other acceptable material. Lumber shall be dressed on at least two edges and one side for tight fit.

2.3 FORMWORK COATINGS

Formwork coatings shall be a commercial formulation that will not bond with, stain, nor adversely affect concrete surfaces or impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede curing with water or curing compounds. Provide a product that has a maximum VOC (Volatile Organic Compounds) of 350 mg/l but not greater than permitted by the local government agency having jurisdiction in the area where the project is located.

2.4 NAILS AND FASTENERS

Use only galvanized nails and fasteners for securing formwork in structures exposed to weather or unconditioned spaces such as garages, canopies and porte-cocheres.

PART 3 - EXECUTION

3.1 FABRICATION AND CONSTRUCTION

- A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position. Maintain formwork construction tolerances complying with ACI 347.
- B. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.
- C. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.
- E. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and patch forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.
- F. Chamfer exposed corners and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- G. Form Ties:

Factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal. Unless otherwise indicated, provide ties so portion remaining within concrete after removal is 1 1/2" inside concrete and will not leave holes larger than 1" diameter in concrete surface. Provide only galvanized form ties in structures exposed to weather or unconditioned spaces.
- H. Provisions for Other Trades:

Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

3.2 CLEANING AND TIGHTENING

Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and all other debris just prior to concrete placement. Retighten forms and bracing prior to concrete placement as required to prevent mortar leaks and maintain proper alignment.

3.3 CLEANING AND RE-USE OF FORMS

Forms reused in the work shall be repaired and cleaned. Split, frayed, delaminated, or otherwise damaged facing material will not be acceptable for exposed surfaces. Forms intended for successive concrete placement shall have surfaces cleaned, fins and laitance removed, and joints tightened to avoid surface offsets. New form coating compound shall be applied to reused forms. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.4 TOLERANCES

Unless specified otherwise, all tolerances for concrete formwork shall conform to ACI Standard 117, "Standard Tolerances for Concrete Construction and Materials". Before concrete placement the Contractor shall check lines and levels of erected formwork and make any corrections and adjustments as required to ensure proper size and location of concrete members and stability of forming systems. During concrete placement the Contractor shall check formwork and supports to ensure that forms have not displaced and that completed work will be within specified tolerances.

3.5 SHORES AND SUPPORTS

A. Definitions

1. Shores: Vertical or inclined support members designed to carry the weight of formwork, concrete, and construction loads above.
2. Reshores: Shores placed snugly under a stripped concrete structural member after the original forms and shores have been removed from the member, thus requiring the member to carry its own weight and superimposed construction loads at the time of installation. Reshores are assumed to carry no load at the time of installation. After the installation of reshores, superimposed construction loads are assumed to be distributed among all members connected by reshores.
3. Backshores: Shores placed snugly under a stripped concrete structural member after the original formwork and shores have been removed from a small area without allowing the structural member to deflect or support its own weight or superimposed construction loads. It is assumed that backshores carry the same load as that carried by the original shores they replace.

Comply with ACI 347 for shoring, reshoring and backshoring in concrete construction and as herein specified where more stringent:

B. Structures with Three Supported Levels or Less:

Extend shoring from soil supported slab or suitable subgrade to uppermost level for structures with three structurally supported levels or less.

3.6 REMOVAL OF FORMS AND SUPPORTS

A. Curing and Stripping Concrete Cylinders:

The General Contractor shall be responsible for making and curing stripping concrete cylinders, cured under field conditions, for the purpose of determining concrete strength at time of form and shore removal. Such cylinders shall be made by the Contractor and tested by his testing laboratory.

B. Formwork Not Supporting Concrete:

Formwork not supporting concrete such as sides of beams, walls, columns and similar parts of the structure, may be removed after cumulatively (not necessarily consecutively) curing at not less than 50°F for 12 hours after placing concrete, provided the concrete is sufficiently hard so as not to be damaged by form removal operations and provided curing and protection operations are maintained. If ambient air temperatures remain below 50°F or if retarding agents are used, then this specified minimum period should be increased as required to safely remove the forms without damage to the concrete. Where such forms also support formwork for slab or beam soffits, the removal times of the latter shall govern.

END OF SECTION 03 10 00

SECTION 03 20 00 - CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

The work of this section includes labor, materials, hardware, equipment, transportation and services required to fabricate and place all reinforcement for cast-in-place concrete including bars, welded wire fabric, ties and supports shown on the drawings and as specified.

1.3 QUALITY ASSURANCE

A. Codes and Standards:

Comply with all provisions of the following codes, specifications and standards except where more stringent requirements are shown or specified:

1. ACI 315, "ACI Manual of Standard Practice for Detailing Reinforced Concrete Structures".
2. ACI 318, "Building Code Requirements for Reinforced Concrete."
3. Concrete Reinforcing Steel Institute, "Reinforced Concrete, Manual of Standard Practice".
4. Concrete Reinforcing Steel Institute, "Placing Reinforcing Bars."

1.4 SHOP DRAWINGS

- A. Shop drawings and samples for all reinforcing steel and related accessories shall be submitted for the Engineer's approval.
- B. Shop Drawings shall show layout, bending and assembly diagrams, bar schedules, stirrup spacing, splicing and laps of bars and shall be prepared in accordance with ACI 315.

1.5 TESTING AND INSPECTION

Perform all tests and inspections specified in Laboratory Testing Section of these specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcement:

1. Reinforcing Steel:

All reinforcing steel shall conform to the "Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement," ASTM A615 Grade 60 unless noted otherwise on the drawings. All reinforcing steel required to be welded shall conform to ASTM A 706 "Standard Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement".

2. Tie Wire:

Tie wire shall be annealed steel tie wire, minimum 16 gauge. Provide only plastic coated or stainless steel tie wire in exposed concrete structures and all architectural concrete.

B. Supports for Reinforcement:

Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations.

1. Slabs-on-Grade:

Use supports with sand plates or horizontal runners.

2.2 SPLICES

A. Splice Type and Lap Lengths:

Required splice type and lap lengths are defined on the drawings. Lap splice lengths for unscheduled bars not shown otherwise on the drawings shall be 40 bar diameters minimum.

PART 3 - EXECUTION

3.1 FABRICATION AND DELIVERY

A. Bending and Forming:

Fabricate bars of indicated sizes and accurately form to shapes and lengths indicated and required, by methods not injurious to materials. Do not heat reinforcement for bending. Bars with kinks or bends not scheduled will be rejected.

B. Marking and Shipping:

Bundle reinforcement and tag with suitable identification to facilitate sorting and placing. Transport and store at site so as not to damage material. Keep sufficient supply of tested, approved and proper reinforcement at the site to avoid delays. Maintain reinforcing bars free of mud, dirt, grease, or other coating.

3.2 PLACING REINFORCEMENT

- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports and as herein specified.
- B. Before placing and again before concrete is placed, clean reinforcement of loose rust and mill scale, earth, ice and other materials which reduce or destroy bond with concrete.
- C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required. Exercise particular care to maintain proper distance and clearance between parallel bars and between bars and forms. Provide metal spreaders and spacers to hold steel in position. Support steel at proper height upon approved chairs.
- D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- E. Coordinate with other trades and expedite materials and labor to avoid omissions and delay.
- F. Install waterproof membrane or moisture barrier as specified prior to placing steel for concrete slabs-on-grade.
- G. Extend reinforcement continuous through construction joints or, if approved on the shop drawings, provide dowels of sufficient length to develop the full tension or compression strength of the bar as applicable.
- H. Provide and place additional reinforcing steel at all sleeves and openings in beams, slabs and walls as specified on the drawings. Where reinforcement is interrupted by sleeves or openings not shown on the drawings, consult with Engineer for instructions for placing and splicing of bars. Provide required additional reinforcing steel at no additional cost to the Owners.

3.3 REINFORCING STEEL SPACING AND COVERAGE

A. Reinforcing Steel Coverage

Reinforcing steel coverage should conform to the requirements specified in the General Notes. Cover specified shall be considered minimums that may require increasing where reinforcing steel intersects for different member types. Cover in structural members not specified in the General Notes shall conform to the requirements of ACI 318-08 Section 7.7 unless specified otherwise on the drawings.

B. Reinforcing Steel Spacing:

The clear distance between parallel bars in a layer shall be not less than the bar diameter nor 1". Where parallel reinforcement is placed in 2 or more layers, bars in the upper layer shall be placed directly above bars in the lower layer with clear distance between layers of not less than 1".

3.4 SPLICING REINFORCING STEEL

A. All lap splices in reinforcing steel shall be contact lap splices unless detailed otherwise on the drawings.

B. Maintain proper cover between reinforcing bars at splices.

C. Lap unscheduled reinforcing bars not otherwise specified a minimum of 40 bar diameters at splices. Lap welded wire fabric a minimum of one full wire mesh plus two inches.

3.5 SHRINKAGE AND TEMPERATURE REINFORCEMENT

Provide shrinkage and temperature reinforcement at right angles to main top and bottom bars for all structural slabs unless detailed otherwise on the drawings. See drawings for sizes and spacings.

3.6 MECHANICAL AND PLUMBING REQUIREMENTS

Refer to Mechanical and Plumbing Drawings for formed concrete requiring reinforcing steel. Such reinforcement shall be furnished as part of the work of this section.

3.7 QUALITY CONTROL TESTING DURING CONSTRUCTION

See Testing Laboratory Services section of these specifications for concrete reinforcement inspection and test requirements.

END OF SECTION 03 20 00

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

- A. Extent of concrete work is shown on drawings, including schedules, notes and details which show size and location of members and type of concrete to be poured. Furnish all labor, materials, services, equipment and hardware required in conjunction with or related to the forming, delivery and pouring of all poured-in-place concrete work.
- B. Architectural Concrete is specified in other Division-3 sections.

1.3 QUALITY ASSURANCE

The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

- A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:
 - 1. ACI 301 - "Specifications for Structural Concrete for Buildings".
 - 2. ACI 302 - "Guide for Concrete Floor and Slab Construction".
 - 3. ACI 304 - "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".
 - 4. ACI 305 - "Recommended Practice for Hot Weather Concreting".
 - 5. ACI 306 - "Recommended Practice for Cold Weather Concreting".
 - 6. ACI 318 - "Building Code Requirements for Reinforced Concrete".
- B. Document Precedence: In case of conflict among documents, including architectural and structural drawings and specifications, notify the Architect prior to submitting proposal. In case of conflict between the structural drawings and specifications, the strictest interpretation shall govern.
- C. Materials and installed work may require testing and retesting, as directed by the Architect/Engineer, at any time during progress of work. Allow free access to material stockpiles and facilities. Tests, not specifically indicated to be done at the Owner's expense, including retesting of rejected materials and installed work, shall be done at the Contractor's expense. See Testing Laboratory section of the Specifications.

Inspection or testing by the Owner does not relieve the Contractor of his responsibility to perform the Work in accordance with the Contract Documents.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items, including admixtures, patching compounds, epoxies, grouts, waterstops, joint systems, curing compounds, dry-shake finish materials, hardeners, sealers and others as requested by Architect/Engineer.
- B. Samples: Submit samples of materials specified if requested by Architect/ Engineer, including names, sources and descriptions.
- C. Laboratory Test Reports and Mix Designs: Submit laboratory test reports for concrete materials and mix designs as specified in the Testing Laboratory section of the Specifications.
- D. Material and Mill Certificates: Provide material and mill certificates as specified herein and in the Testing Laboratory section of the Specifications. Material and mill certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.
- E. Construction Joints: There shall be no construction joints for slab on grade, structural floors or columns where they are not indicated on the drawings.

1.5 PROVISION FOR OTHER WORK

Provide for installation of inserts, hangers, metal ties, anchors, bolts, angle guards, dowels, thimbles, slots, nailing strips, blocking, grounds and other fastening devices required for attachment of work. Properly locate in cooperation with other trades and secure in position before concrete is poured. Do not install sleeves in any concrete slabs, beams or columns except where shown on the drawings or upon written approval of the Architect/Engineer.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

Refer to the drawings for classes and strengths of concrete required.

- A. Portland Cement:
ANSI/ASTM C 150, Type I or Type III, unless otherwise approved by the Architect/Engineer.

Use one brand of cement, for each class of concrete, throughout the project, unless approved otherwise by the Architect/Engineer and the Testing Laboratory.
- B. Normal Weight Aggregates: ANSI/ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.
- C. Water: Clean, fresh, drinkable, free of oils, acids or organic matter.

- D. Air-Entraining Admixture: ANSI/ASTM C 260. Provide air entrainment in all concrete used for vehicular traffic and parking or concrete permanently exposed to the weather as specified in Table 4.5.1 of ACI 318. Submit manufacturer's certification that product conforms to the requirements specified.
- E. Water-Reducing Admixture: ANSI/ASTM C 494, Type A. See maximum permissible chloride ion content in concrete specified below. Submit manufacturer's certification that product conforms to the requirements specified.
- F. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G. See maximum permissible chloride ion content in concrete specified below. Submit manufacturer's certification that product conforms to the requirements specified.
- G. Water-Reducing, Accelerator Admixture (Non-Corrosive, Non-Chloride): ASTM C 494, Type C or E. See maximum permissible chloride ion content in concrete specified below. Submit manufacturer's certification that product conforms to the requirements specified.
- H. Water-Reducing, Retarding Admixture: ASTM C 494, Type D. See maximum permissible chloride ion content in concrete specified below. Submit manufacturer's certification that product conforms to the requirements specified.
- I. Specification for Pozzolan Admixtures: Fly ash or other pozzolans used as admixtures may be used provided they conform to "Specification for Fly Ash and/or Calcined Natural Pozzolans for Use in Portland Cement Concrete", ASTM C 618 Class C or F. Fly ash replacement of cement shall not exceed 20% (one part fly ash max. to four parts cement) by weight. Fly ash may not be used in architecturally exposed concrete. Submit manufacturer's certification that product conforms to the requirements specified.
- J. Admixtures containing Chloride Ions: Admixtures containing chloride ions shall not be used in concrete containing galvanized or aluminum embedments, concrete containing high early strength cement (Type III), or concrete exposed to sulfate containing solutions such as soils with a water soluble sulfate content more than 0.20 percent by weight and all water with a sulfate content more than 1500 parts per million. Admixtures containing more than 0.05% chloride ions shall not be permitted. The maximum chloride ion content in concrete for corrosion protection shall be as follows:

	Max. Water Soluble Chloride Ion in Concrete at 28 Days, % by weight
Type of Member of Cement Reinforced Concrete and other structures, which may be exposed to chloride in service	0.15
Reinforced Concrete in buildings and other structures that will be dry or protected from moisture in service	1.00

All other reinforced concrete
construction

0.30

The Contractor shall have the Concrete Supplier verify in a written submittal to the Architect/Engineer and Testing Laboratory that the chloride ion content in all concrete mix designs used on the project will not exceed limits stated above.

- K. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions are not permitted.
- L. Certification: Written conformance to the above mentioned requirements and the chloride ion content of the admixture will be required from the admixture manufacturer prior to mix design review by the Engineer.

2.2 RELATED MATERIALS

- A. Waterstops: Provide waterstops at all construction joints and other joints in all foundation walls below grade and where shown on the drawings. Size to suit joints.
 - 1. Rubber waterstops: Corps of Engineers CRD-C 513.
 - 2. Polyvinyl chloride (PVC) waterstops: Corps of Engineers CRD-C 572.
 - 3. Preformed Plastic Waterstops: Federal Specifications SS-S-210A "Sealing Compound for Expansion Joints".
- B. Moisture Barrier: Provide moisture barrier cover over prepared base material where indicated. Use only materials, which are resistant to decay when tested in accordance with ANSI/ASTM E 154.
- C. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.
- D. Moisture-Retaining Cover: Complying with ANSI/ASTM C 171:
- E. Non-slip Aggregate Finish: Provide fused aluminum oxide grits, or crushed emery, as abrasive aggregate for non-slip finish with emery aggregate containing not less than 40% aluminum oxide and not less than 25% ferric oxide. Use material that is factory-graded, packaged, rust-proof and non-glazing, and is unaffected by freezing, moisture and cleaning materials.
- F. Colored Wear-Resistant Finish: Packaged, dry, combination of materials, consisting of portland cement, graded quartz aggregate, coloring pigments (if required) and plasticizing admixtures. Use coloring pigments that are finely ground, non-fading mineral oxides, interground with cement. Color, as selected by Architect, unless otherwise indicated. Submit manufacturer's certification that product conforms to the requirements specified.

- G. Liquid Membrane-Forming Curing Compound:
Liquid type membrane forming curing compound complying with ANSI/ASTM C 309, Type I, Class A unless otherwise acceptable to the Architect/Engineer.
Submit manufacturer's certification that product conforms to the requirements specified.
- H. Chemical Curing/Floor Hardener Compound: A clear liquid chemically acting compound of sodium silicate that performs as a curing agent with a penetrating compound that changes the free lime in the concrete to calcium silicate, resulting in a surface having a maximum abrasion coefficient of $0.25 \text{ cm}^3/\text{cm}^2$ when tested in accordance with ASTM C 118. Submit manufacturer's certification that product conforms to the requirements specified.
- I. Chemical Hardener: Colorless aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent, containing not less than 2 lb. of fluosilicates per gal. Submit manufacturer's certification that product conforms to the requirements specified.
- J. Bonding Compound: Polyvinyl acetate or acrylic base, rewettable type for use in cosmetic nonstructural repairs.
- K. Epoxy Products: Two component material suitable for use on dry or damp surface, complying with ASTM C 881, for use in all structural concrete repairs.
- L. Self-Leveling Mortars for Slab Fill Repair:
- M. Expansion Bolts in Concrete:
 - 1. ICBO Approval: Only concrete anchors approved by the International Conference of Building Officials (ICBO) with a published Research Report shall be approved for use.
 - 2. Type: All expansion bolts in concrete shall be only wedge type expansion bolts.
 - 3. Interior Use: All expansion bolts, nuts and washers for use in interior conditioned environments free of potential moisture shall be manufactured from carbon steel zinc plated in accordance with Federal Specification QQ-Z-325C, Type II, Class 3.
 - 4. Exterior or Exposed Use: All expansion bolts, nuts and washers for use in exposed or potentially wet environments, or for attachment of exterior cladding materials shall be galvanized or stainless steel. Galvanized bolts, nuts and washers shall conform to ASTM A 153. Stainless steel bolts shall be manufactured from 300 series stainless steel and nuts and washers from 300 series or Type 18-8 stainless steel.
 - 5. Nuts and Washers: Nuts and washers shall be furnished from the manufacturer and used with the bolts.

N. Non-Shrink Grout:

1. Type: Grout for base plates and bearing plates shall be a non-metallic, shrinkage resistant, premixed, non-corrosive, non-staining product containing Portland cement, silica sands, shrinkage compensating agents and fluidity improving compounds.
2. Specifications: Non-shrink grout shall conform to Corps of Engineers Specification for Non-Shrink Grout, CRD-C621-83.
3. Compressive Strength: Twenty-eight day compressive strength as determined by grout cube tests, shall be:
 - a. 6,000 PSI for supporting concrete 3000 psi and less.
 - b. 8,000 PSI for supporting concrete greater than 3000 psi and less than or equal to 4000 psi.
 - c. 10,000 PSI for supporting concrete greater than 4000 psi.

2.3 PROPORTIONING AND DESIGN OF MIXES

- A. Refer to Testing Laboratory section of the Specifications.

2.4 CONCRETE MIXES

- A. Ready-Mix Concrete:
Comply with requirements of ANSI/ASTM C 94, "Ready Mixed Concrete" and Testing Laboratory section of the specifications.

PART 3 - EXECUTION

3.1 JOINTS IN CONCRETE

- A. Construction Joints: Locate and install construction joints as indicated on the drawings or if not shown on drawings, located so as not to impair strength and appearance of the structure, as acceptable to Architect/Engineer.
1. Place construction joints in the center one third of spans unless specified otherwise. Continue reinforcement across construction joints. Submit construction joint locations not shown on the drawings for Engineer's approval.
 2. Waterstops: Provide waterstops in construction joints as indicated on the Architectural and Structural Drawings. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions.

3.2 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto.
- B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.3 PREPARATION OF FORM SURFACES

- A. Clean reused forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.
- B. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.
- C. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

3.4 CONCRETE PLACEMENT

- A. Preplacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.
- B. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.
- C. Comply with ACI 304, Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete, and as herein specified.
 - 1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
 - 2. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where

placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

3. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309 recommended practices.
4. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
5. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
6. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
7. Bring slab surfaces to correct level with straightedge and strikeoff. Use highway straightedges, bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
8. Maintain reinforcing in proper position during concrete placement operations.

3.5 FINISH OF FORMED SURFACES

- A. Rough Form Finish: Provide rough form finish for formed concrete surfaces not exposed-to-view in the finish work unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.
- B. Smooth Form Finish: Provide smooth form finish for formed concrete surfaces exposed-to-view or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.
- C. Smooth Rubbed Finish: Provide smooth rubbed finish to scheduled concrete surfaces, which have received smooth form finish treatment, not later than one day after form removal. Moisten concrete surfaces and rub with carborundum brick or other abrasive

until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

- D. Grout Cleaned Finish: Provide grout cleaned finish to scheduled concrete surfaces, which have received smooth form finish treatment.
 - 1. Combine one part portland cement to 1-1/2 parts fine sand by volume, and mix with water to consistency of thick paint. Proprietary additives may be used at Contractor's option. Blend standard portland cement and white portland cement, amounts determined by trial patches, so that final color of dry grout will closely match adjacent surfaces.
 - 2. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.
- E. Related Unformed Surfaces: At tops of walls, horizontal offsets surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.6 MONOLITHIC SLAB FINISHES

- A. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo and other bonded applied cementitious finish flooring material, and as otherwise indicated. After placing slabs, plane surface to tolerance specified below. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms or rakes.
- B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated. After screeding, consolidating and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance as specified below. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- C. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint or other thinfilm finish coating system. After floating, begin first trowel finish operation using power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with a level

surface to a tolerance as specified below. Grind smooth surface defects, which would telegraph through applied floor covering system.

- D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified above, then immediately follow with slightly scarifying surface by fine brooming.
- E. Non-Slip Broom Finish: Apply non-slip broom finish to ramps less than 6% exterior concrete platforms, steps and elsewhere as indicated. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
- F. Rake Finish: Provide a rake finish to all ramps exceeding a 6% slope. Finish shall be applied perpendicular to direction of traffic.
- G. Chemical-Hardener Finish: Apply chemical-hardener finish to interior concrete floors where indicated. Apply liquid chemical-hardener after complete curing and drying of the concrete surface. Dilute liquid hardener with water (parts of hardener/water as follows), and apply in 3 coats; first coat, 1/3-strength; second coat, 1/2-strength; third coat, 2/3-strength. Evenly apply each coat and allow 24 hours for drying between coats.

Apply proprietary chemical hardeners, in accordance with manufacturer's printed instructions. After final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

- H. Non-slip Aggregate Finish: Apply non-slip aggregate finish to concrete stair treads, platforms, ramps and elsewhere as indicated on the Architect's or Structural Drawings.

After completion of float finishing, and before starting trowel finish, uniformly spread 25 lb. of dampened non-slip aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified.

After curing, lightly work surface with a steel wire brush, or an abrasive stone, and water to expose non-slip aggregate.

- I. Colored Wear-Resistant Finish: Provide colored wear-resistant finish to monolithic slab surface indicated.

Apply dry shake materials for colored wear-resistant finish at rate of not less than 60 lbs. per 100 sq. ft., unless greater amount is recommended by material manufacturer. Immediately following first floating operation, uniformly distribute approximately 2/3 of required weight of dry shake material over concrete surface, and embed by means of power floating. Follow floating operation with second shake application, uniformly distributing remainder of dry shake material at right angles to first application, and embed by power floating.

After completion of broadcasting and floating, apply trowel finish as herein specified. Cure slab surface with curing compound recommended by dry shake hardener manufacturer, waiting up to time period as required by the manufacturer (depending on humidity and drying) before application. Do not use moisture-cover or moisture curing methods.

3.7 CONCRETE FINISH MEASUREMENT AND TOLERANCES

A. Definitions:

1. Flatness - A measure of a concrete surfaces curvature or deviation from a planar surface. Concrete surfaces that are not flat are wavy or bumpy.
2. Levelness - A measure of a concrete surfaces tilt or inclination from a horizontal plane. Concrete surfaces that are not level are sloped or tilted.

B. Construction Requirements to Achieve Specified Floor Finish Tolerances:

1. Forms shall be properly leveled, in good condition and securely anchored including special attention to ends and transitions.
2. Bearing surfaces for straightedges such as form edges or previously poured slabs shall be kept clean of laitance, sand, gravel, or other foreign elements.
3. Screeds shall be maintained in good condition with true round rolling wheels and level cutting edges. The use of optical sighting equipment such as lasers is recommended for checking levelness and straightness. The Contractor shall promptly adjust or replace equipment when test results indicate substandard work.

C. Concrete Floor Finish Tolerance for Slab-on-Grade Construction:

1. Concrete Placement: Concrete shall be placed and screeded to predetermined marks set to elevations prescribed on the drawings.
2. Tolerance: Finished floor elevation shall not vary more than $\frac{1}{4}$ inch in 10 feet, non cumulative.

D. Remedial Measures for Slab Finish Construction Not Meeting Specified Tolerances:

1. Modification of Existing Surface:
 - a. If, in the opinion of the Architect/Engineer or Owner's Representative, all or any portion of the substandard work can be repaired without sacrifice to the appearance or serviceability of the area, then the Contractor shall immediately undertake the approved repair method.
 - b. The Contractor shall submit for review and approval a detailed work plan of the proposed repair showing areas to be repaired, method of repair and time to effect the repair.

- c. Repair method(s), at the sole discretion of the Architect/Engineer or Owner's Representative, may include grinding (floor stoning), planing, retopping with self leveling grout or polymer concrete, or any combination of the above.
- d. The Architect/Engineer or Owner's Representative maintains the right to require a test repair section using the approved method of repair for review and approval to demonstrate a satisfactory end product. If, in the opinion of the Architect/Engineer or Owner's Representative, the repair is not satisfactory an alternate method of repair shall be submitted or the defective area shall be replaced.
- e. The judgment of the Architect/Engineer or Owner's Representative on the appropriateness of a repair method and its ability to achieve the desired end product shall be final.
- f. All repair work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.

2. Removal and Replacement:

- a. If, in the opinion of the Architect/Engineer or Owner's Representative, all or any portion of the substandard work cannot be satisfactorily repaired without sacrifice to the appearance or serviceability of the area, then the Contractor shall immediately commence to remove and replace the defective work.
- b. Replacement section boundaries shall be made to coincide with the test section boundaries as previously defined.
- c. Sections requiring replacement shall be removed by sawcutting along the section boundary lines to provide a neat clean joint between new replacement floor and existing floor.
- d. The new section shall be reinforced the same as the removed section and doweled into the existing floor as required by the Engineer. No existing removed reinforcing steel may be used. All reinforcing steel shall be new steel.
- e. Replacement sections may be retested for compliance at the discretion of the Architect/Engineer or Owner's Representative.
- f. The judgment of the Architect/Engineer or Owner's Representative on the need for replacement shall be final.
- g. All replacement work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.

3.8 CONCRETE CURING AND PROTECTION

A. General:

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Maintain concrete with minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of concrete.
2. Curing shall commence as soon as free water has disappeared from the concrete surface after placing and finishing. The curing period shall be 7 days for all concrete except high early strength concrete, which shall be cured for 3 days minimum, unless test cylinders, made and kept adjacent to the structure and cured by the same methods, are tested with the average compressive strength equal to 70% of the specified 28 day strength. Curing may also be terminated when the temperature of the concrete is maintained at least 50°F for the same length of time that laboratory cured cylinders, representative of the concrete in place, require to achieve 85% of the 28 day compressive strength.
3. Curing shall be in accordance with ACI 301 procedures. Avoid rapid drying at the end of the curing period.

B. Curing Methods: Perform curing of all concrete horizontal and vertical surfaces (including columns, shear walls and basement walls) by one of the methods specified or by combinations thereof, as herein specified. The Contractor shall choose a curing method that is compatible with the requirements for subsequent material usage on the concrete surface. Parking garages shall be cured using only methods 1 or 2 below.

1. Provide moisture curing by one of the following methods:
 - a. Keep concrete surface continuously wet by covering with water.
 - b. Continuous water-fog spray.
 - c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
2. Provide moisture-cover curing as follows: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Provide curing/hardener or liquid membrane forming curing compound to interior slabs with resilient flooring, carpet over cushion, or left exposed; and to exterior slabs, walks and curbs, as follows:

Apply specified compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Do not allow to puddle. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring (such as ceramic or quarry tile, glue down carpet), painting and other coatings and finish materials, unless otherwise acceptable to the Architect.

Use only clear curing compounds for exposed interior slabs and all exterior concrete.

- C. Curing Formed Surfaces: Where wooden forms are used, cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. When forms are removed, continue curing by methods specified above, as applicable.
- D. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping and other flat surfaces by application of appropriate curing compound.

Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

3.9 HOT WEATHER CONCRETING

- A. Definition:
 - 1. Conditions warranting hot weather concreting practices are defined as any combination of high air temperature, low relative humidity and wind velocity tending to impair the quality of fresh or hardened concrete or otherwise result in abnormal properties.
 - 2. The maximum acceptable concrete temperature at the truck discharge point shall be 95°F.
- B. Specification: Hot weather concreting practices required to limit the concrete temperature at the truck discharge point to 95°F or lower shall be followed according to ACI 305 "Hot Weather Concreting."
- C. Records: Under hot weather conditions, the Contractor shall keep records of outside air temperature, concrete temperature at truck discharge and general weather conditions.
- D. Hot Weather Concreting Requirements: The following items, all or in part as required, should be followed to limit the concrete temperature to 95°F or lower:

1. Design the concrete mixes specifically for hot weather conditions replacing some cement with fly ash or other pozzolan and using a water reducing retarding admixture (ASTM C 494 Type D).
2. Use the largest size and amount of coarse aggregate compatible with the job.
3. Use sunshades and/or windbreaks.
4. Delay construction of indoor slabs-on-grade until the walls and roof are constructed.
5. Cool and shade aggregate stockpiles.
6. Use ice as part of the mixing water or cool the water with liquid nitrogen.
7. Limit the number of revolutions at mixing speed to 125 maximum.
8. Paint mixers and storage bins or silos white to minimize heat absorption.
9. Reduce time between mixing and placing as much as possible.
10. Do not add water to ready-mixed concrete at the job site unless it is part of the amount required initially for the specified water-cement ratio and the specified slump.
11. Schedule concrete placement for early morning, late afternoon, or night.
12. Have all forms, equipment and workers ready to receive and handle concrete.
13. Maintain one standby vibrator for every three vibrators used.
14. Keep all equipment cool by spraying with water including chutes, conveyors, pump lines, tremies, reinforcement and buggies.
15. Dampen the subgrade and side forms with cool water.
16. Protect slab concrete at all stages against undue evaporation by applying a fog spray or mist above the surface or applying a monomolecular film. Where high temperatures and/or placing conditions dictate, use water-reducing retarding admixture (Type D) in lieu of the water-reducing admixture (Type A) as directed by the Owner's Testing Laboratory.
17. Provide continuous curing, preferably with water, during the first 24 hours using wet burlap, cotton mats, continuous spray mist, or by applying a curing compound meeting ASTM C 309. Continue curing for 3 days minimum.
18. Spray exteriors of forms to keep them cool.
19. As soon as possible, loosen forms and run water down the inside. When forms are removed, provide a wet cover to newly exposed surfaces.

3.10 COLD WEATHER CONCRETING

A. Definition:

1. Concrete shall not be placed on any day when the outside air temperature is 40°F or less and falling unless cold weather concreting practices are followed as specified below.
2. Cold weather concreting practices should be followed whenever the mean daily temperature drops below 40°F for more than three successive days.

3. The temperature of concrete mixed and delivered to the job site shall conform to the following requirements:

Air Temperature	Min. Concrete Temperature
Above 30°F	60°F
0°F to 30°F	65°F
Below 0°F	70°F

4. The minimum temperature of concrete during placement and curing shall be 55°F. The maximum concrete temperature heated by artificial means at point of placement shall not exceed 90°F.
- B. Specification: Cold weather concreting practices required to limit the concrete temperatures as specified above shall be followed according to ACI 306R-78 "Cold Weather Concreting".
- C. Records: Under cold weather conditions, the Contractor shall keep records of outside air temperature, concrete temperature as placed and general weather conditions.
- D. Cold Weather Concreting Requirements: The following items, all or in part as required, should be followed to assure acceptable concrete in cold weather conditions:
1. Design the concrete mix suitable for cold weather. Use air entrainment and obtain high early strength by using a higher cement content, a high early strength cement (Type III), or an accelerator (ASTM C 494 Type C and E).
 2. Protect the concrete during curing period using insulating blankets, insulated forms, enclosures and/or heaters.
 3. Concrete cured in heated enclosures shall have heaters vented to prevent exposure of concrete and workmen to noxious gases.
 4. Frozen subgrade shall be thawed prior to concrete placement and snow and ice shall be removed from forms.
 5. Concrete shall be protected and cured at 55°F for three days minimum if normal concrete (Type I cement) is used and for two days minimum if high early strength concrete (concrete with Type III cement, 100 pounds cement added per cubic yard concrete, or an accelerator added).
 6. Concrete not loaded during construction shall be protected a minimum of 3 days for normal concrete and 2 days for high early strength concrete to obtain safe form stripping strength. Concrete fully loaded during construction shall be protected for whatever time period is required to obtain the required strength as determined by nondestructive strength tests (Windsor probe, Swiss Hammer Test) on the in-place concrete.
 7. Heat the mixing water and then blend hot and cold water to obtain concrete no more than 10°F above the required temperature.
 8. Heat the aggregates by circulating steam in pipes placed in the storage bins for air temperatures consistently below 32°F. When either water or aggregate is heated to over 140°F combine them in the mixer first to obtain a maximum temperature of the mixture not to exceed 140°F in order to prevent flash set of the concrete.

9. Uniformly thaw aggregates far in advance of batching to prevent moisture variations in the stockpile.
10. Cover warmed stockpiles with tarps to retain heat.
11. Place air entraining admixture in the batch after the water temperature has been reduced by mixing with cooler solid materials.
12. Use wind screens to protect concrete from rapid cooling.
13. Place vertical pump lines inside the building, if possible, for concrete being pumped.
14. Maintain artificial heat as low as possible to reduce temperature stresses during cooling.
15. Avoid water curing of concrete. Apply the required curing compound to unformed surfaces as soon as possible to prevent drying of concrete from heated enclosures.
16. Delay form stripping as long as possible to help prevent drying from heated enclosures and to reduce damage to formed surfaces caused by premature stripping.
17. Provide triple thickness of insulating materials at corners and edges vulnerable to freezing.
18. Wrap protruding reinforcing bars with insulation to avoid heat drain from the warm concrete.
19. Gradually reduce the heat at the end of the heating period to reduce likelihood of thermal shock.

3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with inplace construction. Provide other miscellaneous concrete filling shown or required to complete work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

3.12 CONCRETE SURFACE REPAIRS

- A. Definition - Defective Areas:
 1. Formed Surfaces: Concrete surfaces requiring repairs shall include all honeycombs, rock pockets and voids exceeding 1/4" in any dimension, holes left by tie rods or bolts, cracks in excess of 0.01" and any other defects that affect the durability or structural integrity of the concrete.

2. Unformed Surfaces: Concrete surfaces requiring repair shall include all surface defects such as crazing, cracks in excess of 0.01" wide or cracks which penetrate to reinforcement or through the member, popouts, spalling and honeycombs.

B. Classification:

1. Structural Concrete Repair: Major defective areas in concrete members that are load carrying (such as shear walls, beams, joists and slabs), are highly stressed, and are vital to the structural integrity of the structure shall require structural repairs. Structural concrete repairs shall be made using a two part epoxy bonder and/or epoxy mortar. Location of structural concrete repairs shall be determined by the Engineer.
2. Cosmetic Concrete Repair: Defective areas in concrete members that are non-load carrying and minor defective areas in load carrying concrete members shall require cosmetic concrete repair. Cosmetic concrete repairs may be made using a non-epoxy non-shrink patching mortar and bonding agent. The location of cosmetic concrete repair required shall be determined by the Engineer. Cosmetic concrete repair in exposed-to-view surfaces will require Architect's approval prior to patching operation.
3. Slab Repairs: High areas in concrete slabs shall be repaired by grinding after concrete has cured at least 14 days. Low areas shall be filled using self-leveling mortars. Repair of slab spalls and other surface defects shall be made using epoxy products as specified above and as determined by the Engineer.

3.13 QUALITY CONTROL TESTING DURING CONSTRUCTION

See Testing Laboratory Services section of these Specifications for concrete materials and cast-in-place concrete inspection and test requirements.

END OF SECTION 03 30 00

SECTION 03 31 00 - EPOXY RELATED WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to the work of this section.

1.2 SCOPE OF WORK

- A. Installation of epoxy grouted dowels or reinforcing steel, and bonding fresh concrete to hardened concrete. Such work shall be done by the Contractor in strict conformance to these specifications.

1.3 QUALITY ASSURANCE

- A. Applicable Standards

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

- C881 Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete

- 2. American Concrete Institute (ACI)

- ACI 503 R Use of Epoxy Compounds with Concrete

- ACI 503.1 Standard Specification for Bonding, Hardened Concrete, Steel, Wood, Brick, and Other Materials to Hardened Concrete with a Multi-Component Epoxy Adhesive

- ACI 503.2 Standard Specification for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive

- ACI 503.3 Standard Specification for Producing a Skid-Resistant Surface on Concrete by the Use of Multi-Component Epoxy System

- ACI 503.4 Standard Specification for Repairing Concrete with Epoxy Mortars

- B. Manufacturer's Qualifications

Companies furnishing the epoxy materials shall have a proven track record of at least five years. Furthermore, they shall have in existence a program of training, certifying and supporting a nationally organized program of approved contractors. Evidence of this shall be made available to the Engineer/Architect upon request.

- C. Contractor's Qualifications: Contractor performing the work shall be an approved contractor by the manufacturer furnishing the epoxy materials, and shall have no less than five years experience in the various types of epoxy related work required in this project. A notarized certification from the manufacturer attesting to the training shall be submitted to the Engineer/Architect along with the proposal to do the work.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EPOXY MATERIALS:

- A. All epoxy material shall be new and manufactured within the shelf life limitations set forth by the manufacturer.
- B. Epoxy shall be a two-part epoxy adhesive material, and shall be of epichlorohydrin/amine type. Polysulphide epoxies are not acceptable.
- C. Epoxy used shall be insensitive to the presence of water and moisture, and shall be capable of application and of strength development even when applied to damp surfaces having a temperature of 40° or above.
- D. Epoxy used shall develop a minimum strength of 6310 psi in tension and 12000 psi in compression at the end of seven days.
- E. Epoxies used shall not deteriorate under approximately 200 freeze thaw cycles.
- F. Epoxies used shall be 100% solids without solvents.
- G. Bonding and strength characteristics of epoxies shall be stable when exposed to ultraviolet rays.

2.2 ADDITIONAL REQUIREMENTS FOR EPOXY MORTARS

- A. Epoxy mortar used for bonding, patching, and resurfacing, shall have the following additional properties:
 - 1. Epoxy mortar shall be non-sagging.
 - 2. Sand used in preparing mortar shall be graded oven dry quartzite and furnished in bags.
 - 3. The epoxy mortar patch material shall match the existing texture and color of exposed concrete without giving a blotchy appearance. A test patch shall be applied for approval prior to final acceptance of the mortar. Size of test patch shall be approximately equal to the size of the average mortar patch to be used on the project.

2.3 GENERAL REQUIREMENTS FOR POLYMER MODIFIED CEMENTITIOUS MORTARS:

- A. Mortar used for bonding, patching, and resurfacing in exposed or exterior environmental conditions with large cyclic temperature changes shall have the following properties:
 - 1. Mortar shall be non-sagging.
 - 2. Coefficient of thermal expansion shall be comparable with that of concrete (5.5×10^{-6} in/in/°F).
 - 3. Sand used in preparing mortar shall be graded oven dry quartzite furnished in bags.
 - 4. The mortar patch material shall match the existing texture and color of exposed concrete without giving a blotchy appearance. A test patch shall be applied for approval prior to final acceptance of the mortar. Size of test patch shall be approximately equal to the size of the average mortar patch to be used on the project.

PART 3 - EXECUTION

3.1 EPOXY MORTAR:

- A. Applicator's Qualifications
 - 1. Epoxy mortar repair work shall only be performed by contractors who have successfully used this process on at least three similar structural repairs of equal scope which have performed successfully for a minimum period of five years.
 - 2. Only adequately trained and experienced personnel shall be used on the job.
- B. Surface Preparation
 - 1. Concrete surface to which the epoxy mortar is to be applied shall be exposed parent concrete free of loose and unsound materials. Surface preparation shall be done by abrasive blasting, waterblasting or as otherwise required by the manufacturer.
 - 2. Necessary approvals shall be obtained by the Contractor from authorizing governmental or other agencies prior to abrasive blasting. Abrasive blasting operations shall comply with the requirements of OSHA and NIOSH (National Institute for Occupational Safety and Health) Standard PB-246-697.
 - 3. Surfaces shall be free of any deleterious materials such as laitance, dust, dirt, and oil.
 - 4. Any exposed reinforcing steel shall also be cleaned and be free of rust and other contaminants. Cleaning shall be accomplished by mechanical means. Use powered wire brushes in locations where reinforcing steel cannot be cleaned by abrasive-blasting or water-blasting. All exposed reinforcing steel shall be coated with a

corrosion inhibiting product specified elsewhere in this specification prior to mortar application.

5. Prime the cleaned surface with primer as required by the manufacturer.

C. Concrete Surface Inspection

1. Ensure that the surface temperature is at least 40°F to permit wetting of concrete surface by epoxy coating.
2. The Contractor shall evaluate the moisture content of concrete surface receiving epoxy mortar. This shall be done by determining if moisture will collect at bond lines between concrete and epoxy mortar before epoxy has cured. Evaluate this by taping a piece of polyethylene sheet to the concrete. If moisture collects on underside of the polyethylene sheet before epoxy would cure, then allow concrete to dry sufficiently to prevent the possibility of moisture between old concrete and new epoxy.

D. Mortar Application

1. Condition epoxy compound components to a temperature between 65°-80°F unless otherwise recommended by the manufacturer. Epoxies beyond this range of temperature shall not be used.
2. Stir each of the two parts of epoxy separately before mixing. Then mix in a clean container free of contaminants.
3. Thoroughly blend epoxy components and sand with Jiffy mixers (made by The Jiffy Mixer Co., Irvine, California) to a uniform and homogenous mixture. Small batches of one quart or less may be mixed by spatulas, palette knives or similar devices.
4. Mixing should be accomplished well within the pot life of epoxy (three minutes when using Jiffy mixer or five minutes when mixed by hand) after allowing for time required for application.
5. Apply mortar by trowel or other means suitable for the consistency of the epoxy-sand mortar mix.
6. Build up the repair area in layers with mortar thicknesses within those specified by the manufacturer (1/4" maximum per layer).
7. Consolidate the mortar thoroughly to remove entrapped air.
8. Finish surface of mortar to match the texture and contours of existing concrete.
9. Allow mortar to cure in accordance to manufacturers recommendations.

E. Cleanup

1. Protect surfaces surrounding the work areas against spillage.

2. Epoxy and epoxy mortar spillages shall be cleaned before they set.
3. Cleanup all portions of the existing structure that are soiled or stained in the process of epoxy mortar repair work.

3.2 EPOXY GROUTED BOLTS, DOWELS OR REINFORCING STEEL:

A. Applicator's Qualifications

1. Epoxy grouting of bolts, dowels or reinforcing steel shall only be performed by contractors who have had successful experience on a minimum of three projects of similar scope.
2. Only adequately trained epoxy applicators shall be used on the job. Furnish current certificate of training on request.

B. Surface Preparation

1. All bolts, dowels and reinforcing bars shall be abrasive blasted no more than eight hours before the grouting. If evidence of oxidation exists on the surface, the bolts, reinforcing bars and dowels shall be recleaned. Blast-clean surfaces using Steel Structures Painting Council, Surface Preparation No. 6, to give a surface condition corresponding to ASa2, BSa2, CSa2 of SSPC Vis 1, depending on the initial surface condition of the steel surface. Prior to blast-cleaning, clean surfaces to conform to SSPC SP1, SP2, and SP3, as required.
2. All holes shall be clean of dust, debris, and contaminants. Use compressed air from an oil-and-water-free compressed air source prior to epoxy application.

C. Drilling Holes for Embedment

1. Use only rotary-percussion type drills for drilling holes.
2. Drills shall be fitted with bits having single tooth that produce large cuttings, and hollow stem drill rods that permit simultaneous blowing of compressed air providing immediate expulsion of the cuttings from the hole.
3. Do not cut through any reinforcing steel unless indicated otherwise on the drawings. Use small diameter exploratory holes to detect presence of reinforcing steel prior to drilling holes for grouting.
4. Core drilling equipment, and electric impact hammers or other tools which do not provide for immediate expulsion of the drill cuttings shall not be used.
5. Unless noted otherwise on the drawings, depth of hole used for embedding the bolts, bars or dowels shall be at least fifteen times their diameter.

6. Unless noted otherwise on the drawings, the center to center distance between the embedded bolts, bars or dowels shall be at least twelve times their diameter.
7. Unless noted otherwise on the drawings, the edge distance shall be at least six times the diameter of the bolt, bar or dowel.
8. Hole diameter shall normally be 1/4" larger than the outside diameter of the embedded item. In no case shall the hole diameter be 3/8" larger than the diameter of the embedded item.

D. Epoxy Application

1. Condition epoxy compound materials at a temperature between 65°-80°F unless otherwise recommended by the manufacturer. Epoxies beyond this range of temperature shall not be used.
2. Mix epoxy materials in a clean container free of contaminants.
3. Thoroughly blend epoxy components with mechanical mixers to a uniform and homogenous mixture. Mix small batches (up to 1 quart) by use of spatulas, palette knives, or similar devices. Take care to use proper proportions of the epoxy components when using small batches.
4. Mixing shall be accomplished well within the pot life of the epoxy after allowing for time required for application.
5. Partially fill the hole with epoxy. Then insert the bolt, dowel or reinforcing bar into the hole such that the resin material oozes out around the embedded item, ensuring complete contact. Twist the bolt, dowel or bar slightly as it is inserted in the hole to ensure complete contact.
6. As an alternative to inserting the embedded item after the epoxy is poured in the hole, the bolt, dowel, or bar may be positioned in the hole and filled up with epoxy by hand caulking guns or injected with an in-head mixing equipment. In either case, the nozzle shall be provided with a hose or tube of sufficient length to reach the bottom of the hole being filled.
7. Where the holes are horizontal or overhead, the opening shall be covered by a masking or a duct tape. Make a split in the tape and insert the epoxy injection tube through the split. Fill hole completely with epoxy and then insert the embedded item through the split tape. Amount of epoxy should be such that a small amount of material oozes through the split. Twist the bolt, dowel or bar slightly as it is inserted in the hole to ensure complete contact.
8. Do not apply epoxy in the rain or in the presence of standing water.

E. Cleanup

1. Protect surfaces surrounding the work area against spillage.
2. Epoxy oozed out from the holes and spillages shall be cleaned before they become difficult to remove.
3. Cleanup whatever portions of the existing structure are soiled or stained in the process of grouting the bolts, dowels or reinforcing bars.

END OF SECTION 03 31 00

SECTION 04 23 00 - REINFORCED UNIT MASONRY

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 each type of reinforced unit masonry work is indicated on drawings and in schedules. Provide all labor, materials, equipment, and services necessary for and incidental to the installation of all reinforced masonry construction as indicated on the drawings and specified herein. Reinforced unit masonry construction includes reinforced concrete masonry including concrete filled masonry beams, pilasters, lintels, and soffits. Accessories include, but are not necessarily limited to ties, horizontal and vertical reinforcement, anchors to the structure, and control joints.

1.3 SUBMITTALS

- A. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcement bars and for steel templates for layout of dowels. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures". Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Reinforcement Bars: Provide deformed bars of following grades complying with ASTM A 615, except as otherwise indicated.
 - 1. Provide Grade 60 for No. 3 bars, except as otherwise indicated.
 - 2. Provide Grade 60 for bars No. 4 to No. 11, except as otherwise indicated.
 - 3. Where No. 2 bars are shown, provide plain, round, carbon steel bars, ASTM A 675, Grade 80.
 - 4. Shop fabricate reinforcement bars which are shown to be bent or hooked.

PART 3 - EXECUTION

3.1 GENERAL

Refer to Section "Masonry Mortaring and Grouting" for general installation requirements of unit masonry.

3.2 PLACING REINFORCEMENT

- A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.
- B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Vertical bars shall be held in position at the top and bottom and at intervals not exceeding 8'-0" with a minimum clearance of 1/4" from the face of the masonry and not less than one bar diameter or 1" (whichever is greater) between adjacent bars.
- C. All dowels shall be grouted into a cell even if the dowel is in an adjacent cell to the vertical steel. Unless detailed otherwise on the drawings, dowels shall be the same size and number as the vertical steel. Unless noted otherwise provide a lap length of dowels to vertical reinforcement equal to 50 times the nominal dowel diameter. Dowels for columns and pilasters shall be set using 1/8" thick steel plate templates. Templates shall be detailed and submitted with reinforcing steel shop drawings.
- D. All horizontal reinforcing steel shall be placed in continuous bond beam or lintel block units and shall be solidly grouted in place. Maintain a minimum of one bar diameter or 1" (whichever is greater) clearance between adjacent bars and a minimum of 1/4" clearance from the face of the masonry. Horizontal reinforcement may be placed as the masonry work progresses.
- E. Splice reinforcement bars where shown; do not splice at other points unless acceptable to the Engineer. Where splices occur, adjacent splices shall be staggered so that no more than 25% of the total number of bars are spliced at any one point with a minimum stagger between splices in adjacent bars of at least the lap length. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.
- F. Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing indicated.

3.3 FORMWORK

- A. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.

- B. Construct formwork to conform to shape, line and dimensions shown. Make sufficiently tight to prevent leakage of mortar, grout, or concrete (if any). Brace, tie and support as required to maintain position and shape during construction and curing of reinforced masonry.
- C. Formwork shall be designed and shop drawings prepared by a registered professional engineer in the state where the project is located.
- D. Formwork shall not be removed until the reinforced masonry member has cured sufficiently to carry its own weight and any other loads that may be placed on it during construction. Allow not less than the following minimum time to elapse after completion of the member before removing shores or forms provided adequate curing conditions have been obtained during the curing period:
 - 1. Lintels and beams - 10 days.
 - 2. Reinforced masonry soffits - 7 days.
 - 3. Allow 16 hours to elapse after completion of masonry columns and walls before placing floor or roof construction loads. Allow an additional 48 hours before applying concentrated loads such as girders, beams, or trusses.

3.4 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY

A. General:

- 1. Do not wet concrete masonry units (CMU).
- 2. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths shown, or if not shown, provide 3/8" joints.

B. Walls:

- 1. Pattern Bond: Lay CMU wall units in 1/2 running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use special shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.
- 2. Maintain vertical continuity of core or cell cavities which are to be reinforced and grouted to provide minimum clear dimensions indicated and to provide minimum clearance and grout coverage for vertical reinforcing bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.
- 3. Provide #4 at 48" on center horizontal reinforcing in addition to joint reinforcing specified. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal

reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.

C. Grouting:

1. General

- a. Use "Fine Grout" per ASTM C 476 for filling spaces less than 4" in one or both horizontal directions. (2,000 psi)
- b. Use "Coarse Grout" per ASTM C 476 for filling 4" spaces or larger in both horizontal directions. (2,000 psi)
- c. Use 3000 PSI normal-weight concrete for filling spaces 10" and larger in both directions.
- d. Grouting Technique: At the Contractor's option, use either low-lift or high-lift grouting techniques subject to requirements which follow.

2. Low-Lift Grouting:

- a. Provide minimum clear dimension of 2" and clear area of 8 square inches in vertical cores to be grouted.
 - b. Place vertical reinforcement prior to laying of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 10 feet.
 - c. Lay CMU to maximum pour height. Do not exceed 5 feet height, or if bond beam occurs below 5 feet height stop pour at course below bond beam.
 - d. Pour grout using chute or container with spout. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 1-1/2" below top course of pour.
 - e. Bond Beams: Stop grout in vertical cells 1-1/2" below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.
3. Preparation of Grout Spaces: Prior to grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.
4. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.
5. Place grout by pumping into grout spaces.
6. Place grout in lintels or beams over openings in one continuous pour.

7. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 1" of vertically reinforced cavities, during construction of masonry.
 8. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 1-1/2" of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.
- D. Anchoring:
1. Anchor reinforced masonry work to supporting structure as indicated.
 2. Anchor reinforced masonry walls to non-reinforced masonry where they intersect, unless shown otherwise.

3.5 QUALITY CONTROL

- A. Masonry Prisms shall be made and tested in accordance with Section "Unit Masonry".
- B. Prism Strength
1. Compressive Strength, f'_m . The compressive strength of reinforced concrete masonry, f'_m , as determined by prism tests shall be as indicated below:
- | | |
|-----------------------------|--|
| Class of Reinforced Masonry | 28 Day Compressive Strength, f'_m = 1500 PSI |
|-----------------------------|--|
- C. Grout Tests
1. Grout shall be sampled and tested in accordance with ASTM C 1019 for every 1,000 square feet of masonry.
Grout strength = 2,000 PSI minimum.

END OF SECTION 04 23 00

SECTION 05 12 00 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

- A. Extent of structural steel work is shown on drawings including schedules, notes and details which show size and location of members, typical connections, and type of steel required. Furnish all labor, materials, services, equipment and appliances required in conjunction with or related to the furnishing, fabrication, delivery, and erection of all structural steel defined below. Include all supplementary parts, members and connections necessary to complete the structural steel work, regardless of whether all such items are specifically shown or specified on the drawings.
- B. Structural steel shall be defined as that work prescribed in Section 2.1 of the AISC Code of Standard Practice and the following items: angle frames for openings in roofs, miscellaneous metal deck support and edge angles, shop welded metal studs, all connection material, temporary construction bracing, and all other structural steel shown or specified on the drawings to be part of the work. Labor shall include shop painting as specified, field touch-up painting, and grouting of base plates and bearing plates.
- C. Miscellaneous metal fabrications, architecturally exposed structural steel, metal stairs, steel joists, and metal deck are specified elsewhere in these Specifications.

1.3 QUALIFICATIONS

- A. Fabricator: The structural steel fabricator shall have not less than 10 years experience in the successful fabrication of structural steel similar to this project. Evidence of compliance with this section shall be submitted to the Architect/Engineer.
- B. Erector: The structural steel erector shall have not less than 5 years successful experience in the erection of structural steel of a similar nature to this project. Evidence of compliance with this section shall be submitted to the Architect/Engineer.

1.4 QUALITY ASSURANCE

The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

- A. Codes and Standards:

Comply with provisions of the following, except as otherwise indicated:

1. All federal (OSHA), state and local laws which govern safety requirements for steel erection and other requirements if more stringent than the codes and standards enumerated below.
2. AISC "Code of Standard Practice for Steel Buildings and Bridges".
3. AISC "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings", including Commentary.
4. AISC "Specification for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation (Research Council on Structural Connections).
5. AWS D1.1 "Structural Welding Code - Steel".
6. "Steel Structures Painting Manual", Volumes 1 and 2, Steel Structures Painting Council.

B. Qualifications for Welding Work:

Qualify welding processes and welding operators in accordance with AWS "Structural Welding Code - Steel".

1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.
2. If recertification of welders is required, retesting will be Contractor's responsibility.

C. Source Quality Control: Materials and fabrication procedures are subject to inspection and tests in the mill, shop, and field by the Owner's testing laboratory. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements. The Contractor shall promptly remove and replace materials or fabricated components which do not comply.

D. Question about Contract Documents: The Contractor shall promptly notify the Architect/Engineer whenever design of members and connections for any portion of the structure are not clearly indicated or when other questions exist about the Contract Documents. Such questions shall be resolved prior to the submission of shop drawings.

E. Testing Laboratory Services: See Structural Drawings required testing. Inspection or testing by the Owner does not relieve the Contractor of his responsibility to perform the Work in accordance with the Contract Documents.

1.5 SUBMITTALS

A. Shop Drawings:

1. General Requirements: Submit shop drawings including complete details and schedules for fabrication and assembly of structural steel members, and details, schedules, procedures and diagrams showing sequence of erection. Shop drawings not complying with the above requirements will not be reviewed. Structural steel shop drawings shall include the following minimum information:
 - a. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld. Holes, flange cuts, slots and openings shall be made as required by the structural drawings, all of which shall be properly located by means of templates.
2. The fabricator alone shall be responsible for all errors of detailing, fabrication, and for the correct fitting of the structural members.
3. All fabricated material and connections shall fit within architectural constraints.
4. Structural steel members for which shop drawings have not been reviewed and approved shall not be fabricated.
5. The omission from the shop drawings of any materials required by the Contract Documents shall not relieve the Contractor of the responsibility of furnishing and installing such materials, even though the shop drawings may have been reviewed and approved.

- B. Test Reports: Submit copies of reports of tests conducted on all field-welded connections that are inspected. Include data on type(s) of tests conducted and test results.

1.6 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 so as not to delay work.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration. Do not store materials on structure in a manner that might exceed allowable loads on or cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed by Architect/Engineer.
- D. Furnish all fuel, maintenance, and equipment required for hoisting and placement of materials under this contract.

- E. Process, pay for and maintain all permits and certificates of on-site inspection required for derricks, cranes and hoisting equipment. No derrick, crane or hoisting equipment shall be operated without a certificate of operation and a certificate of on-site inspection, as required by governing authorities.
1. Wherever the erection equipment is supported by the structure, the Contractor shall be responsible for the retention of a licensed professional engineer to determine the adequacy of the member supporting the erection equipment in relation to the loads imposed thereon. The Contractor shall submit to the Architect/Engineer, for review, the loads which will be imposed by the erection equipment on the building structure. Where the imposed load exceeds the allowable stresses, the Contractor shall be responsible for any additional materials, supports, bracing, connections and similar measures required to support the imposed load of the equipment while in use, subject to review by the Architect/Engineer.
 2. In addition to the above, all hoisting equipment shall be installed, operated and maintained in accordance with all applicable regulations of authorities having jurisdiction.
 3. Street storage and sidewalk crossing permits shall be furnished by the Contractor.

1.7 JOB CONDITIONS

The Contractor shall coordinate the fabrication and erection of all structural steel work with the work of other trades. The contractor shall verify existing conditions prior to beginning work. The contractor shall verify all dimensions shown on the drawings with existing job conditions prior to beginning work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural Steel: All hot rolled steel plates, shapes, sheet piling, and bars shall be new steel conforming to ASTM Specification A6 "Standard Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use". Structural steel shall comply with the provisions of the following ASTM Specifications as appropriate for the grades and types, and at the locations as specified on the drawings:
1. Structural Steel Shapes, Plates and Bars - Carbon Steel, ASTM A992 GR50 "Standard Specification for Structural Steel."
 2. Pipe Columns - ASTM A53 (Type E or S) Grade B, or ASTM A501.
 3. Tube Sections - ASTM A500 Grade B. FY = 46 KSI

4. Connection Material: All connection material except as noted otherwise on the drawings including bearing plates, gusset plates, stiffener plates, filler plates, angles, etc. shall be A36 steel unless a higher or matching grade of steel with the members connected is required by strength or stiffness calculations and provided the resulting sizes are compatible with the members connected.
- B. Structural Bolts and Threaded Fasteners: Structural bolts and threaded fasteners shall comply with the following ASTM Specifications as appropriate for the types and at the locations as specified on the drawings:
1. ASTM A307 Grade A, "Carbon Steel Externally Threaded Standard Fasteners".
 2. ASTM A325 Type 1, "High-Strength Bolts for Structural Steel Joints".
 3. Bolts and Nuts, High Strength Bolts: Bolts and nuts for all 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 A563, "Standard Specification for Carbon and Alloy Steel Nuts".
 4. Washers: All washers shall be circular, flat and smooth and shall conform to the requirements of Type A washers in ANSI Standard B23.1. Washers for high strength bolts shall be hardened and conform to ASTM F436, 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% slope) with an average thickness of 5/16". When an outer face of a bolted part has a slope greater than 1:20 with respect to a plane normal to the bolt axis, a beveled washer shall be used.
 5. Bolt Lubrication: All bolts shall be well lubricated at time of installation. Dry, rusty bolts will not be allowed. Bolts or nuts shall be wax dipped by the bolt supplier or "Johnson's Stick Wax 140" shall be used with all bolts in the shop or field.
 6. New Bolts: All bolts shall be new and shall not be reused.
- C. Electrodes for Welding: Comply with AWS D1.1, "Structural Welding Code - Steel". Electrodes for various welding processes shall be as specified below:
1. SMAW: E70XX low hydrogen
 2. SAW: F7X-EXXX
 3. GMAW: ER70S-X
 4. FCAW: E7XT-X
 5. Weathering Steel Electrodes shall conform to Table 4.1.4 of the AWS D1.1 Manual.

Electrodes shall be compatible with parent metal joined.

D. Structural Steel Primer Paint: Primer paint shall be one of the following types with the indicated surface preparation:

1. SSPC-Paint 1, 100% red lead and linseed oil, TT-P-86 Type I, surface prepared according to SSPC-SP-2 (Hand Tool Cleaning). All materials shall be lead and chromate free.
2. SSPC-Paint 2, red lead-iron oxide and oil-alkyd, surface prepared according to SSPC-SP-2 (Hand Tool Cleaning). All materials shall be lead and chromate free.
3. TT-P-86, Type II, red lead-iron oxide and oil-alkyd, surface prepared according to SSPC-SP-3 (Power Tool Cleaning). All materials shall be lead and chromate free.
4. TT-P-86, Type III, 100% red lead and alkyd varnish, surface prepared according to SSPC-SP-6 (Commercial Blast Cleaning) or SSPC-SP-8 (Pickling).
5. Alkyd Zinc Chromate Metal Primer 0239 Gray as manufactured by Devoe Napko (SSPL-SP6 Commercial Blast Cleaning).
6. Alkyd Fast Dry Primer 298 as manufactured by Porter Paints (SSPL-SP6 Commercial Blast Cleaning).
7. Modified Alkyd Rust Inhibitive Primer 4-56 as manufactured by Tnemec Company, Inc. (SSPL-SP6 Commercial Blast Cleaning).

Refer to Architect's drawings and specifications for final paint finish requirements of structural steel. Primer paint shall be compatible with final paint requirements.

2.2 FABRICATION

A. Shop Fabrication and Assembly:

1. Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specification and as indicated on approved final shop drawings. Fabricator shall coordinate joint fit-up procedures with erector. Provide camber in structural members where indicated. The General Contractor shall coordinate provision of all erection bolts, lifting lugs or other devices required for erection with the fabricator and the erector.
2. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
3. Clearly mark the grade of steel on each piece, distinguishable in the field from floor surfaces, for purpose of field inspection and confirmation of grade of steel.

- B. Dimensional Tolerances: Dimensional tolerances of fabricated structural steel shall conform to Section 6.4 of the AISC Code of Standard Practice.
- C. Splices in Structural Steel: Splicing of structural steel members in the shop or the field is prohibited without prior approval of the Engineer. Any member having a splice not shown and detailed on approved shop drawings will be rejected.
- D. Cutting: Manual oxygen cutting shall be done only with a mechanically guided torch. An unguided torch may be used provided the cut is not within 1/8 inch of the finished dimension and final removal is completed by means such as chipping or grinding to produce a smooth surface quality free of notches or jagged edges. All corners shall be smooth and rounded to a minimum 1/2" radius.

2.3 WELDING

- A. Code: All shop and field welding shall conform to all requirements in the "Structural Welding Code - Steel", ANSI/AWS D1.1, as published by the American Welding Society (AWS).
- B. Welder Certification: All shop and field welders shall be certified according to AWS procedures for the welding process and welding position used. Submit certification certificates to the Architect for record purposes.
- C. Minimum Size and Strength:
 - 1. Fillet Welds: Minimum size of fillet welds shall be as specified in Table 1.17.2A in the AISC Manual of Steel Construction.
 - 2. Minimum Strength of Welded Connections: Unless noted otherwise on the drawings, all shop and field welds shall develop the full tensile strength of the member or element joined. All members with moment connections, noted on the drawings with "MC", shall be welded to develop the full flexural capacity of the member, unless noted otherwise on the drawings.
- D. Filler Metal Requirements: Weld metal shall be as specified in AISC Manual of Steel Construction Table 1.5.3.
- E. Welding Procedures:
 - 1. Welds not specified shall, if possible, be continuous fillet welds developing the minimum strength, as specified above, using not less than the minimum fillet welds as specified by AISC.

2.4 SURFACE PREPARATION AND PAINTING

- A. Specification: Surface preparation, paint, and painting practices shall conform to the "Steel Structures Painting Manual", Volumes 1 and 2, as published by the Steel Structures Painting Council (SSPC).

- B. Scope: Shop paint all steel.
- C. Surface Preparation and Primer Paint - Shop Painted Steel: All structural steel specified to be shop primed shall have paint applied in strict accordance with manufacturers instructions using prescribed surface preparation but not less than specified. Paint shall be applied immediately after surface preparation at a rate to provide a uniform dry film thickness of not less than 1.5 mils. Painting methods shall be used which result in full coverage of joints, corners, edges, and all exposed surfaces. Two coats shall be applied to surfaces which are inaccessible after assembly or erection. The color of the second coat shall be changed to distinguish it from the first coat.

Coordinate shop primer paint requirements with Architectural drawings and specifications.

PART 3 - ERECTION

3.1 ERECTION

- A. Inspection: Erector shall examine areas and conditions under which structural steel work is to be installed and notify the Contractor and the Architect/Engineer in writing of conditions detrimental to proper and timely completion of the work.
- B. Erection Tolerances: Erection tolerances of anchor bolts, embedded items, and all structural steel shall conform to the AISC Code of Standard Practice.
- C. Field Assembly of Structural Steel:
 - 1. As erection of the steel progresses, the work shall be fastened securely to take care of all dead load, wind and erection stresses. Particular care shall be exercised to ensure straightness and tautness of bracing immediately upon raising a steel column.
 - 2. Provide temporary planking and working platforms as necessary to effectively complete work.
 - 3. Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment. Level and plumb individual members of structure within specified AISC tolerances. The Contractor shall coordinate with Erector and Fabricator regarding possible discrepancies in member lengths between temperature at time of fabrication and temperatures during erection, and shall make necessary adjustments to ensure plumbness within AISC tolerances at 60°F. Compensate for cumulative welding draw, construction loadings, sequential applications of dead loads, or any other predictable conditions that could cause distortions to exceed tolerance limitations.

4. On exposed welded construction, remove erection bolts, fill holes with plug welds or filler and grind smooth at exposed surfaces.
 5. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces receiving field welds.
 6. Comply with all bolting and welding requirements of Part 2 of this specification section.
 7. Remove and replace existing finish materials as required to accomplish all work. The contractor shall comply with all fire codes when performing welding of steel or metal studs.
- D. Field Modifications to Structural Steel: Errors in shop fabrication or deformation resulting from handling and transportation that prevent the proper assembly and structural fitting of parts shall be reported immediately to the Architect/Engineer, and approval of the method of correction shall be obtained. Approved corrections shall be made at no additional cost to the Owner. Do not use cutting torches, reamers, or other devices in the field for unauthorized correction of fabrication errors.
- E. Miscellaneous Framing: Provide supplemental structural steel support framing for metal deck where normal deck bearing is interrupted by column flange plates or other framing members and other floor openings whether shown or not on either the architectural, mechanical, or structural drawings.
- F. Removal of Erection Aids and Devices: The erector shall remove all erection aids and devices that interfere with architectural finish or MEP requirements.
- G. Touch-Up Painting:
1. Immediately after erection, clean field welds, bolted connections, and abraded areas that have been shop painted. Apply paint to exposed areas using same material and surface preparation as used for shop painting. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.
 2. All field welded galvanized connections shall have welds protected with "Z.R.C. Cold Galvanizing Compound" as manufactured by Z.R.C. Products Company.
- H. Clean Up: Clean up all debris caused by the Work of this Section, keeping the premises neat and clean at all times. Replace and repair to like new condition, all damaged areas of the interior and exterior of the building.

END OF SECTION 05 12 00

SECTION 05 20 00 - STEEL JOISTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE OF WORK

- A. Extent of steel joists is shown on drawings, including basic layout and type of joists required.
- B. Quantity of joists required shall be determined from the contract drawings.

1.3 QUALITY ASSURANCE

The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

- A. Design and Fabrication: Provide joists designed and fabricated in compliance with the following, and as herein specified.
 - 1. Steel Joist Institute (SJI) Standard Specifications, Load Tables and Weight Tables for K, LH, and DLH Series Steel Joists.
 - 2. Recommended Code of Standard Practice for Steel Joists and Joist Girders.
 - 3. Local fabrication requirements of governing authorities such as the city, county and state having jurisdiction over the site where the project is located.
 - 4. American Welding Society AWS D1.1 Structural Welding Code - Steel or SJI Technical Digest #8 "Welding of Open Web Steel Joists" with successful passage of load tests as defined in this specification section.

1.4 SUBMITTALS

- A. Shop Drawings: Submit detailed drawings showing layout of joist units, connections, jointing and accessories. Include length, camber, mark, number, type, location and spacing of joists and bridging. Submit details for member splices.

1.5 DELIVERY, STORAGE AND HANDLING

Deliver, store and handle steel joists as recommended in SJI specifications. Handle and store these in a manner to avoid deforming members and to avoid excessive stresses.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel: Comply with SJI specifications.
- B. Unfinished Threaded Fasteners: ASTM A307, Grade A, regular hexagon type, low carbon steel.
- C. High-Strength Threaded Fasteners: ASTM A 325 or A 490 heavy hexagon structural bolts with nuts and hardened washers.
- D. Steel Prime Paint: Comply with SJI specifications.

2.2 FABRICATION

- A. General: Fabricate steel joists in accordance with all documents listed in "Quality Assurance", except as noted below.
- B. Splices in Chord Members: All splices shall be designed and provided in accordance with SJI Specifications. The splices in each of the two angles or bars of all members shall not be at the same location, but shall be staggered a minimum of 6 inches.
- C. Holes in Chord Members: Provide holes in chord members where shown in contract drawings for securing other work to steel joists; however, deduct area of holes from the area of chord when calculating strength of member.
- D. Joists shall be cambered for dead loads: Provide all joists with SJI standard camber unless specified otherwise on the drawings. Review the Structural Drawings and Specifications for information concerning dead loads for joists requiring other than standard camber. Joist camber must be shown on shop drawings submitted for review. Camber not shown on shop drawings shall be cause for rejection of shop drawings.
- E. Joist Bearing: Provide minimum end bearing of joists as required by SJI specifications but subject to requirements below:

Joists Less than 60-Foot Span:

- 1. If two joists do not abut each other at a support, provide required joist bearing centered on the supporting member unless detailed otherwise on the drawings.
- 2. If two joists abut each other at a support and sufficient minimum bearing for each joist exists, provide 1/4" space between joist ends centered over the support unless details otherwise on the drawings.
- 3. If two joists abut each other at a support and sufficient minimum bearing for each joist does not exist at the support, offset the ends of each joist and center joist bearing on the center of the support.

- F. Top Chord Extensions and Extended Ends: Provide top chord extensions and extended ends on joists where shown in contract drawings complying with the requirements of SJI specification and load tables. Top chord extensions shall extend back to the first interior panel point from the joist exterior panel point as a minimum.
- G. Ceiling Extensions: Provide ceiling extensions in areas having ceilings attached directly to joist bottom chord. Provide either an extended bottom chord element or a separate unit, to suit manufacturer's standards, of sufficient strength to support ceiling construction. Extend ends to within 1/2" of finished wall surface unless otherwise indicated.
- H. Bridging: Provide horizontal and/or diagonal type bridging for all joists, complying with SJI specifications.
 - 1. Examine the drawings carefully for special bridging requirements.
 - 2. Provide bridging anchors for ends of bridging lines terminating at walls or beams.
- I. End Anchorage: Provide end anchorages to secure joists to adjacent construction, complying with SJI specifications, unless otherwise indicated.
- J. Header Units: Any situation requiring heading of joists not shown on the structural drawings shall be referred to the manufacturer's engineer for framing.
- K. Shop Painting: Remove loose scale, heavy rust, grease, oil and other foreign materials from fabricated joists and accessories by rotary wire brushes and/or solvents before application of shop paint.

Apply one shop coat of primer paint to steel joists and accessories, by spray, dipping, or other method to provide a continuous dry paint film thickness of not less than 0.50 mil.

PART 3 - EXECUTION

3.1 ERECTION

- A. Place and secure steel joists strictly in accordance with SJI code of standard practice, SJI specifications, final shop drawings, and as herein specified.
- B. Placing Joists: Do not start placement of steel joists until supporting work is in place and secured. Place joists on supporting work, adjust and align in accurate locations and spacing before permanently fastening.
 - 1. Provide required bridging, connections, and anchors to ensure lateral stability during construction. Remove as required for architectural, structural, and mechanical clearances after erection.
 - 2. Where members support joists from both sides, and the supporting width does not meet the SJI recommendations for bearing lengths of both joists, then offset

joists to provide recommended bearing lengths. Such offsets shall be subject to approval by the Architect/Engineer.

- C. Bridging: Install bridging simultaneously with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams.

3.2 FASTENING JOISTS

- A. Do not permit erection of decking until joists are secured to supporting members, and are properly braced.
- B. Field weld joists to supporting steel framework in accordance with SJI specifications for type of joists used. Coordinate welding sequence and procedure with placing of joists.
- C. Joists where shown with bottom chord extensions shall not have the bottom chords connected to the supporting members until the full dead load is applied.
- D. Secure joists resting on masonry or concrete bearing surfaces by bedding in grout and anchoring to masonry or concrete construction as specified in SJI specifications for type of steel joist used.
- E. Touch-Up Painting: After joist installation, paint field bolt heads and nuts, welded areas, and abraded or rusty surfaces on joists and steel supporting members. Wire brush surfaces and clean with solvent before painting. Use same type of paint as used for shop painting.

3.3 ATTACHMENTS TO JOISTS

- A. The Contractor shall ensure that no cuts or holes are made in the members of the erected joists for attachment of ceiling, ducts, pipes, or any other items not specifically shown in the contract drawings. Use of power driven fasteners in the diagonal and bottom chord members of the joists is prohibited.
- B. The Contractor shall not hang any elements from the top or bottom chords of joists except ceiling, ducts, pipes or other items specifically shown on the Contract Documents, without the written authorization of the Engineer.

All pipes, ducts, and other mechanical, electrical, and plumbing equipment suspended from the joists shall have the hanger attached at a joist panel point only. No mechanical, electrical, or plumbing equipment shall be hung along the top or bottom chord between panel points except as approved otherwise in writing by the Architect/Engineer.

All ceilings weighing 3 PSF or less may have the grid hung anywhere along the bottom chord. Ceilings weighing more than 3 PSF shall have the grid hung only at joist panel points.

Heavy pipes, ducts, or other equipment hung from bar joists may require additional joist reinforcement and shall be referred to the Engineer for framing.

3.4 FIELD INSPECTION

Joists welded in place are also subject to inspection and testing. Remove and replace work found to be defective and provide new acceptable work at no cost to Owner. Expense of removing and replacing any portion of the steel joists for testing purposes will be borne by the Owner if welds are found to be satisfactory.

END OF SECTION 05 20 00

SECTION 05 31 00 - STEEL ROOF DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2. SCOPE OF WORK

- A. Supplier: The metal deck supplier shall furnish all metal deck materials and accessories indicated on the Architectural, Structural, and Mechanical Drawings required to produce a complete job including but not necessarily limited to deck units, cover plates, pour stops, metal deck edge closures, cell closures, cant strips, sump pans, and all related accessories.
- B. Erector: The Subcontractor responsible for erecting the metal deck shall provide all labor and equipment as required to place all metal deck components and accessories as described above.

1.3 QUALIFICATIONS

The metal deck supplier shall be a manufacturer with a minimum of two years successful experience and with a minimum of two successful jobs of a comparable size and scope to this project.

1.4 QUALITY ASSURANCE

The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

- A. Codes and Standards: Comply with provisions of the following codes and standards except as otherwise indicated or specified:
 - 1. "Design Manual for Composite Decks, Form Decks, and Roof Decks", as published by the Steel Deck Institute (SDI).
 - 2. "Specification for the Design of Cold Formed Steel Structural Members", as published by the American Iron and Steel Institute (AISI).
 - 3. "Structural Welding Code - Steel", as published by the American Welding Society (AWS).
- B. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with AWS procedures.

1.5 SUBMITTALS

- A. Product Certification: Submit manufacturer's specifications and installation instructions for each type of deck specified. Also submit a certificate of product compliance with SDI Standards as specified.
- B. Shop Drawings: Submit detailed shop drawings showing type of deck, complete layout, attachment details, closures, edge strips, supplementary framing, and all other accessories.
- C. Insurance Certification: Assist Architect and Owner in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire, windstorm, and extended coverage insurance.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. See General Notes on the drawings for the location, depth, design thickness, section properties, and suggested manufacturer for all required roof decks.

2.2 GRADES OF STEEL

Steel deck shall be manufactured from steel conforming to ASTM Designation A611 Grades C, D, or E for painted deck or A446 Grades A, B, C, D, E or F for galvanized deck or Engineer approved equal, having a minimum yield strength of 33,000 PSI.

2.3 FINISH

- A. Galvanizing: Steel deck shall be galvanized with a protective zinc coating conforming to ASTM A525 G60 class.

2.4 ROOF DECK ACCESSORIES

Provide minimum 20 gauge ridge and valley plates, minimum 20 gauge cant strips, minimum 14 gauge sump pans, minimum 20 gauge inside or outside closure channels, minimum 20 gauge butt strips at change of deck directions, minimum 20 gauge filler sheets, and rubber closures as required to provide a finished surface for the application of insulation and roofing.

2.5 FABRICATION

- A. Metal Deck Spans: Metal deck spans shall not exceed the maximum center-to-center spans as required by SDI criteria. Where possible, all metal deck shall extend over three or more supports.
- B. Metal Closure Strips: Fabricate metal closure strips of not less than 0.071" minimum (14 gage) cold-formed sheet steel. Form to provide tight fitting closures at open ends of cells or flutes and sides of decking. Provide sheet metal closures at all slab edges, columns, walls, and openings unless steel angles or bent plates are specified in details on the

drawings. Also, provide wherever deck stops or changes direction. Weld closures at edge supports with 1" long weld at 12" maximum centers unless shown otherwise on the drawings. Provide minimum 2" bearing over steel support. Closures and support welds shall be designed to support a 200 pound concentrated load at the roof edge without exceeding a stress of 0.8 Fy.

2.6 ROOF OPENINGS

Roof openings less than 6" square or diameter require no reinforcement. Openings 6" to 10" inclusive shall be reinforced with a 20 gauge galvanized plate welded to the deck at each corner and 6" maximum centers with a 5/8" diameter puddle weld or sheet metal screws. Larger openings shall be referred to the Engineer for framing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install deck units as accessories in accordance with manufacturers recommendations and approved shop drawings, and as specified herein:

1. Place deck units on supporting framework and adjust to final position with ends accurately aligned and bearing 2" minimum on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.
2. Place deck units in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting units.
3. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.
4. Do not place deck units on concrete supporting structure until concrete has cured and is dry.
5. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
6. Do not use roof deck units for storage or working platforms until permanently secured.

B. Attachment of Roof Deck:

1. Welding:
 - a. Typical Requirements: Roof deck units shall be welded to each structural support member using 5/8" diameter puddle welds at spacing shown on Typical Detail on plans. Weld metal shall penetrate all layers of deck material at end laps and side joints and shall have good fusion to the supporting members.

- b. Side Laps: Side laps of adjacent units shall be fastened by sheet metal screws at spacing shown on Typical Detail on plans.
 - c. Welding Washers: Welding washers shall be used only when welding steel deck less than 0.028" thickness.
- 2. Minimum Bearing: Provide a minimum end bearing of 3" over supports.
- 3. End Laps: End laps of sheets shall be a minimum of two inches and shall occur over supports. Roofs having a slope of 1/4 inch or more in 12 inches shall be erected beginning at the low side to insure that end laps are shingle fashion.
- C. Welding Requirements: Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
- D. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking.
- E. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength continuity of decking and support of other work shown on the drawings.
- F. Hanger Slots or Clips: Provide UL approved punched hanger slots between cells or flutes of lower element where roof deck units are to receive hangers for support of ceiling construction, air ducts, diffusers, or lighting fixtures.
 - 1. Hanger clips designed to clip over male side lap joints of roof deck units may be used instead of hanger slots.
 - 2. Locate slots or clips at not more than 14" o.c. in both directions, not over 9" from walls at ends, and not more than 12" from walls at sides, unless otherwise shown.
 - 3. Provide manufacturer's standard hanger attachment devices.
 - 4. Loads hanging from metal deck slabs shall not exceed 100 pounds unless specifically detailed otherwise on the drawings.
- G. Joint Covers: Provide metal joint covers at abutting ends and changes in direction of deck units, except where taped joints are specified.

3.2 TOUCH-UP PAINTING

After deck installation, wire brush, clean and paint scarred areas, welds and rust spots on top and bottom surfaces of decking units and supporting steel members.

Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.

Touch-up painted surfaces with same type of shop paint used on adjacent surfaces.

In areas where shop-painted surfaces are to be exposed, apply touch-up paint to blend into adjacent surfaces.

3.3 INSPECTION

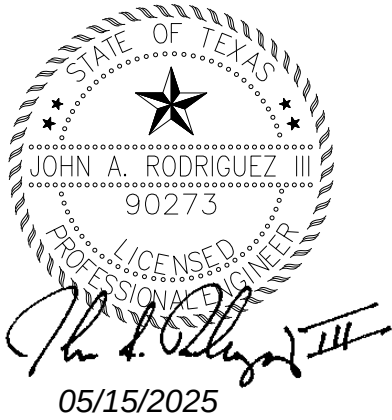
Welded decking in place is subject to inspection and testing by the Owner's Testing Laboratory. Expense of removing and replacing portions of decking for testing purposes will be borne by Owner if welds are found to be satisfactory. Remove work found to be defective and replace with new acceptable work. Cost of such removal and replacement shall be borne by the Contractor.

END OF SECTION 05 31 00

TABLE OF CONTENTS
MECHANICAL ELECTRICAL & PLUMBING SPECIFICATIONS
CITY OF PORT ARANSAS
NEW LIFEGUARD FACILITY

<u>SECTION</u>	<u>NAME</u>	<u>PAGES</u>
SECTION 22 05 00	BASIC MATERIALS AND METHODS	23
SECTION 22 07 00	INSIDE UTILITY TRENCH EXCAVATION, BACKFILL, AND COMPACTION	4
SECTION 22 08 00	OUTSIDE UTILITY TRENCH EXCAVATION, BACKFILL, AND COMPACTION	3
SECTION 22 14 00	HANGERS AND SUPPORTS	8
SECTION 22 19 00	SYSTEM IDENTIFICATION AND PIPE MARKING	3
SECTION 22 26 00	PIPING INSULATION	5
SECTION 22 41 00	PLUMBING PIPING & VALVES	20
SECTION 22 43 00	PLUMBING SPECIALTIES	6
SECTION 22 44 00	PLUMBING FIXTURES	5
SECTION 22 45 00	PLUMBING EQUIPMENT	6
SECTION 23 05 00	BASIC MATERIALS AND METHODS	23
SECTION 23 07 19	DX PIPING SYSTEM INSULATION	5
SECTION 23 14 00	SUPPORTS AND ANCHORS	7
SECTION 23 17 00	MOTORS AND MOTOR CONTROLLERS	6
SECTION 23 29 00	DUCT INSULATION	5
SECTION 23 53 00	REFRIGERANT PIPING	2
SECTION 23 58 54	DX FAN COIL UNIT	2
SECTION 23 67 10	AIR COOLED CONDENSING UNITS	3
SECTION 23 88 10	AIR DISTRIBUTION DEVICES	4
SECTION 23 88 85	AIR FILTERS	2
SECTION 23 89 00	METAL DUCTWORK	9
SECTION 23 91 00	DUCTWORK ACCESSORIES	7
SECTION 23 99 00	TESTING, ADJUSTING, & BALANCING	12
SECTION 26 01 00	ELECTRICAL GENERAL PROVISIONS	6
SECTION 26 06 00	GROUNDING	5
SECTION 26 07 50	ELECTRICAL IDENTIFICATION	4
SECTION 26 12 30	WIRE & CABLE	6
SECTION 26 13 60	RACEWAYS	8
SECTION 26 14 00	WIRING DEVICES	4
SECTION 26 24 16	PANELBOARDS	8

SECTION 26 43 13	SURGE PROTECTION DEVICES	4
SECTION 26 44 10	DISCONNECT SWITCHES	4
SECTION 26 51 00	LUMINAIRES	13
SECTION 26 74 00	TELEPHONE / DATA SYSTEM (ROUGH-IN)	2
SECTION 26 75 00	CABLE TELEVISION SYSTEM (ROUGH-IN)	2



SECTION 22 05 00 BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.
- B. The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore, shall be submitted to the Architect for approval as soon as practicable. No such departures shall be made without the prior written approval of the Architect.
- C. Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, such reference shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Architect, expressed in writing, is equal to that specified.

1.02 SCOPE OF WORK

- A. The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form the complete and functioning systems in all of its various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The contractor shall review all pertinent drawings, including those of other contracts prior to commencement of Work.
- B. This Division requires the furnishing and installing of all items Specified herein, indicated on the Drawings or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.
- C. The approximate locations of Mechanical (HVAC) and Plumbing items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building, and will in all cases be subject to the Review of the Owner or

BASIC MATERIALS AND METHODS	22 05 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

- D. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.
- E. All discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to the bidding, where this cannot be done at least 7 working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.
- F. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.
- G. It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified later, or necessary for a complete and functioning heating, ventilating and air conditioning system shall be considered a part of the overall "Scope".
- H. The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

1.03 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

- A. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the approved shop drawings.
- B. All duct or pipe or equipment locations as indicated on the documents do not indicate every transition, offset, or exact location. All transitions, offsets clearances and exact locations shall be established by actual field measurements, coordination with the structural, architectural and reflected ceiling plans, and other trades. Submit shop drawings for approval.
- C. All transitions, offsets and relocations as required by actual field conditions shall be performed by the contractor at no additional cost to the owner.
- D. Additional coordination with electrical contractor may be required to allow adequate clearances of electrical equipment, fixtures and associated appurtenances. Contractor to

BASIC MATERIALS AND METHODS	22 05 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

notify Architect and Engineer of unresolved clearances, conflicts or equipment locations.

1.04 SITE VISIT AND FAMILIARIZATION

- A. Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.
- B. Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.
- C. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.05 WORK SPECIFIED IN OTHER SECTIONS

- A. Finish painting is specified. Prime and protective painting are included in the work of this Division.
- B. Owner and General Contractor furnished equipment shall be properly connected to Mechanical (HVAC) and Plumbing systems.
- C. Furnishing and installing all required Mechanical (HVAC) and Plumbing equipment control relays and electrical interlock devices, conduit, wire and J-boxes are included in the Work of this Division.

1.06 PERMITS, TESTS, INSPECTIONS

- A. Arrange and pay for all permits, fees, tests, and all inspections as required by governmental authorities.

1.07 DATE OF FINAL ACCEPTANCE

- A. The date of final acceptance shall be the date of owner occupancy, or the date all punch list items have been completed or final payment has been received. Refer to Division 1 for additional requirements.
- B. The date of final acceptance shall be documented in writing and signed by the architect, owner and contractor.

1.08 DELIVERY, STORAGE, AND HANDLING

BASIC MATERIALS AND METHODS	22 05 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
- B. Deliver products to the project at such time as the project is ready to receive the equipment, pipe or duct properly protected from incidental damage and weather damage.
- C. Damaged equipment, duct or pipe shall be promptly removed from the site and new, undamaged equipment, pipe and duct shall be installed in its place promptly with no additional charge to the Owner.

1.09 NOISE AND VIBRATION

- A. The heating, ventilating and air conditioning systems, and the component parts thereof, shall be guaranteed to operate without objectionable noise and vibration.
- B. Provide foundations, supports and isolators as specified or indicated, properly adjusted to prevent transmission of vibration to the Building structure, piping and other items.
- C. Carefully fabricate ductwork and fittings with smooth interior finish to prevent turbulence and generation or regeneration of noise.
- D. All equipment shall be selected to operate with minimum of noise and vibration. If, in the opinion of the Architect, objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of the Work, the Contractor shall rectify such conditions without extra cost to the Owner.

1.10 APPLICABLE CODES

- A. Obtain all required permits and inspections for all work required by the Contract Documents and pay all required fees in connection thereof.
- B. Arrange with the serving utility companies for the connection of all required utilities and pay all charges, meter charges, connection fees and inspection fees, if required.
- C. Comply with all applicable codes, specifications, local ordinances, industry standards, utility company regulations and the applicable requirements of the following nationally accepted codes and standards:
 - 1. Air Moving & Conditioning Association, AMCA.
 - 2. American Standards Association, ASA.
 - 3. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE.
 - 4. American Society of Mechanical Engineers, ASME.
 - 5. American Society of Plumbing Engineers, ASPE.

BASIC MATERIALS AND METHODS	22 05 00 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

6. American Society of Testing Materials, ASTM.
 7. American Water Works Association, AWWA.
 8. National Bureau of Standards, NBS.
 9. National Fire Protection Association, NFPA.
 10. Sheet Metal & Air Conditioning Contractors' National Association, SMACNA.
 11. Underwriters' Laboratories, Inc., UL.
 12. International Energy Conservation Code, IECC.
- D. Where differences existing between the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, the more stringent or costly application shall govern. Promptly notify the Engineer in writing of all differences.
- E. When directed in writing by the Engineer, remove all work installed that does not comply with the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, correct the deficiencies, and complete the work at no additional cost to the Owner.

1.11 DEFINITIONS AND SYMBOLS

- A. General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 1.
- B. Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.
- C. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.
- D. Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

BASIC MATERIALS AND METHODS	22 05 00 - 5
24214 - COPA New Lifeguard Facility	5-15-2025

- E. Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.
- F. Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.
- G. Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.
- H. Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.
- I. Installer: Entity (person or firm) engaged by the Contractor or its subcontractor or Sub-contractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.
- J. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or when so noted by other identified installers or entities.
- K. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.
- L. Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self explanatory nature have been included in text of Specifications and Drawings. Specific

BASIC MATERIALS AND METHODS	22 05 00 - 6
24214 - COPA New Lifeguard Facility	5-15-2025

abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by 2004 ASHRAE Fundamentals Handbook, chapter 37 "Abbreviations and Symbols", ASME and ASPE published standards.

1.12 DRAWINGS AND SPECIFICATIONS

- A. These Specifications are intended to supplement the Drawings and it will not be the province of the Specifications to mention any part of the work which the Drawings are competent to fully explain in every particular and such omission is not to relieve the Contractor from carrying out portions indicated on the Drawings only.
- B. Should items be required by these Specifications and not indicated on the Drawings, they are to be supplied even if of such nature that they could have been indicated thereon. In case of disagreement between Drawings and Specifications, or within either Drawings or Specifications, the better quality or greater quantity of work shall be estimated and the matter referred to the Architect or Engineer for review with a request for information and clarification at least 7 working days prior to bid opening date for issuance of an addendum.
- C. The listing of product manufacturers, materials and methods in the various sections of the Specifications, and indicated on the Drawings, is intended to establish a standard of quality only. It is not the intention of the Owner or Engineer to discriminate against any product, material or method that is equal to the standards as indicated and/or specified, nor is it intended to preclude open, competitive bidding. The fact that a specific manufacturer is listed as an acceptable manufacturer should not be interpreted to mean that the manufacturers' standard product will meet the requirements of the project design, Drawings, Specifications and space constraints.
- D. The Architect or Engineer and Owner shall be the sole judge of quality and equivalence of equipment, materials and methods.
- E. Products by other reliable manufacturers, other materials, and other methods, will be accepted as outlined, provided they have equal capacity, construction, and performance. However, under no circumstances shall any substitution be made without the written permission of the Architect or Engineer and Owner. Request for prior approval must be made in writing 10 days prior to the bid date without fail.

BASIC MATERIALS AND METHODS	22 05 00 - 7
24214 - COPA New Lifeguard Facility	5-15-2025

- F. Wherever a definite product, material or method is specified and there is not a statement that another product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method is the only one that shall be used without prior approval.
- G. Wherever a definite material or manufacturer's product is specified and the Specification states that products of similar design and equal construction from the specified list of manufacturers may be substituted, it is the intention of the Owner or Engineer that products of manufacturers that are specified are the only products that will be acceptable and that products of other manufacturers will not be considered for substitution without approval.
- H. Wherever a definite product, material or method is specified and there is a statement that "OR EQUAL" product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method or an "OR EQUAL" product, material or method may be used if it complies with the specifications and is submitted for review to the Engineer as outline herein.
- I. Where permission to use substituted or alternative equipment on the project is granted by the Owner or Engineer in writing, it shall be the responsibility of the Contractor or Subcontractor involved to verify that the equipment will fit in the space available which includes allowances for all required Code and maintenance clearances, and to coordinate all equipment structural support, plumbing and electrical requirements and provisions with the Mechanical (HVAC) and Plumbing Design Documents and all other trades, including Division 26.
- J. Changes in architectural, structural, electrical, mechanical, and plumbing requirements for the substitution shall be the responsibility of the bidder wishing to make the substitution. This shall include the cost of redesign by the affected designer(s). Any additional cost incurred by affected subcontractors shall be the responsibility of this bidder and not the owner.
- K. If any request for a substitution of product, material or method is rejected, the Contractor will automatically be required to furnish the product, material or method named in the Specifications. Repetitive requests for substitutions will not be considered.
- L. The Owner or Engineer will investigate all requests for substitutions when submitted in accordance with above and if accepted, will issue a letter allowing the substitutions.
- M. **Where equipment other than that used in the design as specified or shown on the Drawings is substituted (either from an approved manufacturers list or by submittal review), it shall be the responsibility of the substituting Contractor to coordinate space requirements, building provisions and connection requirements with his trades and all other trades and pay all additional costs to other trades, the Owner, the Architect or Engineer, if any, due to the substitutions.**

BASIC MATERIALS AND METHODS	22 05 00 - 8
24214 - COPA New Lifeguard Facility	5-15-2025

- N. The electrical design and electrical drawings are based on the equipment and/or electric motors of the type, size and electrical characteristics shown and specified on the mechanical drawings. Any change in equipment and/or motor size or type brought on directly or indirectly by a substitution or mechanical equipment having characteristics requiring a change, shall be the responsibility of the Mechanical Contractor and the entire cost of such change, including conduit, wiring, motor starting equipment, etc., shall be paid for by the Mechanical Contractor at no additional charge, unless the substitution was initiated by the Owner. Submittals must clearly show and deviations. Mechanical Contractor is responsible for coordinating any required changes with the Electrical Contractor, prior to Electrical Contractors ordering of panels and associated equipment.

1.13 SUBMITTALS

- A. Coordinate with Division 1 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded the Contractor shall submit a minimum of eight (8) complete bound sets of shop drawings and complete data covering each item of equipment or material. The first submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive shop drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain one (1) copy each of all shop drawings for their files. Where full size drawings are involved, submit one (1) print and one (1) reproducible sepia or mylar in lieu of eight (8) sets. All literature pertaining to an item subject to Shop Drawing submittal shall be submitted at one time. A submittal shall not contain information from more than one Specification section, but may have a section subdivided into items or equipment as listed in each section. The Contractor may elect to submit each item or type of equipment separately. Each submittal shall include the following items enclosed in a suitable binder:
1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
 2. An index page with a listing of all data included in the Submittal.
 3. A list of variations page with a listing all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.

BASIC MATERIALS AND METHODS	22 05 00 - 9
24214 - COPA New Lifeguard Facility	5-15-2025

4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
 5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
 6. Identification of each item of material or equipment matching that indicated on the Drawings.
 7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
 8. Additional information as required in other Sections of this Division.
 9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".
- B. Refer to Division 1 for additional information on shop drawings and submittals.
- C. Equipment and materials submittals and shop drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of shop drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.
- D. Where shop drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.
- E. Shop drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:
1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.
 2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.

BASIC MATERIALS AND METHODS	22 05 00 - 10
24214 - COPA New Lifeguard Facility	5-15-2025

3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.
 4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous shop drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.
 5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all shop drawings.
 6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.
- F. Materials and equipment which are purchased or installed without shop drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.
- G. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.
- H. Submittals are required for, but not limited to, the following items:
1. Pipe Material and Specialties.
 2. Pipe Fabrication Drawings.
 3. Basic Materials.
 4. Variable Air Volume Boxes.
 5. Air Handling Units.
 6. Cooling Towers.
 7. Chillers.
 8. Air Cooled Condensing Units.

BASIC MATERIALS AND METHODS	22 05 00 - 11
24214 - COPA New Lifeguard Facility	5-15-2025

9. Water Treatment.
10. Expansion Compensation.
11. Variable Frequency Drives.
12. Noise and Vibration Controls.
13. Plumbing Fixtures and Specialties.
14. Plumbing Equipment.
15. Sanitary DWV Fittings, Pipe and Accessories.
16. Domestic Hot and Cold Water Pipe, Fittings and Accessories.
17. HVAC Pipe and Duct Insulation.
18. Hydronic and Plumbing Valves.
19. Hydronic Piping and Accessories.
20. Hydronic Pumps.
21. Roof-Top A/C Units.
22. Heating Water Boiler.
23. Portable Pipe Hanger and Equipment Supports.
24. Duct Specialties.
25. Duct Fabrication Drawings.
26. Air Distribution Devices.
27. Fan Coil Units.
28. Filters.
29. Fans.
30. Fire Dampers and Fire Smoke Dampers.
31. Temperature Controls and Control Sequences.
32. Test, Adjust and Balance Reports.
33. Testing, Adjusting and Balancing Contractor Qualifications.
34. Coordination Drawings.

- I. Refer to other Division 22 sections for additional shop drawing requirements. Provide samples of actual materials and/or equipment to be used on the Project upon request of the Owner or Engineer.
- J. Contractor to submit Mechanical/Electrical equipment coordination sheet with equipment submittal for all AHU's, ACCU's, and Fans. Reference chart at end of section. Provide copy to electrical subcontractor.

1.14 COORDINATION DRAWINGS

- A. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

BASIC MATERIALS AND METHODS	22 05 00 - 12
24214 - COPA New Lifeguard Facility	5-15-2025

1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:
 - a. Wall and type locations.
 - b. Clearances for installing and maintaining insulation.
 - c. Locations of light fixtures and sprinkler heads.
 - d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
 - e. Equipment connections and support details.
 - f. Exterior wall and foundation penetrations.
 - g. Routing of storm and sanitary sewer piping.
 - h. Fire-rated wall and floor penetrations.
 - i. Sizes and location of required concrete pads and bases.
 - j. Valve stem movement.
 - k. Structural floor, wall and roof opening sizes and details.
 2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
 3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
 4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.
- B. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.
- C. By submitting shop drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.15 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements in Special Project Requirements, in addition to the requirements specified in Division 22, indicate the following installed conditions:
1. Duct mains and branches, size and location, for both exterior and interior; locations of dampers, fire dampers, duct access panels, and other control devices; filters, fuel fired heaters, fan coils, condensing units, and roof-top A/C 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

BASIC MATERIALS AND METHODS	22 05 00 - 13
24214 - COPA New Lifeguard Facility	5-15-2025

- located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.
3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 4. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
 5. Contract Modifications, actual equipment and materials installed.
- B. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.
- C. The Contractor shall maintain a set of clearly marked black line record "AS-BUILT" prints on the job site on which he shall mark all work details, alterations to meet site conditions and changes made by "Change Order" notices. These shall be kept available for inspection by the Owner, Architect or Engineer at all times.
- D. Refer to Division 1 for additional requirements concerning record drawings. If the Contractor does not keep an accurate set of as-built drawings, the pay request may be altered or delayed at the request of the Architect. Mark the drawings with a colored pencil. Delivery of as-built prints and reproducible is a condition of final acceptance.
- E. The record prints shall be updated on a daily basis and shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed pipe or duct, locations of all concealed valves, controls and devices and any deviations from the work shown on the Construction Documents which are required for coordination. All dimensions shall include at least two dimensions to permanent structure points.
- F. Submit three prints of the tracings for approval. Make corrections to tracings as directed and delivered "Auto Positive Tracings" to the architect. "As-Built" drawings shall be furnished in addition to shop drawings.
- G. When the option described in paragraph F., above is not exercised then upon completion of the work, the Contractor shall transfer all marks from the submit a set of clear concise set of reproducible record "AS-BUILT" drawings and shall submit the reproducible drawings with corrections made by a competent draftsman and three (3) sets of black line prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The reproducible record "AS-BUILT" drawings shall have the Engineers Name and Seal removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

BASIC MATERIALS AND METHODS	22 05 00 - 14
24214 - COPA New Lifeguard Facility	5-15-2025

(NAME OF GENERAL CONTRACTOR)

BY: _____
(SIGNATURE)

(NAME OF SUBCONTRACTOR)

BY: _____
(SIGNATURE)

1.16 OPERATING MANUALS

- A. Prepare maintenance manuals in accordance with Division 1 and 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.

1.17 CERTIFICATIONS AND TEST REPORTS

- A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and schedule date for each test. This detailed completion and test schedule shall be submittal at least 90 days before the projected Project completion date.
- B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.
- C. Submit 4 copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.
- D. Certifications and test reports to be submitted shall include, but not be limited to those items outlined in Section of Division 22.

BASIC MATERIALS AND METHODS	22 05 00 - 15
24214 - COPA New Lifeguard Facility	5-15-2025

1.18 MAINTENANCE MANUALS

- A. Coordinate with Division 1 for maintenance manual requirements, unless noted otherwise bind together in "D ring type" binders by National model no. 79-883 or equal, binders shall be large enough to allow $\frac{1}{4}$ " of spare capacity. Three (3) sets of all approved shop drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections and labeled for easy reference and shall utilize the individual specification section numbers shown in the Mechanical Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 22 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.
- B. Prepare maintenance manuals in accordance with Special Project Conditions, in addition to the requirements specified in Division 22, include the following information for equipment items:
1. Identifying names, name tags designations and locations for all equipment.
 2. Valve tag lists with valve number, type, color coding, location and function.
 3. Reviewed shop drawing submittals with exceptions noted compliance letter.
 4. Fabrication drawings.
 5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
 6. 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.
 7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions, servicing instructions and lubrication charts and schedules.
 8. Equipment and motor name plate data.
 9. Wiring diagrams.
 10. Exploded parts views and parts lists for all equipment and devices.
 11. Color coding charts for all painted equipment and conduit.
 12. Location and listing of all spare parts and special keys and tools furnished to the Owner.
 13. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.
- C. Refer to Division 1 for additional information on Operating and Maintenance Manuals.

BASIC MATERIALS AND METHODS	22 05 00 - 16
24214 - COPA New Lifeguard Facility	5-15-2025

- D. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer a minimum of 14 working days prior to the beginning of the operator training period.

1.19 OPERATOR TRAINING

- A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include 12 hours of on site training in three 4 hour shifts.
- B. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.
- C. Refer to other Division 22 Sections for additional Operator Training requirements.

1.20 FINAL COMPLETION

- A. At the completion of the work, all equipment and systems shall be tested and faulty equipment and material shall be repaired or replaced. Refer to Sections of Division 22 for additional requirements.
- B. Clean and adjust all air distribution devices and replace all air filters immediately prior to final acceptance.
- C. Touch up and/or refinish all scratched equipment and devices immediately prior to final acceptance.

1.21 CONTRACTOR'S GUARANTEE

- A. Use of the HVAC and Plumbing systems to provide temporary service during construction period will not be allowed without permission from the Owner in writing and if granted shall not be cause warranty period to start, except as defined below.
- B. Contractor shall guarantee to keep the entire installation in repair and perfect working order for a period of one year after its completion and final acceptance, and shall furnish free of additional cost to the Owner all materials and labor necessary to comply with the above guarantee throughout the year beginning from the date of issue of Substantial Completion, Beneficial Occupancy by the Owner or the Certificate of Final Payment as agreed upon by all parties.

BASIC MATERIALS AND METHODS	22 05 00 - 17
24214 - COPA New Lifeguard Facility	5-15-2025

- C. This guarantee shall not include cleaning or changing filters except as required by testing, adjusting and balancing.
- D. All air conditioning compressors shall have parts and labor guarantees for a period of not less than 5 years beyond the date of final acceptance.
- E. Refer to Sections in Division 22 for additional guarantee or warranty requirements.

1.22 TRANSFER OF ELECTRONIC FILES

- A. Project documents are not intended or represented to be suitable for reuse by Architect/Owner or others on extensions of this project or on any other project. Any such reuse or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner's risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney's fees arising out of or resulting thereof.
- B. Because data stored in electric media format can deteriorate or be modified inadvertently, or otherwise without authorization of the data's creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.
- C. When transferring documents in electronic media format, Engineer makes no representations as to the long term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.
- D. Any reuse or modifications will be Contractor's sole risk and without liability or legal exposure to Architect, Engineer or any consultant.
- E. The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect's written consent.

It is agreed that "MEP" hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The contract documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement between Architect and Owner.

If the client, Architect/Owner, or developer of the project requires electronic media for "record purposes", then an AutoCAD based compact disc ("CD") will be prepared. The "CD"

BASIC MATERIALS AND METHODS	22 05 00 - 18
24214 - COPA New Lifeguard Facility	5-15-2025

will be submitted with all title block references intact and will be formatted in a “plot” format to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.

- F. At the Architect/Owner’s request, Engineer will prepare one “CD” of electronic media to assist the contractor in the preparation of submittals. The Engineer will prepare and submit the “CD” to the Architect/Owner for distribution to the contractor. All copies of the “CD” will be reproduced for a cost of reproduction fee of Five Hundred Dollars (\$500.00) per “CD”.

The “CD” will be prepared and all title blocks, names and dates will be removed. The “CD” will be prepared in a “.dwg” format to permit the end user to revise the drawings.

- G. This Five Hundred Dollars (\$500.00) per “CD” cost of reproduction will be paid directly from the Contractor to the Engineer. The “CD” will be prepared only after receipt of the Five Hundred Dollars (\$500.00). The Five Hundred Dollars (\$500.00) per “CD” cost of reproduction is to only recover the cost of the manhours necessary to reproduce the documents. It is not a contractual agreement between the Contractor and Engineer to provide any engineering services, nor any other service.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide materials and equipment manufactured by a domestic United States manufacturer.
- B. Access Doors: Provide access doors as required for access to equipment, valves, controls, cleanouts and other apparatus where concealed. Access doors shall have concealed hinges and screw driver cam locks.
- C. All access panels located in wet areas such as restrooms, locker rooms, shower rooms, kitchen and any other wet areas shall be constructed of stainless steel.
- D. Access Doors: shall be as follows:
1. Plastic Surfaces: Milcor Style K.
 2. Ceramic Tile Surface: Milcor Style M.
 3. Drywall Surfaces: Milcor Style DW.
 4. Install panels only in locations approved by the Architect.

PART 3 - EXECUTION

3.01 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected via reviewed submittals.

BASIC MATERIALS AND METHODS	22 05 00 - 19
24214 - COPA New Lifeguard Facility	5-15-2025

- B. Refer to equipment specifications in Divisions 2 through 28 for additional rough-in requirements.

3.02 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.
 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 architectural action markings on submittal, 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, resolve conflicts and route proposed solution to the Architect for review.
 9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
 10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location and label.
 11. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified.
 12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

BASIC MATERIALS AND METHODS	22 05 00 - 20
24214 - COPA New Lifeguard Facility	5-15-2025

13. Provide roof curbs for all roof mounted equipment. Coordinate with roof construction for pitched roof. Provide roof curb to match roof slope. Refer to architectural drawings and details.
14. The equipment to be furnished under this Specification shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the product of the same manufacturer.
15. The architectural and structural features of the building and the space limitations shall be considered in selection of all equipment. No equipment shall be furnished which will not suit the arrangement and space limitations indicated.
16. Lubrication: Prior to start-up, check and properly lubricate all bearings as recommended by the manufacturer.
17. Where the word "Concealed" is used in these Specifications in connection with insulating, painting, piping, ducts, etc., it shall be understood to mean hidden from sight as in chases, furred spaces or suspended ceilings. "Exposed" shall be understood to mean the opposite of concealed.
18. Identification of Mechanical Equipment:
 - a. Mechanical equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Shop drawings shall include dimensions and lettering format for approval. Attachments shall be with escutcheon pins, self-tapping screws, or machine screws.
 - b. Tags shall be attached to all valves, including control valves, with nonferrous chain. Tags shall be brass and at least 1-1/2 inches in diameter. Nameplate and tag symbols shall correspond to the identification symbols on the temperature control submittal and the "as-built" drawings.

3.03 CUTTING AND PATCHING

- A. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
 1. Uncover Work to provide for installation of ill-timed Work.
 2. Remove and replace defective Work.
 3. Remove and replace Work not conforming to requirements of the Contract Documents.
 4. Remove samples of installed Work as specified for testing.
 5. Install equipment and materials in existing structures.
 6. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer/Owner's observation of concealed Work, without additional cost to the Owner.

BASIC MATERIALS AND METHODS	22 05 00 - 21
24214 - COPA New Lifeguard Facility	5-15-2025

7. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers; refer to the materials and methods required for the surface and building components being patched; Refer to Section "DEFINITIONS" for definition of "Installer."
- C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, mechanical ducts and HVAC 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.

3.04 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER

- A. The Owner will cooperate with the Contractor, however, the following provisions must be observed:
 1. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Sub-Contractors and the Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.
 2. During the construction of this project, normal facility activities will continue in existing buildings until renovated areas are completed. Plumbing, fire protection, lighting, electrical, communications, heating, air conditioning, and ventilation systems will have to be maintained in service within the occupied spaces of the existing building.

END OF SECTION 22 05 00

Plumbing/Elec. Equipment Coordination Sheet					
Mark #	Unit Type	Manufacturer's Recomm. Fuse Size (MOCP)	Mark #	Unit Type	Manufacturer's Recomm. Fuse Size (MOCP)

BASIC MATERIALS AND METHODS	22 05 00 - 22
24214 - COPA New Lifeguard Facility	5-15-2025

BASIC MATERIALS AND METHODS	22 05 00 - 23
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 22 07 00 INSIDE UTILITY TRENCH EXCAVATION, BACKFILL, AND COMPACTION

PART 1 – GENERAL

1.01 DESCRIPTION

- A. This section describes general requirements, products, and methods of execution relating to excavation, backfill and compaction of inside trenches for mechanical work. Inside trenches are those which occur within an arbitrary, imaginary boundary five feet beyond the outside perimeter of the structure.
- B. Scope: Provide all trench work for mechanical work of every description and of whatever substance encountered to the depth indicated, or to provide pipe slopes and elevations shown on the drawing. Excavate and backfill utility trenches. Place and compact bedding material on compact backfill material.
- C. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.02 APPLICABLE CODES

- A. Local Codes and Ordinances
- B. Texas Safety Standards
- C. OSHA – Section 1926.650

1.03 SAFETY PRECAUTIONS AND PROGRAMS

- A. It shall be the duty and responsibility of the Contractor and all of its subcontractors to be familiar and comply with all requirements of Public Law 91-696, 29 U.S.C. Secs. 651 et. seq., the Occupational Safety and Health Act of 1970, (OSHA) and all amendments thereto, and to enforce and comply with all of these provisions of this Act. IN ADDITION, ON PROJECTS IN WHICH TRENCH EXCAVATION WILL EXCEED A DEPTH OF FIVE FEET, THE CONTRACTOR AND ALL OF ITS SUBCONTRACTORS SHALL COMPLY WITH ALL REQUIREMENTS OF 29 C.F.R. SECS. 1926.652 AND 1926.653, OSHA SAFETY AND HEALTH STANDARDS.

PART 2 – BEDDING MATERIAL

2.01 BEDDING MATERIAL

INSIDE UTILITY TRENCH EXCAVATION, BACKFILL, AND COMPACTION	22 07 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Select bedding material from trench excavation using care to separate it from unsuitable material. If suitable bedding material is not available from trench excavation, import it from sources approved by the Architect.
- B. Use clean sand. Maintain moisture content within a range that will allow specified compaction.

2.02 TRENCH BACKFILL

- A. Obtain trench backfill material from trench excavation. If sufficient suitable trench backfill material compatible with structural backfill is not available from trench excavation, import it from sources approved by Architect.
- B. Use granular material, free from large stones, boulders and debris. Maintain moisture content within a range that will allow specified compaction. Maximum aggregate size four inches (4").

PART 3 – EXECUTION

3.01 EXCAVATION

- A. Place all excavated material suitable for backfill in an orderly manner, and in conformance with safety codes.
- B. Dispose of all material not suitable for backfilling.
- C. Form bell holes so pipelines rest on continuous undisturbed soil. If larger rocks or boulders are encountered, remove them. If trenches are below specified grade, backfill to required depth with select granular materials free from debris and rock, and compact to proper grade before installing piping.

3.02 LOCATION

- A. Locate trenches to accommodate utilities shown on drawings
- B. Construct trench with adequate width to allow compaction equipment to be used at the sides of pipes.
- C. Make trench side slopes conform to prevailing safety code requirements.

3.03 DEWATERING

- A. Perform whatever work is necessary to prevent the flow and accumulation of surface or ground water in the excavation.

3.04 TIMING

INSIDE UTILITY TRENCH EXCAVATION, BACKFILL, AND COMPACTION	22 07 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Do not backfill until underground mechanical system has been properly tested, inspected and approved.
- B. Coordinate with the work of others, and complete all trench work in a timely manner.

3.05 BEDDING

- A. Place bedding material under, around, and over the pipe in lifts not exceeding 8" in depth.
- B. Work material around pipe by hand methods, taking care to keep any oversize or sharp stones out of contact with the pipe, and to provide uniform support for the pipe.
- C. Cover pipe with bedding material to building subgrade or to a minimum 12" depth before adding other backfill.

3.06 BACKFILLING

- A. Continue placing backfill material until trench is completely filled to building subgrade, or as shown on drawings.
- B. Place backfill material in lifts not to exceed 12" in depth.

3.07 COMPACTION

- A. Compact all bedding material to at least 95% of maximum density, taking care not to damage the pipe.
- B. Compact all backfill under footings, slabs, and other structures to 95% of maximum density or more, if required by the Architect.
- C. Compact other areas to preclude future settlements, or at least 85% of maximum density.

3.08 FINISHING

- A. After completion of backfilling, dispose of excess material and smooth the surface of grade.
- B. Do not allow heavy equipment to be used over backfilled work that does not have sufficient cover to prevent pipe damage.

3.09 SPECIAL PRECAUTIONS

- A. Avoid unauthorized and unnecessary excavations.

INSIDE UTILITY TRENCH EXCAVATION, BACKFILL, AND COMPACTION	22 07 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

- B. Minimize number and size of excavations under footings or bearing walls.
- C. Support footings, foundations, and walls with timbers and jacks if there appears to be any possible chance of damage, and keep such precautions in place to eliminate possible damage.
- D. Backfill under footings and bearing walls, using maximum compaction or concrete or proportions as specified for footings.
- E. Avoid damage to all existing underground services, foundations, cables, conduit lines or foundations. Repair any existing underground work accidentally damaged at no additional cost to the Owner.

3.10 UNDER EXISTING SLAB INSTALLATION

- A. When breaking out an existing floor slab, make a saw cut and remove concrete. When repouring concrete, compact the fill to the same specifications as the building fill. Re: Architectural/Structural. Make necessary saw cuts and patching as required.

END OF SECTION 22 07 00

INSIDE UTILITY TRENCH EXCAVATION, BACKFILL, AND COMPACTION	22 07 00 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 22 08 00 OUTSIDE UTILITY TRENCH EXCAVATION, BACKFILL, AND COMPACTION

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

- A. Related Work Specified Elsewhere:
 - 1. Section 220500 – Basic Materials and Methods
 - 2. Division 2 – Site Work
- B. Description: This section described general requirements, products, and methods of execution relating excavation, backfill, and compaction of utility trenches outside of buildings. The arbitrary line of demarcation between inside and outside of buildings occurs 5 feet outside the building perimeters.
- C. It shall be the duty and responsibility of the Contractor and all of its subcontractors to be familiar and comply with all requirements of Public Law 91-696, 29 U.S.C. Secs. 651 et. seq., the Occupational Safety and Health Act of 1970, (OSHA) and all amendments thereto, and to WHICH TRENCH EXCAVATION WILL EXCEED A DEPTH OF FIVE FEET, THE CONTRACTOR AND ALL OF ITS SUBCONTRACTORS SHALL COMPLY WITH ALL REQUIREMENTS OF 29 C.F.R. SECS. 1926.652 AND 1926.653, OSHA SAFETY AND HEALTH STANDARDS.
- D. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

PART 2 – PRODUCTS

2.01 BEDDING MATERIAL

- A. Select bedding material from trench excavation using care to separate it from unsuitable material. If suitable bedding material is not available from trench excavation, import it from sources approved by the Architect.
- B. Use granular material, free from large stones, boulders and debris. Maximum aggregate size passing a 2" sieve opening. Maintain moisture content within a range that will allow specified compaction.

2.02 TRENCH BACKFILL

OUTSIDE UTILITY TRENCH EXCAVATION, BACKFILL, AND COMPACTION	22 08 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Obtain trench backfill material from trench excavation. If sufficient suitable trench backfill material is not available from trench excavation, import it from sources approved by the Architect.
- B. Use granular material, free from large stones, boulders, and debris. Maintain moisture content within range that will allow specified compaction. Maximum aggregate size shall be 4 inches.

PART 3 – EXECUTION

3.01 EXCAVATION

- A. Excavate trenches to depth and grades as shown on drawings.
- B. Place all excavated material suitable for backfill in an orderly manner and in conformance with safety codes.
- C. Dispose of all material not suitable for backfill.
- D. Form bell holes so pipelines rest on continuous undisturbed soil. If larger rocks or boulders are encountered, remove them. If ground surface is below specified pipe grade, fill to required depth with granular materials free from debris and rock, and compact to proper grade before installing piping.

3.02 LOCATION

- A. Locate trenches to accommodate utilities shown on the drawings.
- B. Construct trench with adequate width to allow compaction equipment to be used at the side of pipes.
- C. Make trench side slopes conform to prevailing safety code requirements.

3.03 DE-WATERING

- A. Perform whatever work is necessary to prevent flow and accumulation of surface or ground water in the excavation.

3.04 TIMING

- A. Do not complete backfill until utility system has been properly tested, inspected, and approved.
- B. Coordinate with the work of others and complete all trench work in a timely manner.

OUTSIDE UTILITY TRENCH EXCAVATION, BACKFILL, AND COMPACTION	22 08 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

3.05 BEDDING

- A. Place bedding material under, around, and over pipe in lifts not exceeding 8" in depth.
- B. Work material around pipe by hand methods, taking care to keep any oversize or sharp stones out of contact with the pipe, and provide uniform support for the pipe.
- C. Cover pipe with bedding material to a minimum 6" depth before adding other backfill.
- D. Cover water line with 18" bedding material before backfilling.

3.06 BACKFILLING

- A. Continue placing backfill material until trench is completely filled to finished grade, or as shown on the drawing.
- B. Place backfill material in lifts not to exceed 12" in depth.

3.07 COMPACTION

- A. Compact all bedding material to at least 95% of maximum density, taking care not to damage the pipe.
- B. Compact backfill material to preclude future settlement or at least to 90% of maximum density.

3.08 FINISHING

- A. After completion of backfilling, dispose of excess material and smooth the surface to grade.
- B. Restore all surface areas to original conditions, or improve as shown on the drawings.
- C. Replace all paving, base course, gravel surfacing, sub-base, topsoil or other existing finished surface shown or not shown on the drawings.
- D. Clean up and finish all construction areas to original condition or better.

END OF SECTION 22 08 00

OUTSIDE UTILITY TRENCH EXCAVATION, BACKFILL, AND COMPACTION	22 08 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 22 14 00 HANGERS, SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Pipe, and equipment hangers, supports, and associated anchors.
- B. Sleeves and seals.
- C. Flashing and sealing equipment and pipe stacks.

1.02 RELATED WORK

- A. Section 232400 - Vibration Isolation.
- B. Section 222600 - Piping Insulation.
- C. Section 232800 - Equipment Insulation.
- D. Section 211300 - Fire Protection System.
- E. Section 224100 - Plumbing System.
- F. Section 235100 - Hydronic Piping.
- G. Section 235300 – Refrigerant Piping

1.03 REFERENCES

- A. ANSI/ASME B31.1 - Power Piping.
- B. NFPA 13 - Standard for the Installation of Sprinkler Systems.
- C. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.

1.04 QUALITY ASSURANCE

- A. Supports for Sprinkler Piping: In conformance with NFPA 13.
- B. Supports for Standpipes: In conformance with NFPA 14.

1.05 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Division 1.

HANGERS, SUPPORTS AND ANCHORS	22 14 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

- B. Indicate hanger and support framing and attachment methods.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch Malleable iron, adjustable swivel, split ring.
- B. Hangers for Pipe Sizes 2 to 4 Inches Carbon steel, adjustable, clevis.
- C. Hangers for Pipe Sizes 6 Inches and over: Adjustable steel yoke, cast iron roll, double hanger.
- D. All hangers, struts, supports and rods in areas exposed to the outdoors, such as but not limited to crawl spaces, service bays, wash bays, open shops and warehouses shall be marine grade 316 stainless steel.
- E. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for pipe sizes 6 inches and over.
- F. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
- G. Wall Support for Pipe Sizes 4 Inches and over: adjustable steel yoke and cast iron roll.
- H. Vertical Support: Steel riser clamp.
- I. Floor Support for Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.
- J. Floor Support for Pipe Sizes 6 Inches and over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
- K. Roof Pipe Supports and Hangers: Marine grade 316 Stainless Steel Channel System as manufactured by Portable Pipe Hangers, Inc. or approved equal.
- For pipes 2-1/2" and smaller – Type PP10 with roller
For pipes 3" through 8" – Type PS
For multiple pipes – Type PSE - Custom
- L. Copper Pipe Support and Hangers: Electro-galvanized with thermoplastic elastomer cushions; Unistrut "Cush-A-Clamp" or equal. Hangers: Plastic coated; Unistrut or equal.
- M. For installation of protective shields refer to specification section 231400-3.03.

HANGERS, SUPPORTS AND ANCHORS	22 14 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

- N. Shields for Vertical Copper Pipe Risers: Sheet lead.
- O. Pipe Rough-In Supports in Walls/Chases: Provide preformed plastic pipe supports, Sioux Chief "Pipe Titan" or equal.

2.02 HANGER RODS

- A. Galvanized Hanger Rods: Threaded both ends, threaded one end, or continuous threaded. Hanger rods exposed to the outdoors including garage bays shall be 316 stainless steel.

2.03 INSERTS

- A. Inserts: Malleable iron case of stainless steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.04 FLASHING

- A. Metal Flashing: 20 gage stainless steel.
- B. Lead Flashing: 4 lb./sq. ft. sheet lead for waterproofing; 1 lb./sq. ft. sheet lead for soundproofing.
- C. Caps: Steel, 20 gage minimum; 16 gage at fire resistant elements.
- D. Coordinate with roofing contractor/architect for type of flashing on metal roofs.

2.05 EQUIPMENT CURBS

- A. Fabricate curbs of stainless steel unless noted otherwise.

2.06 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: Form with 18 gage galvanized steel, tack welded to form a uniform sleeve.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Form with steel pipe, schedule 40.
- C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fireproofing: Prefabricated fire rated steel sleeves including seals, UL listed.
- D. Sleeves for Round Ductwork: Form with galvanized steel.

HANGERS, SUPPORTS AND ANCHORS	22 14 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

- E. Sleeves for Rectangular Ductwork: Form with galvanized steel.
- F. Fire Stopping Insulation: Glass fiber type, non-combustible, U.L. listed.
- G. Caulk: Paintable 25-year acrylic sealant.
- H. Pipe Alignment Guides: Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted, two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

2.07 FABRICATION

- A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- B. Design hangers without disengagement of supported pipe.
- C. Design roof supports without roof penetrations, flashing or damage to the roofing material.

2.08 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.01 INSERTS

- A. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Coordinate with structural engineer for placement of inserts.
- B. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- C. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.
- D. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab. Verify with structural engineer prior to start of work.

3.02 PIPE HANGERS AND SUPPORTS

HANGERS, SUPPORTS AND ANCHORS	22 14 00 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Support horizontal piping as follows:

<u>PIPE SIZE</u>	<u>MAX. HANGER SPACING</u>	<u>HANGER DIAMETER</u>
(Steel Pipe)		
1/2 to 1-1/4 inch	7'-0"	3/8"
1-1/2 to 3 inch	10'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
(Copper Pipe)		
1/2 to 1-1/4 inch	5'-0"	3/8"
1-1/2 to 2-1/2 inch	8'-0"	3/8"
3 to 4 inch	10'-0"	3/8"
6 to 8 inch	10'-0"	1/2"
(Cast Iron)		
2 to 3 inch	5'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
(PVC Pipe)		
1-1/2 to 4 inch	4'-0"	3/8"
6 to 8 inch	4'-0"	1/2"
10 and over	4'-0"	5/8"

- B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- C. Place a hanger within 12 inches of each horizontal elbow and at the vertical horizontal transition.

HANGERS, SUPPORTS AND ANCHORS	22 14 00 - 5
24214 - COPA New Lifeguard Facility	5-15-2025

- D. Use hangers with 1-1/2 inch minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Install hangers with nut at base and above hanger; tighten upper nut to hanger after final installation adjustments.
- J. Portable pipe hanger systems shall be installed per manufactures instructions.

3.03 Insulated Piping: Comply with the following installation requirements.

- A. Clamps: Attach galvanized clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.
- B. Saddles: Install galvanized protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.
- C. Shields: Install protective shields MSS Type 40 on cold and chilled water piping that has vapor barrier. Shields shall span an arc of 180 degrees and shall have dimensions in inches not less than the following:

<u>NPS</u>	<u>LENGTH</u>	<u>THICKNESS</u>
1/4 THROUGH 3-1/2	12	0.048
4	12	0.060
5 & 6	18	0.060
8 THROUGH 14	24	0.075
16 THROUGH 24	24	0.105

- D. Piping 2" and larger provide galvanized sheet metal shields with calcium silicate at hangers/supports.
- E. Insert material shall be at least as long as the protective shield.

HANGERS, SUPPORTS AND ANCHORS	22 14 00 - 6
24214 - COPA New Lifeguard Facility	5-15-2025

- F. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.04 EQUIPMENT BASES AND SUPPORTS

- A. Provide equipment bases of concrete.
- B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct support of steel members. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.05 FLASHING

- A. Provide flexible flashing and metal counter flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting 8 inches minimum above finished roof surface with lead worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter flash and seal.
- C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.
- D. Seal floor shower mop sink and all other drains watertight to adjacent materials.
- E. Provide curbs for plumbing roof installations 14 inches minimum high above roofing surface. Contact architect for all flashing details and roof construction. Seal penetrations watertight.

3.06 SLEEVES

- A. Set sleeves in position in formwork. Provide reinforcing around sleeves.
- B. Extend sleeves through floors minimum one inch above finished floor level. Caulk sleeves full depth with fire rated thermfiber and 3M caulking and provide floor plate.
- C. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with U.L. listed fire stopping insulation and caulk seal air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

HANGERS, SUPPORTS AND ANCHORS	22 14 00 - 7
24214 - COPA New Lifeguard Facility	5-15-2025

- D. Fire protection sleeves may be flush with floor of stairways.

END OF SECTION 22 14 00

HANGERS, SUPPORTS AND ANCHORS	22 14 00 - 8
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 22 19 00 SYSTEM IDENTIFICATION AND PIPE MARKING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.
- B. The Basic Materials and Methods, Section 220500, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

1.03 Refer to Architectural Sections for additional requirements.

PART 2 - PRODUCTS

2.01 VALVE AND PIPE IDENTIFICATION

- A. Valves:
 - 1. All valves shall be identified with a 1-1/2" diameter brass disc wired onto the handle. The disc shall be stamped with 1/2" high depressed black filled identifying numbers. These numbers shall be numerically sequenced for all valves on the job.
 - 2. The number and description indicating make, size, model number and service of each valve shall be listed in proper operational sequence, properly typewritten. Three copies to be turned over to Owner at completion.
 - 3. Tags shall be fastened with approved meter seal and 4 ply 0.018 smooth copper wire. Tags and fastenings shall be manufactured by the Seton Name Plate Company or approved equal.
 - 4. All valves shall be numbered serially with all valves of any one system and/or trade grouped together.
- B. Pipe Marking:
 - 1. All interior visible piping located in accessible spaces such as above accessible ceilings, equipment rooms, attic space, under floor spaces, etc., shall be

SYSTEM IDENTIFICATION AND PIPE MARKING	22 19 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

identified with all temperature pipe markers as manufactured by W.H. Brady Company, 431 West Rock Ave., New Haven, Connecticut, or approved equal.

2. All exterior visible piping shall be identified with UV and acid resistant outdoor grade acrylic plastic markers as manufactured by Set Mark distributed by Seton nameplate company. Factory location 20 Thompson Road, Branford, Connecticut, or approved equal.
3. Generally, markers shall be located on each side of each partition, on each side of each tee, on each side of each valve and/or valve group, on each side of each piece of equipment, and, for straight runs, at equally spaced intervals not to exceed 75 feet. In congested area, marks shall be placed on each pipe at the points where it enters and leaves the area and at the point of connection of each piece of equipment and automatic control valve. All markers shall have directional arrows.
4. Markers shall be installed after final painting of all piping and equipment and in such a manner that they are visible from the normal maintenance position. Manufacturer's installation instructions shall be closely followed.
5. Markers shall be colored as indicated below per ANSI/OSHA Standards:

<u>SYSTEM</u>	<u>COLOR</u>	<u>LEGEND</u>
Sanitary Sewer	Green	Vent Sanitary Sewer
Domestic Water	Green	Domestic Water
Domestic Hot Water Supply	Yellow	Domestic Hot Water Supply
Domestic Hot Water Re-circulating	Yellow	Domestic Hot Water Return
Fire Protection	Red	Fire Protection
Automatic Sprinkler	Red	Fire Sprinkler

C. Pipe Painting:

1. All piping exposed to view shall be painted as indicated or as directed by the Architect in the field. Confirm all color selections with Architect prior to installation.

SYSTEM IDENTIFICATION AND PIPE MARKING	22 19 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

2. The entire fire protection piping system shall be painted red.
3. All piping located in mechanical rooms and exterior piping shall be painted as indicated below:

<u>System</u>	<u>Color</u>
Storm Sewer	White
Sanitary Sewer Waste and Vent	Light Gray
Domestic Cold Water	Dark Blue
Domestic Hot Water Supply and Return	Orange
Compressed Air	Green
Chilled Water Supply and Return	Light Blue

PART 3 - EXECUTION

- 3.01** All labeling equipment shall be installed as per manufacturers printed installation instructions.
- 3.02** All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractor's price shall include all items required as per manufacturers' requirements.
- 3.03** All piping shall be cleaned of rust, dirt, oil and all other contaminants prior to painting. Install primer and a quality latex paint over all surfaces of pipe.

END OF SECTION 22 19 00

SYSTEM IDENTIFICATION AND PIPE MARKING	22 19 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 22 26 00 PIPING INSULATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.
- B. The Basic Materials and Methods, Section 220500, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

- A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.
- B. Work specified elsewhere.
 - 1. Painting.
 - 2. Pipe hangers and supports.
- C. All pipes subject to freezing conditions shall be insulated.

1.03 WARRANTY

- A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.
- B. Defects shall include, but not be limited to, the following:
 - 1. Mildewing.
 - 2. Peeling, cracking, and blistering.
 - 3. Condensation on exterior surfaces.

1.04 SUBMITTALS

- A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.
- B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, project variations, and accessories.

1.05 DELIVERY AND STORAGE

PIPING INSULATION	22 26 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

- A. DELIVERY: Deliver undamaged materials in the manufacturer's unopened containers. Containers shall be clearly labeled with the insulation's flame and smoke ratings.

PART 2 - PRODUCTS

- 2.01 It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.
- 2.02 The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved prior to installation.
- 2.03 A sample quantity of each type of insulation and each type application shall be installed and approval secured prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.
- 2.04 All insulation shall have composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) fire and smoke hazard as tested by Procedure ASTM E084, NFPA 255 and UL 723 not exceeding:

Flame Spread 25
Smoke Developed 50

- 2.05 Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above.
- 2.06 All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

2.07 APPROVED MANUFACTURERS

- A. Calcium silicate materials shall be as manufactured by Johns Manville.
- B. Glass fiber materials shall be as manufactured by Johns Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer.
- C. Adhesives shall be as manufactured by Childers, Foster, HB Fuller or Armstrong, and

PIPING INSULATION	22 26 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

- D. Armaflex elastomeric cellular thermal insulation by Armstrong.
- E. Phenolic foam insulation shall be as manufactured by PolyPhen 2500 Insulation.
- F. Polyisocyanurate insulation shall be as manufactured by Dow "Trymer 2000 XP".
- G. Metal jacketing and fitting covers shall be as manufactured by Childers or RPR Products.

2.08 MATERIALS

- A. For insulation purpose piping is defined as the complete piping system including supplies and returns, pipes, valves, automatic control valve bodies, fittings, flanges, strainers, thermometer well, unions, reducing stations, and orifice assemblies.
- B. INTERIOR DOMESTIC WATER PIPE: provide fiberglass pipe insulation with all service jackets with self sealing lap joint.
- C. EXTERIOR DOMESTIC WATER PIPE: Provide elastomeric cellular thermal, or preformed phenolic foam pipe insulation with secured metal jacketing.
- D. DRAIN BODIES AND DOWN SPOUTS: Insulate all horizontal roof drain down spouts, underside of all roof drain bodies, chilled water waste lines from drinking fountain to junction with main waste stacks, and branch lines including traps and exposed underside of floor drains receiving cooling coil condensate, same as water piping where exposed to building occupant view. When concealed, insulation may be same as specified for external duct wrap.
- E. CONDENSATE DRAINAGE PIPING: Fire resistant fiberglass insulation; insulation not required when piping is exposed on roof.
- F. METAL JACKETING: Utilize Childers "Strap-On" jacketing. Provide preformed fitting covers for all elbows and tees.

PART 3 - EXECUTION

- 3.01** All insulation shall be installed in accordance with the manufacturers' recommendations and printed installation instructions, including high density inserts at all hangers and pipe supports to prevent compression of insulation.
- 3.02** All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.

PIPING INSULATION	22 26 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

3.03 Pipes located outdoors or in crawl spaces shall be insulated same as concealed piping; and in addition shall have a jacket of 0.016 inch thick, smooth aluminum with longitudinal modified Pittsburgh Z-Lock seam and 2 inch overlap. Jacketing shall be easily removed and replaced without damage. All butt joints shall be sealed with gray silicone. Galvanized banding is not acceptable.

3.04 All insulated piping located over driveways shall have an aluminum shield permanently banded over insulation to protect it from damage from car antennas.

3.05 WATER PIPE INSULATION INSTALLATION

A. The insulation shall be applied to clean, dry pipes with all joints firmly butted together. Where piping is interrupted by fittings, flanges, valves or hangers and at intervals not to exceed 25 feet on straight runs, an isolating seal shall be formed between the vapor barrier jacket and the bare pipe. The seal shall be by the applications of adhesive to the exposed insulation joint faces, carried continuously down to and along 4 inches of pipe and up to and along 2 inches of jacket.

B. Pipe fittings and valves shall be insulated with pre-molded or shop fabricated glass fiber covers finished with two brush coats of vapor barrier mastic reinforced with glass fabric.

C. All under lap surfaces shall be clean and free of dust, etc. before the SSL is sealed. These laps shall be firmly rubbed to insure a positive seal. A brush coat of vapor retarder shall be applied to all edges of the vapor barrier jacket.

3.06 FIRE RATED INSULATION

A. All pipe penetrations through walls and concrete floors shall be fire rated by applying USG Thermafiber in the space between the concrete and the pipe.

B. The fire rating shall be additionally sealed by using 3M brand model CP 25 or 303 fire barrier caulk and putty.

C. All fire rating material shall be insulated in accordance with manufacturer's printed instructions.

PART 4 - SCHEDULES

4.01 LOW TEMPERATURE SURFACES

**MINIMUM INSULATION THICKNESS
BASED ON FIBERGLASS**

- | | | |
|----|--|---------|
| A. | Exposed exterior domestic water pipe: | 1½ inch |
| B. | All Interior domestic cold water pipe: | 1 inch |

PIPING INSULATION	22 26 00 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

- | | | |
|----|--|---|
| C. | Condensate drain lines: | ¾ inch |
| D. | Drains receiving condensate: | 1 inch |
| E. | Concealed horizontal leader from roof drain: | 1½ inch blanket wrap |
| | Exposed horizontal leader from roof drain: | 1 inch thick rigid (phenolic)
with all service jackets |

4.02 HIGH TEMPERATURE SURFACES

**MINIMUM INSULATION
THICKNESS**

- | | | |
|----|---|--------|
| A. | Domestic Hot Water and Hot Water Circulating Piping | 1 inch |
|----|---|--------|

END OF SECTION 22 26 00

PIPING INSULATION	22 26 00 - 5
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 22 41 00 PLUMBING, PIPING, AND VALVES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Pipe and pipe fittings.
- B. Valves.
- C. Sanitary sewer piping system.
- D. Storm sewer piping system.
- E. Domestic water piping system.

1.02 RELATED SECTIONS

- A. Section 022220 - Excavating.
- B. Section 022230 - Backfilling.
- C. Section 022250 - Trenching.
- D. Section 221400 - Supports and Anchors.
- E. Section 221900 – System Identification and Pipe Marking.
- F. Section 232420 - Vibration Isolation.
- G. Section 222600 - Piping Insulation.
- H. Section 224400 - Plumbing Fixtures.
- I. Section 224500 - Plumbing Equipment.

1.03 REFERENCES

- A. ANSI B31.1 - Power Piping.
- B. ANSI B31.9 - Building Service Piping.
- C. ASME - Boiler and Pressure Vessel Code.
- D. ASME Sec. 9 - Welding and Brazing Qualifications.

PLUMBING, PIPING, AND VALVES	22 41 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

- E. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800.
- F. ASME B16.3 - Malleable Iron Threaded Fittings.
- G. ASME B16.4 - Cast Iron Threaded Fittings Class 125 and 250.
- H. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings
- I. ASTM A47 - Ferritic Malleable Iron Castings.
- J. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- K. ASTM A74 - Cast Iron Soil Pipe and Fittings.
- L. ASTM B32 - Solder Metal.
- M. ASTM B42 - Seamless Copper Pipe.
- N. ASTM B306 - Copper Drainage Tube (DWV).
- O. ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120.
- P. ASTM D2241 - Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR).
- Q. ASTM D2466 - Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- R. ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
- S. ASTM D2729 - Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- T. ASTM D2846 - Chlorinated Polyvinyl Chloride (CPVC) Pipe, Fittings, Solvent Cements and Adhesives for Potable Hot Water Systems.
- U. ASTM F493 - Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
- V. AWWA C111- Rubber-Gasket Joints for Ductile Iron and Gray-Iron Pressure Pipe and Fittings.
- W. AWWA C651 - Disinfecting Water Mains.
- X. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.
- Y. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.

1.04 SUBMITTALS

PLUMBING, PIPING, AND VALVES	22 41 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Submit under provisions of Division 1.
- B. Product Data: Provide data on pipe materials, Pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.05 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.
- B. Record actual locations of valves.

1.06 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 1.
- B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.07 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating cast or marked on valve body.
- B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.
- C. Welders Certification: In accordance with ASME Sec 9.
- D. Foreign pipe, fittings or valves are unacceptable.
- E. Piping shall be labeled along entire length indicating size, class, material specification, manufacturers name and country of origin.

1.08 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 5 years documented experience and must be a domestic manufacturer.
- B. Installer: Company specializing in performing the work of this section with minimum 5 years documented experience.

1.09 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with plumbing and building codes having jurisdiction.

PLUMBING, PIPING, AND VALVES	22 41 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

- B. Conform to applicable codes for the provision and installation of all required backflow prevention devices.
- C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.
- D. No PVC pipe or fittings will be allowed for any areas where pipe is to penetrate a fire rated assembly or to be installed in a return air plenum unless the entire length of all such piping is encased within a minimum 2 hour fire rated enclosure.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Division 1.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system. Tape will not be allowed as an acceptable end cover.

1.11 EXTRA MATERIALS

- A. Furnish under provisions of Division 1.
- B. Provide two repacking kits for each size valve.

PART 2 - PRODUCTS

2.01 SANITARY SOIL WASTE AND VENT PIPING, BURIED BEYOND 5 FEET OUTSIDE OF BUILDING

- A. PVC Pipe: ASTM D 1785/D 2729 schedule 40; installed per ASTM D 2321.
 - 1. Fittings: PVC, ASTM D 3311/D 2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
 - 2. Joints: solvent weld with ASTM D 2564 solvent cement, clear, **medium bodied**, for sizes 3" and smaller and gray, **heavy bodied**, for sizes 4" and larger, mating surfaces shall be prepared with ASTM F 656 purple primer immediately prior to cement application.

OR

PLUMBING, PIPING, AND VALVES	22 41 00 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

- B. PVC pipe: ASTM D 3034, SDR 35; installed per ASTM D 2321.
 - 1. Fittings: ASTM F 1336 PVC, drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
 - 2. Joints: ASTM F 477 or F 913, elastomeric gaskets or solvent weld.

2.02 SANITARY SOIL, WASTE AND VENT PIPING, BURIED WITHIN 5 FEET OF BUILDING, BELOW GRADE

- A. PVC Pipe: ASTM D 1785/D 2665 schedule 40
 - 1. Fittings: PVC, ASTM D 3311/D 2665 drainage pattern, with bell and spigot ends to be furnished by the same manufacturer as pipe or approved equal.
 - 2. Joints: solvent weld with ASTM D 2564 solvent cement, clear, medium bodied, for sizes 3" and smaller and gray, heavy bodied, for sizes 4" and larger, mating surfaces shall be prepared with ASTM F 656 purple primer immediately prior to cement application.

2.03 SANITARY SOIL, WASTE AND VENT PIPING, WITHIN BUILDING, ABOVE GRADE

- A. PVC Pipe: ASTM D 1785/D 2665 schedule 40
 - 1. Fittings: PVC, ASTM D 3311/D 2665 drainage pattern, with bell and spigot ends to be furnished by the same manufacturer as pipe or approved equal.
 - 2. Joints: solvent weld with ASTM D 2564 solvent cement, clear, medium bodied, for sizes 3" and smaller and gray, heavy bodied, for sizes 4" and larger, mating surfaces shall be prepared with ASTM F 656 purple primer immediately prior to cement application.

2.04 STORM DRAINAGE PIPING, BURIED BEYOND 5 FEET OUTSIDE OF BUILDING

- A. Pipe and fittings shall be same as specified for the sanitary soil, waste and vent piping system.

2.05 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET OF BUILDING, BELOW GRADE

- A. Pipe and fittings shall be same as specified for the sanitary soil, waste and vent piping system.

2.06 DOMESTIC WATER PIPING, BURIED BEYOND 5 FEET OUTSIDE OF BUILDING

- A. Cross-linked Polyethylene (PEX) ASTM F877 tubing for hot and cold water distribution systems. Manufactured in accordance with ASTM F876 and ASTM F877 and tested for compliance by an independent third-party agency
 - 1. ASTM F876 cross-linked polyethylene (PEX) tube, ASTM F1807 fittings and ASTM F2159 fittings.
 - 2. Non-barrier type.
 - 3. Shall have a pressure and temperature rating of 160 PSI at 73°F, 100 PSI at 180°F and 80 PSI at 200°F

PLUMBING, PIPING, AND VALVES	22 41 00 - 5
24214 - COPA New Lifeguard Facility	5-15-2025

4. Tubing shall have a minimum of 6 months UV protection.
5. Tubing shall have a 25/50 flame and smoke developed rating as per ASTM E84.
6. Tubing shall have a 25 year warranty.

B. PVC Pipe: ASTM D 1785 schedule 80.

1. Fittings: ASTM D 2467 PVC.
2. Joints: ASTM D 2855, solvent weld with ASTM D 2564 solvent cement.

2.07 DOMESTIC WATER PIPE, BURIED WITHIN 5 FEET OF BUILDING, BELOW GRADE

A. Cross-linked Polyethylene (PEX) ASTM F877 tubing for hot and cold water distribution systems. Manufactured in accordance with ASTM F876 and ASTM F877 and tested for compliance by an independent third-party agency

1. ASTM F876 cross-linked polyethylene (PEX) tube, ASTM F1807 fittings and ASTM F2159 fittings.
2. Non-barrier type.
3. Shall have a pressure and temperature rating of 160 PSI at 73°F, 100 PSI at 180°F and 80 PSI at 200°F
4. Tubing shall have a minimum of 6 months UV protection.
5. Tubing shall have a 25/50 flame and smoke developed rating as per ASTM E84.
6. Tubing shall have a 25 year warranty.
7. Tubing shall be used with copper manifolds and nipples.

B. Copper Tubing: ASTM B88, Type K, soft annealed. Provide for pipe sizes up to and including 2-1/2".

1. Fittings: ASTM B16.22 wrought copper pressure fittings.
2. Joints shall be as follows:
 - a. **No joints shall be permitted for pipe sizes 2" and smaller. All such piping must be run continuous below slab on grade and brought up to no less than 12" above the finished floor before any joint is provided.**
 - b. For sizes larger than 2", joints between copper pipe and fittings shall be brazed and shall be made in accordance with all the applicable portions of ASTM B828, manufacturer's recommendations, and AWS requirements. Brazing filler metal shall be in accordance with AWS A5.8 and any required flux shall meet AWS A5.31, Type FB3-A or FB3-C.
3. Beginning at no closer than the 5'-0" mark from the building, all piping buried or in contact with concrete shall be provided with one of the following, which shall also extend to a minimum of 6" above the finished floor:
 - a. AWWA C209 cold-applied, integrated primer type, elastomeric adhesive, laminate polymeric tape coating, minimum 35 mil nominal thickness, in accordance with manufacturer's installation guidelines. Chase Construction Products Tapecoat H35 or approved equivalent.
 - b. Continuous polyethylene lining, minimum 60 mil nominal thickness.

C. Ductile Iron Pipe: Minimum pressure class 150, ANSI/AWWA C151/A21.51. Provide for pipe sizes 3" and larger.

PLUMBING, PIPING, AND VALVES	22 41 00 - 6
24214 - COPA New Lifeguard Facility	5-15-2025

1. Fittings: Standard ductile iron, ANSI/AWWA C110/A21.10.
2. Joints: Rubber-gasketed and bolted mechanical joints, ANSI/AWWA C111/A21.11. Installation shall be in accordance with ANSI/AWWA C600 and approved pipe lubricant shall be used for optimum gasket sealing and long-term performance.
3. Note: A single fitting may be installed below slab on grade to facilitate underground pipe entry up to above floor from an immediately adjacent exterior building wall.
4. Provide continuous polyethylene encasement for all piping buried or in contact with concrete in accordance with ANSI/AWWA C105/A21.5, beginning at no closer than the 5'-0" mark from the building and to a minimum of 6" above the finished floor.

D. Stainless Steel Pre-Fabricated In-Building Riser (acceptable for sizes 2" through 10")

1. Corrosion resistant Type 304 stainless steel construction single, extended 90 degree fitting.
2. UL listed, FM approved and NFPA 24 compliant.
3. Lead free and NSF/ANSI 61 (372) certified.
4. Acceptable manufacturers:
 - a. Ames Fire & Waterworks Series IBR (4" through 10") and IBR2 (2", 2-1/2", and 3")
 - b. Zurn Wilkins Model WBR (4" through 10")
5. Note: For this application, the inlet joint for larger diameter (4" through 10") piping (which **shall not** be located below a building slab or foundation) can be rubber gasketed push-on type, ANSI/AWWA C111/A21.11. Installation shall be in accordance with ANSI/AWWA C600.
6. Provide continuous polyethylene encasement for all piping buried or in contact with concrete in accordance with ANSI/AWWA C105/A21.5, beginning at no closer than the 5'-0" mark from the building and to a minimum of 6" above the finished floor.

2.08 DOMESTIC WATER PIPING, WITHIN BUILDING, ABOVE GRADE:

A. Copper Tubing: ASTM B 88, Type L, hard drawn.

1. Fittings: ASME B 16.18, cast bronze, or ASTM B 16.22 wrought copper alloy.
2. Joints between copper pipe and fittings shall be made in accordance with ASTM B828 using ASTM B32 Alloy HB lead-free solder.
3. Fittings and joints for pipe sizes 1/2" through 4" may be mechanical press-connect system joints with ASME B16.51 lead-free copper bodied fittings with integral ethylene-propylene diene monomer rubber (EPDM) sealing gaskets. All fittings, couplings, and adapters shall be the product of a single system manufacturer and only that manufacturer's approved press tools, kits, and jaws shall be used.

PLUMBING, PIPING, AND VALVES	22 41 00 - 7
24214 - COPA New Lifeguard Facility	5-15-2025

- a. EPDM o-rings shall be pre-installed and lubricated with ANSI/NSF 61 listed lubricant.
 - b. All installers of copper press-connect fittings shall be trained by the fitting manufacturer's appointed representative and carry such credentials for the duration of the project.
 - c. The fitting manufacturer's representative shall conduct periodic inspections of the installation and shall provide written reports of such inspections to the Contractor and Engineer, including any observed deviations from the manufacturer's recommended installation practices.
 - d. Acceptable system manufacturers: Viega, Merit Brass, or pre-approved equal.
- B. Cross-linked Polyethylene (PEX) ASTM F877 tubing for hot and cold water distribution systems. Manufactured in accordance with ASTM F876 and ASTM F877 and tested for compliance by an independent third-party agency
- 1. ASTM F876 cross-linked polyethylene (PEX) tube, ASTM F1807 fittings and ASTM F2159 fittings.
 - 2. Non-barrier type.
 - 3. Shall have a pressure and temperature rating of 160 PSI at 73°F, 100 PSI at 180°F and 80 PSI at 200°F
 - 4. Tubing shall have a minimum of 6 months UV protection.
 - 5. Tubing shall have a 25/50 flame and smoke developed rating as per ASTM E84.
 - 6. Tubing shall have a 25 year warranty.
 - 7. Tubing shall be used with copper manifolds and nipples.
 - 8. Support all PEX piping as per the manufacturer's instructions. Provide additional supports as required to prevent piping from sagging.

2.09 FLANGES AND UNIONS

- A. Drainage Applications:
- 1. Provide approved listed adapter and transition fittings appropriate to the specific pipe transition and in accordance with code requirements.
 - 2. For piping above ground, provide stainless steel shielded, molded elastomeric couplings and adapters meeting ASTM C564 and FM 1680. No-hub couplings shall be heavy duty type with four band stainless steel bands clamps and solid shield assembly constructed of type 300 series stainless steel.
 - 3. For dissimilar piping above ground, provide heavy duty stainless steel shielded, molded elastomeric couplings and adapters meeting ASTM C564 and ASTM C1460. Applies to installations including cast iron to PVC transitions immediately adjacent to building slabs on grade.
 - 4. For dissimilar underground piping not below building slab, provide shear resistant .012" thick 300 series stainless steel shielded, PVC gasketed flexible couplings and adapters meeting ASTM D5926 and ASTM C1173. For direct-bury applications, provide AWWA C209 cold-applied, integrated primer type, elastomeric adhesive, laminate polymeric tape coating, minimum 35 mil nominal thickness, in accordance with manufacturer's installation guidelines, to completely wrap the

PLUMBING, PIPING, AND VALVES	22 41 00 - 8
24214 - COPA New Lifeguard Facility	5-15-2025

shield, banding, and screws. Chase Construction Products Tapecoat H35 or approved equivalent.

5. Acceptable manufacturers:

- a. Anaco-Husky/Cremco
- b. Mission Rubber Company LLC
- c. Fernco, Inc.
- d. Fernco, Inc. Strong Back RC 1000 Series (underground piping, not below building slab; or readily accessible underground piping transitions in backwater valve pits, etc.)

6. Adapters, couplings, bushings for copper DWV pipe shall be cast bronze or wrought copper, ASME B16.23/B16.29.

B. Domestic Water Applications:

- 1. Provide joints between various materials with approved adapter and transition fittings appropriate to the specific pipe transition and in accordance with code requirements and the manufacturer's instructions.
- 2. For copper tube and pipe: adapters, bushings, plugs, caps, and couplings shall be wrought copper or cast bronze; flanges (minimum class 150) and unions shall be cast bronze. Provide with solder or threaded connections as necessary and as produced to applicable ASME standards B16.15, B16.18, B16.22, B16.24, B16.50, B1.20.1. All such appurtenances shall be for use in above ground potable water systems.
- 3. Above slab transitions for water service entries:
 - a. 100% fusion bonded epoxy coated ASTM A536 cast ductile iron construction coupling with acrylonitrile butadiene rubber (NBR) gaskets and EPDM insulating boot for water service. 5/8 inch high strength stainless steel bolts and nuts. Coupling shall meet AWWA C219. Romac Industries, Inc. IC501 or pre-approved equivalent.
 - b. 100% fusion bonded 14 mil epoxy coated coupling with ASTM A536 cast ductile iron rings. Complete with acrylonitrile butadiene rubber (NBR) gaskets and type 304 stainless steel bridge, spacers, nuts, and bolts. Coupling shall meet AWWA C219, NSF 61, and NSF 372. Krausz USA Hymax Grip Coupling Restraint or pre-approved equivalent.
- 4. Dielectric connections:
 - a. For pipe sizes 2 inch and smaller, provide lead-free dielectric unions, rated to 180 F at 250 psi and compliant to ASSE 1079.
 - b. For pipe sizes larger than 2 inches, provide lead-free dielectric flanged pipe fittings, rated to 180 F at 175 psi and meeting ASME B16.1.
 - c. For grooved copper joining systems, provide grooved end dielectric transition fitting from system manufacturer, with virgin polypropylene internal lining, meeting NSF 61.

C. General:

- 1. Unions for ferrous pipe shall be ASTM B16.39 galvanized malleable iron, threaded, minimum pressure class 150.

PLUMBING, PIPING, AND VALVES	22 41 00 - 9
24214 - COPA New Lifeguard Facility	5-15-2025

2. Plugs and bushings for ferrous pipe shall be ASME B16.14 galvanized malleable iron, threaded.
3. Nipples for ferrous pipe shall be schedule 40, galvanized, ASTM A53 welded steel pipe nipples, threaded, meeting ASTM A733.
4. Couplings for ferrous pipe shall be galvanized steel, threaded, manufactured in accordance with ASTM A865.
5. Flanges for ferrous pipe shall be galvanized forged steel construction, either socket weld or slip-on weld type, minimum pressure class 150, manufactured to ASME B16.5.
6. Bolts, nuts, and gaskets for flanged connections shall be appropriate to the pipe material, fluid type, temperature, and pressure. 1/16" thick pre-formed neoprene, typical.
7. Provide flexible stainless steel connectors at pumps and other such equipment, in accordance with manufacturer's recommendations. Connectors shall have corrugated hose and braided 300 series stainless steel jacketing. Carbon steel flanged or grooved ends as appropriate. NSF 372 lead-free for all potable water applications. Metraflex Company or pre-approved equivalent.

2.10 GATE VALVES

A. Manufacturers:

1. Nibco No. T-111 up to 2-1/2"; F-617-O 3" and over.
2. Other acceptable manufacturers offering equivalent products.
 - a. Crane No. 428 up to 2-1/2"; 465-1/2 3" and over.
 - b. Stockham No. B-100 up to 2-1/2"; G-623 3" and over.
 - c. Grinnell No. 3010 up to 2-1/2"; 6020A 3" and over.

B. Up to and including 2-1/2" Inches: Bronze body, bronze trim, rising stem, handwheel, inside screw, solid wedge threaded ends.

C. Over 3" Inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, solid wedge, flanged ends.

D. Provide bronze tee or cast iron square nut operator for all valves installed below ground.

1. Valves 2-1/2" and smaller shall be equipped with ASTM B62 solid red bronze tee securely affixed to the valve stem.
2. Valves 3" and larger shall be equipped with a standard 2" square combination nut/socket securely affixed to the valve stem.
3. Provide owner with two extended tee handle operating wrenches for each type of valve head installed.

2.11 BALL VALVES

A. Manufacturers:

PLUMBING, PIPING, AND VALVES	22 41 00 - 10
24214 - COPA New Lifeguard Facility	5-15-2025

1. Nibco No. T-585-66-LF (full port) for all sizes up through 2"
 2. Nibco No. T-580-66-LF (conventional port) for sizes 2-1/2" and 3"
 3. Valves 4" and larger shall be split body stainless steel construction, 275psi cold working pressure, blow-out proof stem, PTFE seated, type 316 stainless steel trimmed, class 150 full port desing with manual gear operator. Nibco F-515-S6-F-66-FS
 4. Other acceptable manufacturers offering equivalent products.
 - a. Apollo 70LF-140 series (full port) for all sizes up through 2".
 - b. Milwaukee UPBA-400S (full port) for all sizes up through 2".
 - c. Apollo 70LF-140 series (full port) for size 2-1/2" and Apollo 70LF-140 series (standard port) for 3".
 - d. Milwaukee UPBA-100S (standard port) for sizes 2-1/2" and 3".
- B. Up to and including 2 Inches: Bronze two 600 PSI piece body full port, lead-free, stainless steel ball and stem, Teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends with union.
- C. Ball valves used for balancing shall have memory stops.

2.12 SWING CHECK VALVES

- A. Manufacturers:
1. Nibco No. T-413-Y-LF up to 2"; F-918-B-LF 2-1/2" and over.
 2. Other acceptable manufacturers offering equivalent products.
 - a. Crane No. 37 up to 2-1/2"; 372 3" and over.
 - b. Stockham No. B-319; up to 2-1/2"; G931 3" and over.
 - c. Grinnell No. 3300 up to 2-1/2"; 6300A 3" and over.
- B. Up to and including 2-1/2 Inches: Bronze swing disc, screwed ends.
- C. Over 2-1/2 Inches: Iron body, bronze trim, swing disc, renewable disc and seat, flanged ends. Include outside lever and adjustable weight where required for quiet operation.

2.13 SPRING LOADED (SILENT) CHECK VALVES

- A. Manufacturers:
1. Nibco No. W-910
 2. Other acceptable manufacturers offering equivalent products.
 - a. Grinnell No. 402
- B. Iron body, bronze trim, stainless steel spring, renewable composition disc, screwed, wafer, or flanged ends.

PLUMBING, PIPING, AND VALVES	22 41 00 - 11
24214 - COPA New Lifeguard Facility	5-15-2025

2.14 SOLDER

- A. 95.5% tin, 4% copper, 0.5% silver.
- B. Lead free, antimony free, zinc-free.
- C. Silvabrite 100, by Engelhard Corporation or approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Coordinate and verify excavations under provisions of Division 2.
- B. Verify that all excavations are to the required grade, dry, and not over-excavated.

3.02 EXCAVATION, BEDDING AND BACKFILL

- A. This section shall apply for the excavation, bedding, and backfill of all buried piping unless specifically noted otherwise. All work shall be coordinated with any job site subsurface drainage/dewatering and adjusted accordingly.
- B. Establish elevations of buried piping outside the building to ensure the following:
 - 1. Not less than 2 feet of cover, or not less than maximum depth of frost penetration, whichever is the greater.
 - 2. For water lines intended for fire protection service, the depth of cover shall be:
 - a. Not less than 2'-6" in those locations where frost is not a factor.
 - b. Not less than 1'-0" below the frost line for the locality.
 - c. Not less than 3'-0" for piping under driveways.
 - d. Not less than 1'-0" below the bottom of the building foundation/footers.
 - e. In full compliance with the requirements of NFPA 13 and NFPA 24.
- C. Excavation:
 - 1. Excavate trenches for underground piping to the required depths.
 - 2. The bottom of the trench or excavation shall be cut to a uniform grade.
 - 3. Should rock be encountered, excavate 6 inches below grade, fill with bedding material and tamp to existing density.
 - 4. Coordinate alignment of pipe trenches to avoid obstructions. Ensure that proposed routing of pipe will not interfere with building foundation before any trenching has begun. Should conflicts occur, contact Architect/Engineer before proceeding.
 - 5. Should any sleeves through the building foundation be required, this shall be provided as directed by the structural engineer of record AND in accordance with the prevailing code, but in no case shall the sleeve be any less than two (2) pipe sizes greater than the pipe it serves.
- D. Bedding and Backfill:
 - 1. Backfill shall not be placed until the piping has been inspected, tested and

PLUMBING, PIPING, AND VALVES	22 41 00 - 12
24214 - COPA New Lifeguard Facility	5-15-2025

approved. Complete backfill to the surface of natural ground or to the lines and grades indicated on drawings. Provide 6 inch stabilized sand bed with 4 inch stabilized sand cover around each pipe. Provide select fill up to finished surface or grade, unless indicated otherwise by project geotechnical report or specified otherwise in Division 02.

2. Compacting Backfill: Place material in uniform layers of 8 inches maximum, loose measure and compact to not less than 95% of maximum soil density as determined by ASTM D-698 Standard Proctor.
3. Restoration: Compact backfill, where trenching or excavation is required in improved areas such as pavements, walks and similar areas, to a condition equal to the adjacent undisturbed earth and restore surface of the area to the condition existing prior to trenching or excavating operation.
4. A clay fill "trench plug" extending 3 feet inside the building line and 5 feet outside the building line shall be placed to completely surround utility lines passing beneath the foundation and grade beam. The materials shall consist of on-site soils with a plasticity index (PI) between 20 and 30 percent compacted to at least 95 percent of the Standard Proctor and maximum dry density as determined by ASTM D-698.

E. Cement Stabilized Sand:

1. Materials:
 - a. Cement shall be Type I Portland cement conforming to ASTM C150.
 - b. Sand shall be clean, durable sand meeting grading requirements for fine aggregates of ASTM C33 and free of organic matter and deleterious substances.
 - c. Water shall be potable and free of oils, acids, alkalis, organic matter, or other deleterious substances, meeting requirements of ASTM C94.
2. Mixture:
 - a. Product shall consist of not less than 1.5 sacks of Portland cement per ton of dry sand.
 - b. Mixture shall contain sufficient water to hydrate the cement and be thoroughly mixed in a pugmill type mixer.

F. For water lines (including In-Building Risers) intended for fire protection service, provide joint restraints by way of concrete thrust blocks in accordance with the requirements of NFPA 13 and NFPA 24.

G. Aggressive Soil Conditions: Soil shall be considered aggressive and protection of buried metallic piping shall be provided as specified if any of the following situations exist:

1. Conditions are identified as such by the project geotechnical report or project geotechnical engineer.
2. The soil environment is a landfill area, swamp, marsh, polluted river bottom, cinder bed, or has alkaline soils.
3. A score of ten or higher is tallied when applying the soil assessment tool detailed in Appendix A of AWWA C105. An excerpt of this evaluation procedure is provided below for reference but is not intended as a substitute for the complete and latest Standard:

PLUMBING, PIPING, AND VALVES	22 41 00 - 13
24214 - COPA New Lifeguard Facility	5-15-2025

Numerical Corrosivity Scale

Soil Parameter	Assigned Points
Resistivity (ohm-cm)	
<700	10
700 – 1,000	8
1,000 – 1,200	5
1,200 – 1,500	2
1,500 – 2,000	1
>2,000	0
pH	
0 – 2	5
2 – 4	3
4 – 6.5	0
6.5 – 7.5	0
7.5 – 8.5	0
>8.5	3
Redox Potential (mV)	
>100	0
50 – 100	3.5
0 – 50	4
<0	5
Sulfides	
Positive	3.5
Trace	2
Negative	0
Moisture	
Poor drainage continuously wet	2
Fair drainage generally moist	1
Good drainage generally dry	0

3.03 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale, oil and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

- D. Install, clean bank sand backfill in trench to a minimum of 6 inches below pipe, and to cover all piping a minimum of 12 inches above pipe.

3.04 INSTALLATION

- A. Install all materials in accordance with manufacturer's published instructions.
- B. All exposed sewer and water pipe in toilet rooms or other finished areas of the building shall be chromium plated.
- C. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- D. Route piping in orderly manner, parallel and perpendicular to building column grid lines, unless indicated otherwise on drawings, and maintain gradients.
- E. Install piping to conserve building space and not conflict with other trades or interfere with intended use of space.
- F. Group piping whenever practical at common elevations.
- G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- H. Provide clearance for installation of insulation and access to valves and fittings. Valves installed beyond reasonable reach shall be provided with chain operator.
- I. Provide access doors where valves and operable fittings are not exposed. Access doors shall be of approved types set in locations pre-approved by submittal to the Architect.
- J. Establish elevations of buried piping outside the building to ensure not less than 2 feet of cover, or maximum depth of frost penetration, which ever is the greater.
- K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- L. Provide encasement for and support of utility meters in accordance with requirements of utility companies.
- M. Gate valves installed below grade shall be covered with an adjustable cast iron roadway box extended to grade. Cover shall be cast iron with 'water' cast on top and set flush to finished paving or 2" above finished earthen grade. Box shall be supported from undisturbed soil or concrete base and shall not introduce any stress to piping under all traffic conditions.
- N. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting.
- O. Excavate in accordance with Division 2.

PLUMBING, PIPING, AND VALVES	22 41 00 - 15
24214 - COPA New Lifeguard Facility	5-15-2025

- P. Backfill in accordance with Division 2.
- Q. Install bell and spigot pipe with bell end upstream.
- R. Maintain uniformity in the installation of piping materials and joining methods. Do not mix materials types.
- S. Install valves with stems upright or horizontal, not inverted.
- T. Solder joints shall be wiped clean at each joint, remove excess metal while molten and flux residue when cooled.
- U. No PVC pipe or fittings will be allowed for any areas where pipe is installed in return air plenum unless the entire length of all such piping is encased within a minimum 2 hour fire rated enclosure.
- V. Installations of thermoplastic piping systems shall be in strict conformity to the manufacturers published instructions. Under ground drainage pipe installations shall be in conformity to ASTM D 2321.
- W. Installation of solvent cement joints for PVC piping shall be in strict conformity to the requirements outlined in ASTM D 2855.
- X. Waste nipple from wall to tapped tee shall be schedule 40 threaded galvanized steel pipe or brass or copper with threaded adapter.
- Y. Provide approved PVC slip by cast iron no hub adaptor at each transition from underground PVC piping to above ground cast iron pipe using standard or wide bodied no hub couplings for as specified elsewhere in this section. Transition shall be made as close as possible to floor for sanitary DWV piping systems and at test tee for storm drainage piping. Support vertical cast iron pipe from floor anchors with using riser clamp and galvanized all thread rod as specified in section 231400.

3.05 APPLICATION

- A. Install union downstream of all valves at equipment or apparatus connections.
- B. Install male adapters each side of threaded valves in copper piped system. Sweat solder adapters to tube prior to make-up of threaded connections.
- C. Install gate valves for shut-off and to isolate all equipment items, distinct parts of systems, or vertical risers.
- D. Each plumbing fixture shall have a shut-off valve on each hot water and cold water supply line.

PLUMBING, PIPING, AND VALVES	22 41 00 - 16
24214 - COPA New Lifeguard Facility	5-15-2025

- E. Each plumbing water rough-in stub out shall be fitted with a shut off valve.
- F. Install globe, ball or butterfly valves for throttling, bypass, or balancing (manual flow control) services.
- G. Ball valves installed in insulated piping shall be fitted with extended lever operators of sufficient length to raise handle above the insulation jacket material. Where valve is used for throttling service valve handle shall be equipped with adjustable memory stop device.
- H. Provide spring loaded, non-slam, check valves on discharge of water pumps.

3.06 ERECTION TOLERANCES

- A. All drainage lines in the building shall have 1/4 inch to the foot fall where possible and not less than 1/8 inch to the foot fall toward the main sewer. Pipe must be so laid that the slope will be uniform and continuous. Permission shall be secured from the Architect and Engineer before proceeding with any Work where existing conditions prevent the installation at minimum grade specified.
- B. Slope all water piping and arrange to drain at low points. Provide loose key operated, polished chrome, sill cock flush to wall where fixture stop will not suffice for this requirement.

3.07 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, all domestic water systems shall be complete, thoroughly flushed clean and free of all foreign matter or erection residue.
- B. Ensure PH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. On building side of the main shut off valve, provide a 3/4" connection through which chlorine can be introduced into the water piping
- D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, in sufficient quantity to obtain 50 to 80 mg/L residual free chlorine solution throughout the entire domestic water piping systems.
- E. Bleed water from outlets as required to ensure complete distribution and test for disinfectant residual at a minimum 15 percent of total outlets.
- F. Maintain disinfectant in system for 24 hours.
- G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

PLUMBING, PIPING, AND VALVES	22 41 00 - 17
24214 - COPA New Lifeguard Facility	5-15-2025

- H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- I. Take samples no sooner than 24 hours after flushing, from 5 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.08 SERVICE CONNECTIONS

- A. Provide new sanitary and storm sewer services connecting to existing building services or utility lines as shown on the drawings.
- B. Before commencing work, field verify invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover as required.
- C. Provide new domestic water service connecting to existing building services or utility lines as shown on plans. Assure connections are in compliance with requirements of the jurisdiction having authority.
- D. Extension of services to the building shall be fabricated from the same materials as the utility service lines or those materials specified herein.
- E. Should points of connection vary from those indicated on the drawings contractor shall properly allow for this in the actual connections field fabricated.

3.09 RODDING SEWERS

- A. All sanitary soil and waste lines, both in the building and out, shall be rodded out after completion of the installation.
- B. This Work shall be done, as part of the contract, to make certain that all lines are clear, and any obstruction that may be discovered shall be removed immediately. Rodding shall be accomplished by utilizing a rotary cutter, which shall be full size of pipe being cleaned.

3.10 TESTING OF PLUMBING PIPING SYSTEMS

- A. During the progress of the work and upon completion, tests shall be made as specified herein and as required by Authorities Having Jurisdiction, including Inspectors, Owner or Architect. The Architect or duly authorized Construction Inspector shall be notified in writing at least 2 working days prior to each test or other Specification requirement which requires action on the part of the Construction Inspector.
- B. Tests shall be conducted as part of this work and shall include all necessary instruments, equipment, apparatus, and service as required to perform the tests with qualified personnel. Submit proposed test procedures, recording forms, and test equipment for approval prior to the execution of testing.

PLUMBING, PIPING, AND VALVES	22 41 00 - 18
24214 - COPA New Lifeguard Facility	5-15-2025

- C. Tests shall be performed before piping of various systems have been covered or furred-in. For insulated piping systems testing shall be accomplished prior to the application of insulation.
- D. All piping systems shall be tested with water and proved absolutely tight for a period of not less than 24 hours. Tests shall be witnessed by the Architect or an authorized representative and pronounced satisfactory before pressure is removed or any water drawn off.
- E. Leaks, damage or defects discovered or resulting from test shall be repaired or replaced to a like new condition. Leaking pipe joints, or defective pipe, shall be removed and replaced with acceptable materials. Test shall be repeated after repairs are completed and shall continue until such time as the entire test period expires without the discovery of any leaks.
- F. Wherever conditions permit, each piping system shall thereafter be subjected to its normal operating pressure and temperature for a period of no less than five 5 days. During that period, it shall be kept under the most careful observation. The piping systems must demonstrate the propriety of their installation by remaining absolutely tight during this period.
- G. Domestic Water:
 - 1. Provide hydrostatic pressure test at one and one half times the normal working pressure or 125 psig, which ever is the greater, for 24 hours.
- H. Sanitary Soil, Waste and Vents and Storm Sewer:
 - 1. After the rough-in soil, waste and vent and other parts of the sanitary sewer including branch laterals have been set from the lowest level, at point of connection to existing utility lines, to above the floor line, all outlets shall be temporarily plugged or capped, except as are required for testing as described herein. Ground work shall not permit the backfill of trenches to cover any joints until the completion of testing. Back fill shall be limited to mid sections of full joints of piping only. For pipe in ground the piping shall be readied as described herein and filled with water to a verifiable and visible level to 10' above the lowest portions of the system being tested.
 - 2. On multi-level buildings only one floor level shall be tested at a time. Each floor shall be tested from a level below the structure of the floor, or the outlet of the building in the case of the lowest level, to a level of 12 inches above the floor immediately above the floor being tested, or the top of the highest vent in the case of the highest building level. The pipes for the level being tested shall be filled with water to a verifiable and visible level as described above and be allowed to remain so for 24 hours. If after 24 hours the level of the water has been lowered by leakage, the leaks must be found and stopped, and the water level shall again be raised to the level described, and the test repeated until, after a 24 hour retention

PLUMBING, PIPING, AND VALVES	22 41 00 - 19
24214 - COPA New Lifeguard Facility	5-15-2025

period, there shall be no perceptible lowering of the water level in the system being tested.

3. Should the completion of these tests leave any reasonable question or doubt of the integrity of the installation, additional tests including peppermint smoke, or other measures shall be performed to demonstrate the reliability of these systems to the complete satisfaction of the Owner's duly authorized representative. Such tests shall be conducted and completed before any joints in plumbing are concealed or made inaccessible.

3.11 COMPLETE FUNCTIONING OF WORK

- A. All work fairly implied as essential to the complete functioning of the systems shown on the Drawings and Specification shall be completed as part of the work of this Division unless specifically stated otherwise. It is the intention of the Drawings and Specification to establish the type and function of systems but not to set forth each item essential to the functioning of any system. In case of doubt as to the work intended or in the event of amplification or clarification thereof, the Contractor shall call upon the Architect for Supplementary Instructions and Drawings, etc.

END OF SECTION 22 41 00

PLUMBING, PIPING, AND VALVES	22 41 00 - 20
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 22 43 00 PLUMBING SPECIALTIES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Cleanouts.
- B. Backflow preventers.
- C. Water hammer arrestors.
- D. Thermostatic mixing valves.
- E. Hose bibbs hydrants.

1.02 RELATED WORK

- A. Section 221400 - Supports and Anchors.
- B. Section 224100 - Plumbing Piping.
- C. Section 224400 - Plumbing Fixtures.

1.03 REFERENCES

- A. ANSI/ASSE 1012 - Backflow Preventers with Immediate Atmospheric Vent.
- B. ANSI/ASSE 1011 - Hose Connection Vacuum Breakers.
- C. ANSI/ASSE 1013 - Backflow Preventers, Reduced Pressure Principle.
- D. ANSI/ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.
- E. ANSI A112.21.1 - Floor Drains.
- F. ANSI A112.26.1 - Water Hammer Arresters.
- G. PDI WH-201 Water Hammer Arresters
- H. AWWA C506 - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.

1.04 QUALITY ASSURANCE

PLUMBING SPECIALTIES	22 43 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Manufacturer: For each product specified, provide components by same manufacturer throughout.

1.05 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Submit product data under provisions of Division 1.
- C. Include component sizes, rough-in requirements, service sizes, and finishes.
- D. Manufacturer's Installation Instructions: Indicate assembly and support requirements.

1.06 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.
- B. Record actual locations of equipment, cleanouts, and backflow preventers.

1.07 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 1.
- B. Operation Data: Indicate frequency of treatment required for interceptors.
- C. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Division 1.
- B. Accept specialties on site in original factory packaging. Inspect for damage.

1.09 EXTRA MATERIALS

- A. Furnish under provisions of Division 1.
- B. Provide two loose keys for hose bibbs and spare hose end vacuum breakers.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS - FLOOR DRAINS

- A. Zurn

PLUMBING SPECIALTIES	22 43 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

- B. Watts
- C. Jay R. Smith
- D. MiFab
- E. Substitutions: Under provisions of Division One.
- F. Floor Drains
 - 1. Lacquered cast iron floor drain with anchor flange, standard satin finish nickel bronze strainer with vandal proof stainless steel allen key screws. Provide floor drains with trap guard insert.
- G. Shower Drains
 - 1. Galvanized cast iron floor drain body with anchor flange, membrane clamp, **stainless steel strainer** with vandal proof stainless steel allen key screws.

2.02 ACCEPTABLE MANUFACTURERS - CLEANOUTS

- A. Zurn
- B. Watts
- C. Jay R. Smith
- D. Substitutions: Under provisions of Division 1.
- E. Cleanouts
 - 1. Exterior Surfaced Areas: Square cast nickel bronze access frame and non-skid cover;
 - 2. Exterior Unsurfaced Areas: Line type with lacquered cast iron body and round epoxy coated gasketed cover;
 - 3. Interior Finished Floor Areas: Galvanized cast iron, two piece body with double drainage flange, weep holes, reversible clamping collar, and adjustable nickel-bronze strainer, round with scored cover in service areas and round with depressed cover to accept floor finish in finished floor areas;
 - 4. Interior Finished Wall Areas: Line type with lacquered cast iron body and round epoxy coated gasketed cover, and 6" round stainless steel access cover secured with machine screw;
 - 5. Interior Unfinished Accessible Areas: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.03 ACCEPTABLE MANUFACTURERS - HOSE BIBBS/HYDRANTS

- A. Woodford
- B. Zurn

PLUMBING SPECIALTIES	22 43 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

- C. Jay R. Smith
- D. Substitutions: Under provisions of Division 1.
- E. HOSE BIBBS/HYDRANTS
 - 1. Bronze or brass, replaceable hexagonal disc, hose thread spout, chrome plated where exposed to interior with lockshield and removable key, integral vacuum breaker in conformance with ANSI/ASSE 1011;
 - 2. Wall Hydrant: ANSI/ASSE 1019; non-freeze, self-draining type with rough chrome plated lockable recessed box hose thread spout, lockshield and removable key, and vacuum breaker;
 - 3. Floor Hydrant: ANSI/ASSE 1019; chrome plated lockable recessed box, hose thread spout, lockshield and removable key, and vacuum breaker;

2.04 RECESSED VALVE BOX

- A. Manufacturers:
 - 1. Oatey.
 - 2. Other acceptable manufacturers offering equivalent products.
 - 3. Sioux Chief
 - 4. Guy Gray.
 - 5. Washing Machine: Plastic preformed rough-in box with brass quarter turn ball valves and water hammer arrestors on both hot and cold connections, socket for waste, slip in finishing cover;
 - 6. Refrigerator: Plastic preformed rough-in box with quarter turn brass ball valve, slip in finishing cover;

2.05 ACCEPTABLE MANUFACTURERS - BACKFLOW PREVENTERS

- A. Watts
- B. Wilkins
- C. Febco
- D. Substitutions: Under provisions of Division 1.
- E. BACKFLOW PREVENTERS
 - 1. Reduced Pressure Backflow Preventers: ANSI/ASSE 1013; bronze body with bronze and plastic internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve which opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks;

PLUMBING SPECIALTIES	22 43 00 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

2. Double Check Valve Assemblies: ANSI/ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent;

2.06 ACCEPTABLE MANUFACTURERS - WATER HAMMER ARRESTORS

- A. Sioux Chief
- B. Wilkins
- C. Zurn
- D. Substitutions: Under provisions of Division 1.
- E. WATER HAMMER ARRESTORS
 1. ANSI A112.26.1; sized in accordance with PDI WH-201, precharged suitable for operation in temperature range -100 to 300 degrees F (-73 to 149 degrees C) and maximum 250 psig (1700 kPa) working pressure;

2.07 ACCEPTABLE MANUFACTURERS - THERMOSTATIC MIXING VALVES

- A. Powers
- B. Bradley
- C. Leonard
- D. Substitutions: Under provisions of Division 1.
- E. Thermostatic Mixing Valves
 1. Provide thermostatic mixing valve, with check valve, volume control shut-off valve on outlet, stem type thermometer on outlet, strainer stop check on inlet, mounted in lockable cabinet of 16 gage (1.5 mm) prime coated steel.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Coordinate cutting, forming of roof and/or floor construction to receive drains to required invert elevations.

3.02 INSTALLATION AND APPLICATION

PLUMBING SPECIALTIES	22 43 00 - 5
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Install specialties in accordance with manufacturer's instructions to permit intended performance.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Pipe relief from back flow preventer to nearest drain.

END OF SECTION 22 43 00

PLUMBING SPECIALTIES	22 43 00 - 6
24214 - COPA New Lifeguard Facility	5-15-2025

22 44 00 PLUMBING FIXTURES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.
- B. The Basic Materials and Methods, Section 220500, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

- A. **WORK INCLUDED:** Include the following Work in addition to items normally part of this Section:
 - 1. Plumbing fixtures.
 - 2. Drains and cleanouts.
- B. **WORK SPECIFIED ELSEWHERE:**
 - 1. Piping systems.
 - 2. Pipe valves, and fittings.
 - 3. Plumbing systems testing.

1.03 WARRANTY

- A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.
- B. Defects shall include, but not be limited to, the following:
 - 1. Noisy operation.
 - 2. Noticeable deterioration of finish.
 - 3. Leakage of water.

1.04 SUBMITTALS

- A. **SHOP DRAWINGS:** Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

PLUMBING FIXTURES	22 44 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

- B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.
- C. OPERATION AND MAINTENANCE INSTRUCTIONS: Provide pre-printed operating and maintenance instructions for each item specified. Instruct and demonstrate the proper operation and maintenance to the Owner's designated representative.

1.05 DELIVERY AND STORAGE

- A. DELIVERY: Deliver clearly labeled, undamaged materials in the manufacturers' unopened containers.
- B. TIMING AND COORDINATION: Deliver materials to allow for minimum storage time at the project site. Coordinate delivery with the scheduled time of installation.
- C. STORAGE: Store materials in a clean, dry location, protected from weather and abuse.

1.06 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.
- B. Confirm and field coordinate that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. PLUMBING FIXTURES:
 - 1. GENERAL: Provide plumbing fixtures as specified on drawings. The approved equal products manufacturers are as follows:
 - a. Water closet, urinals, lavatories, bath tubs and showers: American Standard, Kohler, Eljer.
 - b. Stainless steel sinks: Elkay, Just and Moen.
 - c. Mop sinks: Stern-Williams, Fiat
 - d. Faucets: American Standard, Kohler, Eljer,
 - e. Faucets: Chicago, T&S Brass, Zurn, Sloan
 - f. Faucets: Moen Commercial, Speakman
 - g. Shower valves: Leonard, Powers, Symmons, Chicago
 - h. Shower Systems: Bradley, Acorn, Willoughby
 - i. Flush Valves: Sloan "Royal", Zurn "AquaVantage"
 - j. Drinking fountains: Halsey Taylor, Elkay, Haws, Acorn Aqua.
 - k. Floor drains and roof drains: Zurn, J.R. Smith, Josam and Watts.
 - l. Emergency Fixtures: Bradley, Chicago, Haws, Speakman and Encon

PLUMBING FIXTURES	22 44 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

2. CHAIR CARRIERS: ANSI/ASME A112.6.1.; Adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers. As manufactured by Zurn, J. R. Smith, Josam or Watts.
3. DRINKING FOUNTAIN & URINAL WALL SUPPORTS: ANSI/ASME A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs. As manufactured by Zurn, J. R. Smith, Josam or Watts.
4. TRAPS, STOPS AND RISERS: Heavy pattern as manufactured by McGuire, Chicago or Zurn.

B. CLEANOUTS:

1. GENERAL: Provide cleanouts as shown on Drawings and as required by the city building code.
2. ACCEPTABLE MANUFACTURERS: Zurn J. R. Smith, Josam and Watts.
3. TYPES:
 - a. FINISHED FLOOR CLEANOUTS: Provide cast iron, adjustable floor level assembly with round nickel bronze top and gasket cover.
 - b. RESILIENT OR TILE FINISHED FLOOR CLEANOUTS: Provide cast iron, adjustable assembly with round nickel-bronze top with gasketed water tight cover and depressed top to receive flooring finish material.
 - c. DRY WALL CLEANOUTS: Provide cast iron tee and counter sink bronze plug with square nickel bronze frame and stainless steel cover.
 - d. Provide membrane clamp rings for slab on grade cleanouts.
 - e. All cleanouts shall have tapered bronze plugs.
 - f. All cleanouts outside of building on grade shall be set in a 18" x 18" x 4" thick concrete pad.

PART 3 - EXECUTION

3.01 PREPARATION

- A. EXAMINATION OF CONDITIONS: Examine conditions affecting this Work. Report unsatisfactory conditions to the proper authority and do not proceed until those conditions have been corrected. Commencing Work implies acceptance of existing conditions as satisfactory to the outcome of this Work.

3.02 INSTALLATION

- A. Install fixtures in locations and heights as shown on Drawings or as directed by the Architect.
- B. Install materials plumb, level, securely, and in accordance with manufacturer's recommendations.

PLUMBING FIXTURES	22 44 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

- C. All rough-in pipe openings, for final connections with all supply waste soil and vent systems shall be closed with caps or plugs during early stages of construction and installation. Tape shall not be considered sufficient protection.
- D. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.
- E. Provide gate valves in piping serving batteries of fixtures. Label stops "Hot" and "Cold." Valves to be located above accessible ceiling. If ceiling are not accessible, provide access panels of adequate size to make valves fully accessible.
- F. Plumbing fixtures shall be supported by a concealed chair carrier where required to properly support the fixture specified. All carriers to be securely mounted, bolted and checked prior to concealment.
- G. Caulk around fixtures with best grade white silicone caulking. Do not use grout.
- H. All handles on supply and drainage fittings or other brass items shall be properly lined up and adjusted. Fittings shall not be left in any haphazard manner.
- I. All fixtures shall have individual chrome plated loose key cutoff stops on supply lines. Where same are not specified as a part of the fixture trim, they shall be installed as close to fixtures as possible in the hot and cold water supply.
- J. Install each fixture with trap, easily removable for servicing and cleaning.
- K. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
- L. Hot and cold water riser air chambers: Provide air chambers for hot and/or cold water riser located at the rough-in tee at all fixtures.

The air chamber shall be of the same materials and the next larger diameter than the required rough-in supply pipe and a minimum of 24" tall.

The contractor may install water hammer arrestors in lieu of air chambers. Water hammer arrestors shall be PDI Certified and sized and placed as recommended by manufacture. Provide an accessible isolation valve and proper access to arrestor for replacement.

3.03 INTERFACE WITH OTHER PRODUCTS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

PLUMBING FIXTURES	22 44 00 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

3.04 ADJUSTING

- A. Adjust work under provisions of Division 1.
- B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.05 CLEANING

- A. Clean work under provisions of Division 1.
- B. At completion clean plumbing fixtures and equipment.

3.06 PROTECTION OF FINISHED WORK

- A. Protect finished Work under provisions of Division 1.
- B. Do not permit use of fixtures.

3.07 ADA ACCESSIBLE FIXTURES

- A. Install fixtures to heights, indicated on architectural drawings.
- B. Handicapped fixtures shall be installed to required heights, shall be of types suitable for, and supplied with controls properly installed, to comply with requirements as directed by ADA Accessibility of Federal Registry, Part III, Department of Justice 28 CFR 36 and comply with all state and local ADA Code requirements.
- C. Exposed accessible sink or lavatory p-trap and angle valve assemblies shall be insulated with the fully molded, Truebro, Handi Lav-guard insulation kit. Provide the proper model for fixtures specified. All kits shall be White or as selected by Architect.
- D. Wall mounted drinking fountains and coolers which protrude into passages or corridor space, whether single or paired with adjacent accessible fixture, shall be supplied with skirt or apron to lower the underside clearance of non-accessible fixture equal to that required for accessible fixture.

END OF SECTION 22 44 00

PLUMBING FIXTURES	22 44 00 - 5
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 22 45 00 PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Water Heaters.
- B. In-line circulator pumps.

1.02 RELATED SECTIONS

- A. Section 221400 - Supports and Anchors.
- B. Section 232400 – Sound & Vibration Control.
- C. Section 224100 - Plumbing Piping & Valves.
- D. Section 224300 - Plumbing Specialties.
- E. Section 261800 - Equipment Wiring Systems: Electrical characteristics and wiring connections.

1.03 REFERENCES

- A. ANSI/ASHRAE 90A - Energy Conservation in New Building Design.
- B. ASME Section VIID - Pressure Vessels; Boiler and Pressure Vessel Codes.
- C. ANSI/NFPA 54 - National Fuel Gas Code.
- D. ANSI/NFPA 70 - National Electrical Code.
- E. ANSI/UL 1453 - Electric Booster and Commercial Storage Tank Water Heaters.

1.04 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Shop Drawings:
 - 1. Include heat exchanger dimensions. size of tappings, and performance data.
 - 2. Include dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

PLUMBING EQUIPMENT	22 45 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

C. Product Data:

1. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.
2. Indicate pump type, capacity, power requirements, and affected adjacent construction.
3. Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
4. Provide electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions.

1.05 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 1.
- B. Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with authorities having jurisdiction.
- B. Provide pumps with manufacturer's name, model number, and rating/capacity identified.
- C. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:
1. American Gas Association (AGA).
 2. National Sanitation Foundation (NSF).
 3. American Society of Mechanical Engineers (ASME).
 4. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
 5. National Electrical Manufacturers' Association (NEMA).
 6. Underwriters Laboratories (UL).
- D. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.07 REGULATORY REQUIREMENTS

- A. Conform to AGA NSF ANSI/NFPA 54 ANSI/NFPA 70 ANSI/UL 1453 requirements for water heaters.

PLUMBING EQUIPMENT	22 45 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

- B. Conform to ASME Section VIII D for manufacture of pressure vessels for heat exchangers.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Section Division 1.
- B. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.09 WARRANTY

- A. Provide five year warranty under provisions of Division 1.
- B. Warranty: Include coverage of domestic water heaters, water storage tanks, and packaged water heating systems.

1.10 EXTRA MATERIALS

- A. Furnish under provisions of Division 1.
- B. Provide two sets of electric heater elements.

PART 2 - PRODUCTS

2.01 COMMERCIAL ELECTRIC WATER HEATERS

- A. Manufacturers:
 - 1. A.O. Smith.
 - 2. Other acceptable manufacturers offering equivalent products.
 - a. State Industries.
 - b. Bradford White.
- B. Type: Factory-assembled and wired, electric, vertical storage.
- C. Tank: Glass lined welded steel; 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.
- D. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F (16 to 82 degrees C), flanged or screw-in nickel-chrome elements, high temperature limit thermostat.
- E. Accessories: Brass water connections and dip tube, drain valve, high-density magnesium anode, and ASME rated temperature and pressure relief valve.

2.02 COMMERCIAL GAS FIRED DIRECT VENT WATER HEATER

PLUMBING EQUIPMENT	22 45 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Manufacturers:
 - 1. A.O. Smith
 - 2. Other acceptable manufacturers offering equivalent products.
 - a. State.
 - b. Bradford White.
 - c. Lochinvar.
- B. Type: Automatic, natural gas-fired, vertical storage direct vent water heater.
- C. Tank: Glass lined welded steel ASME labeled; maximum hydrostatic working pressure of 160 psi, 4 inch diameter inspection port, down fired power burner, spiral shaped heat exchanger, thermally insulated with minimum 2 inch insulation, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.
- D. Accessories: Brass water connections and dip tube, drain valve, maintenance free powered anode or a minimum of two high-density magnesium anode, and ASME rated temperature and pressure relief valve.
- E. Approval: By AGA as automatic storage water heater and automatic circulating tank water heater for operation at 180 degrees F. Meets or exceeds the thermal efficiency and standby loss requirements of the U.S. Dept. of Energy and current ASHRAE 90.1. Water heater must comply with SCAQMD Rule 1146.2 for low NOx emissions
- F. Controls: Automatic direct immersion thermostat with temperature range adjustable minimum 175 degrees F (97 degrees C) differential, automatic reset high temperature limiting thermostat, factory set at 205 degrees F (96 degrees C), gas pressure regulator, multi-ribbon or tubular burner, 100 percent safety shut-off pilot and thermocouple, intermittent electronic ignition monitoring pilot and main flame, trial for re-ignition for momentary loss of flame, shut down of pilot and main burner in 2-4 seconds after loss of flame, and power burner and vent.

2.03 DIAPHRAGM-TYPE COMPRESSION TANKS

- A. Manufacturer:
 - 1. Amtrol.
 - 2. Other acceptable manufacturers offering equivalent products.
 - a. Bell & Gossett.
 - b. Armstrong.
 - c. Taco.
- B. Construction: Welded steel, tested and stamped in accordance with Section 8D of ASME Code; supplied with National Board Form U-1, rated for working pressure of 125 psig,

PLUMBING EQUIPMENT	22 45 00 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

- C. Accessories: Pressure gage and air-charging fitting, tank drain; pre-charge to 12 psig.

2.04 IN-LINE CIRCULATOR PUMPS

- A. Manufacturers:
1. Bell & Gossett.
 2. Other acceptable manufacturers offering equivalent products.
 - a. TACO.
 - b. Grundfos
 - c. Armstrong
- B. Casing: Bronze, rated for 125 psig working pressure.
- C. Impeller: Bronze.
- D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
- E. Seal: Carbon rotating against a stationary ceramic seat.
- F. Drive: Flexible coupling.

PART 3 - EXECUTION

3.01 WATER HEATER INSTALLATION

- A. Install water heaters in accordance with manufacturer's instructions and to AGA NSF ANSI/NFPA 54 UL requirements.
- B. Coordinate with plumbing piping and related work to achieve operating system.
- C. Provide secondary drain pan and route secondary drain pipe to outside the building or as indicated on the construction documents.
- D. Route TPR drain line to the exterior of the building and terminate 6 inches above grade.
- E. Provide 18 inch high galvanized stand manufactured for supporting water heaters.

3.02 DOMESTIC HOT WATER STORAGE TANK INSTALLATION

- A. Install tanks in accordance with manufacturer's instructions.
- B. Provide steel pipe support for tanks, independent of building structural framing

PLUMBING EQUIPMENT	22 45 00 - 5
24214 - COPA New Lifeguard Facility	5-15-2025

members.

- C. Clean and flush tank after installation. Seal until pipe connections are made.

3.03 PUMP INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Ensure shaft length allows sump pumps to be located minimum 24 inches below lowest invert into sump pit and minimum 6 inches clearance from bottom of sump pit.
- C. Provide air cock and drain connection on horizontal pump casings.
- D. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
- E. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and over.
- F. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
- G. Align and verify alignment of base mounted pumps prior to start-up.

END OF SECTION 22 45 00

PLUMBING EQUIPMENT	22 45 00 - 6
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 23 05 00

BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.
- B. The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore, shall be submitted to the Architect for approval as soon as practicable. No such departures shall be made without the prior written approval of the Architect.
- C. Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, such reference shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Architect, expressed in writing, is equal to that specified.

1.02 SCOPE OF WORK

- A. The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form the complete and functioning systems in all of its various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The contractor shall review all pertinent drawings, including those of other contracts prior to commencement of Work.
- B. This Division requires the furnishing and installing of all items Specified herein, indicated on the Drawings or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.
- C. The approximate locations of Mechanical (HVAC) and Plumbing items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building, and will in all cases be subject to the Review of the Owner or

BASIC MATERIALS AND METHODS	23 05 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

- D. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.
- E. All discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to the bidding, where this cannot be done at least 7 working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.
- F. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.
- G. It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified later, or necessary for a complete and functioning heating, ventilating and air conditioning system shall be considered a part of the overall "Scope".
- H. The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

1.03 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

- A. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the approved shop drawings.
- B. All duct or pipe or equipment locations as indicated on the documents do not indicate every transition, offset, or exact location. All transitions, offsets clearances and exact locations shall be established by actual field measurements, coordination with the structural, architectural and reflected ceiling plans, and other trades. Submit shop drawings for approval.
- C. All transitions, offsets and relocations as required by actual field conditions shall be performed by the contractor at no additional cost to the owner.
- D. Additional coordination with electrical contractor may be required to allow adequate clearances of electrical equipment, fixtures and associated appurtenances. Contractor to

BASIC MATERIALS AND METHODS	23 05 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

notify Architect and Engineer of unresolved clearances, conflicts or equipment locations.

1.04 SITE VISIT AND FAMILIARIZATION

- A. Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.
- B. Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.
- C. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.05 WORK SPECIFIED IN OTHER SECTIONS

- A. Finish painting is specified. Prime and protective painting are included in the work of this Division.
- B. Owner and General Contractor furnished equipment shall be properly connected to Mechanical (HVAC) and Plumbing systems.
- C. Furnishing and installing all required Mechanical (HVAC) and Plumbing equipment control relays and electrical interlock devices, conduit, wire and J-boxes are included in the Work of this Division.

1.06 PERMITS, TESTS, INSPECTIONS

- A. Arrange and pay for all permits, fees, tests, and all inspections as required by governmental authorities.

1.07 DATE OF FINAL ACCEPTANCE

- A. The date of final acceptance shall be the date of owner occupancy, or the date all punch list items have been completed or final payment has been received. Refer to Division 1 for additional requirements.
- B. The date of final acceptance shall be documented in writing and signed by the architect, owner and contractor.

1.08 DELIVERY, STORAGE, AND HANDLING

BASIC MATERIALS AND METHODS	23 05 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
- B. Deliver products to the project at such time as the project is ready to receive the equipment, pipe or duct properly protected from incidental damage and weather damage.
- C. Damaged equipment, duct or pipe shall be promptly removed from the site and new, undamaged equipment, pipe and duct shall be installed in its place promptly with no additional charge to the Owner.

1.09 NOISE AND VIBRATION

- A. The heating, ventilating and air conditioning systems, and the component parts there of, shall be guaranteed to operate without objectionable noise and vibration.
- B. Provide foundations, supports and isolators as specified or indicated, properly adjusted to prevent transmission of vibration to the Building structure, piping and other items.
- C. Carefully fabricate ductwork and fittings with smooth interior finish to prevent turbulence and generation or regeneration of noise.
- D. All equipment shall be selected to operate with minimum of noise and vibration. If, in the opinion of the Architect, objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of the Work, the Contractor shall rectify such conditions without extra cost to the Owner.

1.10 APPLICABLE CODES

- A. Obtain all required permits and inspections for all work required by the Contract Documents and pay all required fees in connection thereof.
- B. Arrange with the serving utility companies for the connection of all required utilities and pay all charges, meter charges, connection fees and inspection fees, if required.
- C. Comply with all applicable codes, specifications, local ordinances, industry standards, utility company regulations and the applicable requirements of the following nationally accepted codes and standards:
 - 1. Air Moving & Conditioning Association, AMCA.
 - 2. American Standards Association, ASA.
 - 3. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE.
 - 4. American Society of Mechanical Engineers, ASME.
 - 5. American Society of Plumbing Engineers, ASPE.

BASIC MATERIALS AND METHODS	23 05 00 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

6. American Society of Testing Materials, ASTM.
 7. American Water Works Association, AWWA.
 8. National Bureau of Standards, NBS.
 9. National Fire Protection Association, NFPA.
 10. Sheet Metal & Air Conditioning Contractors' National Association, SMACNA.
 11. Underwriters' Laboratories, Inc., UL.
 12. International Energy Conservation Code, IECC.
- D. Where differences existing between the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, the more stringent or costly application shall govern. Promptly notify the Engineer in writing of all differences.
- E. When directed in writing by the Engineer, remove all work installed that does not comply with the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, correct the deficiencies, and complete the work at no additional cost to the Owner.

1.11 DEFINITIONS AND SYMBOLS

- A. General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 1.
- B. Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.
- C. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.
- D. Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

BASIC MATERIALS AND METHODS	23 05 00 - 5
24214 - COPA New Lifeguard Facility	5-15-2025

- E. Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.
- F. Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.
- G. Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.
- H. Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.
- I. Installer: Entity (person or firm) engaged by the Contractor or its subcontractor or Sub-contractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.
- J. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or when so noted by other identified installers or entities.
- K. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.
- L. Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self explanatory nature have been included in text of Specifications and Drawings. Specific

BASIC MATERIALS AND METHODS	23 05 00 - 6
24214 - COPA New Lifeguard Facility	5-15-2025

abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by 1993 ASHRAE Fundamentals Handbook, chapter 34 "Abbreviations and Symbols", ASME and ASPE published standards.

1.12 DRAWINGS AND SPECIFICATIONS

- A. These Specifications are intended to supplement the Drawings and it will not be the province of the Specifications to mention any part of the work which the Drawings are competent to fully explain in every particular and such omission is not to relieve the Contractor from carrying out portions indicated on the Drawings only.
- B. Should items be required by these Specifications and not indicated on the Drawings, they are to be supplied even if of such nature that they could have been indicated thereon. In case of disagreement between Drawings and Specifications, or within either Drawings or Specifications, the better quality or greater quantity of work shall be estimated and the matter referred to the Architect or Engineer for review with a request for information and clarification at least 7 working days prior to bid opening date for issuance of an addendum.
- C. The listing of product manufacturers, materials and methods in the various sections of the Specifications, and indicated on the Drawings, is intended to establish a standard of quality only. It is not the intention of the Owner or Engineer to discriminate against any product, material or method that is equal to the standards as indicated and/or specified, nor is it intended to preclude open, competitive bidding. The fact that a specific manufacturer is listed as an acceptable manufacturer should not be interpreted to mean that the manufacturers' standard product will meet the requirements of the project design, Drawings, Specifications and space constraints.
- D. The Architect or Engineer and Owner shall be the sole judge of quality and equivalence of equipment, materials and methods.
- E. Products by other reliable manufacturers, other materials, and other methods, will be accepted as outlined, provided they have equal capacity, construction, and performance. However, under no circumstances shall any substitution be made without the written permission of the Architect or Engineer and Owner. Request for prior approval must be made in writing 10 days prior to the bid date without fail.

BASIC MATERIALS AND METHODS	23 05 00 - 7
24214 - COPA New Lifeguard Facility	5-15-2025

- F. Wherever a definite product, material or method is specified and there is not a statement that another product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method is the only one that shall be used without prior approval.
- G. Wherever a definite material or manufacturer's product is specified and the Specification states that products of similar design and equal construction from the specified list of manufacturers may be substituted, it is the intention of the Owner or Engineer that products of manufacturers that are specified are the only products that will be acceptable and that products of other manufacturers will not be considered for substitution without approval.
- H. Wherever a definite product, material or method is specified and there is a statement that "OR EQUAL" product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method or an "OR EQUAL" product, material or method may be used if it complies with the specifications and is submitted for review to the Engineer as outline herein.
- I. Where permission to use substituted or alternative equipment on the project is granted by the Owner or Engineer in writing, it shall be the responsibility of the Contractor or Subcontractor involved to verify that the equipment will fit in the space available which includes allowances for all required Code and maintenance clearances, and to coordinate all equipment structural support, plumbing and electrical requirements and provisions with the Mechanical (HVAC) and Plumbing Design Documents and all other trades, including Division 16.
- J. Changes in architectural, structural, electrical, mechanical, and plumbing requirements for the substitution shall be the responsibility of the bidder wishing to make the substitution. This shall include the cost of redesign by the affected designer(s). Any additional cost incurred by affected subcontractors shall be the responsibility of this bidder and not the owner.
- K. If any request for a substitution of product, material or method is rejected, the Contractor will automatically be required to furnish the product, material or method named in the Specifications. Repetitive requests for substitutions will not be considered.
- L. The Owner or Engineer will investigate all requests for substitutions when submitted in accordance with above and if accepted, will issue a letter allowing the substitutions.
- M. Where equipment other than that used in the design as specified or shown on the Drawings is substituted (either from an approved manufacturers list or by submittal review), it shall be the responsibility of the substituting Contractor to coordinate space requirements, building provisions and connection requirements with his trades and all other trades and pay all additional costs to other trades, the Owner, the Architect or Engineer, if any, due to the substitutions.

BASIC MATERIALS AND METHODS	23 05 00 - 8
24214 - COPA New Lifeguard Facility	5-15-2025

- N. The electrical design and electrical drawings are based on the equipment and/or electric motors of the type, size and electrical characteristics shown and specified on the mechanical drawings. Any change in equipment and/or motor size or type brought on directly or indirectly by a substitution or mechanical equipment having characteristics requiring a change, shall be the responsibility of the Mechanical Contractor and the entire cost of such change, including conduit, wiring, motor starting equipment, etc., shall be paid for by the Mechanical Contractor at no additional charge, unless the substitution was initiated by the Owner. Submittals must clearly show and deviations. Mechanical Contractor is responsible for coordinating any required changes with the Electrical Contractor, prior to Electrical Contractors ordering of panels and associated equipment.

1.13 SUBMITTALS

- A. Coordinate with Division 1 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded the Contractor shall submit a minimum of eight (8) complete bound sets of shop drawings and complete data covering each item of equipment or material. The first submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive shop drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain one (1) copy each of all shop drawings for their files. Where full size drawings are involved, submit one (1) print and one (1) reproducible sepia or mylar in lieu of eight (8) sets. All literature pertaining to an item subject to Shop Drawing submittal shall be submitted at one time. A submittal shall not contain information from more than one Specification section, but may have a section subdivided into items or equipment as listed in each section. The Contractor may elect to submit each item or type of equipment separately. Each submittal shall include the following items enclosed in a suitable binder:
1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
 2. An index page with a listing of all data included in the Submittal.
 3. A list of variations page with a listing all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.

BASIC MATERIALS AND METHODS	23 05 00 - 9
24214 - COPA New Lifeguard Facility	5-15-2025

4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
 5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
 6. Identification of each item of material or equipment matching that indicated on the Drawings.
 7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
 8. Additional information as required in other Sections of this Division.
 9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".
- B. Refer to Division 1 for additional information on shop drawings and submittals.
- C. Equipment and materials submittals and shop drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of shop drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.
- D. Where shop drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.
- E. Shop drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:
1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.
 2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.

BASIC MATERIALS AND METHODS	23 05 00 - 10
24214 - COPA New Lifeguard Facility	5-15-2025

3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.
 4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous shop drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.
 5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all shop drawings.
 6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.
- F. Materials and equipment which are purchased or installed without shop drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.
- G. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.
- H. Submittals are required for, but not limited to, the following items:
1. Pipe Material and Specialties.
 2. Pipe Fabrication Drawings.
 3. Basic Materials.
 4. Air Handling Units.
 5. Air Cooled Condensing Units.
 6. Noise and Vibration Controls.
 7. Plumbing Fixtures and Specialties.
 8. Plumbing Equipment.

BASIC MATERIALS AND METHODS	23 05 00 - 11
24214 - COPA New Lifeguard Facility	5-15-2025

9. Sanitary DWV Fittings, Pipe and Accessories.
10. Domestic Hot and Cold Water Pipe, Fittings and Accessories.
11. HVAC Pipe and Duct Insulation.
12. Plumbing Valves.
13. Portable Pipe Hanger and Equipment Supports.
14. Duct Specialties.
15. Duct Fabrication Drawings.
16. Air Distribution Devices.
17. Fan Coil Units.
18. Filters.
19. Fans.
20. Fire Dampers and Fire Smoke Dampers.
21. Temperature Controls and Control Sequences.
22. Test, Adjust and Balance Reports.
23. Testing, Adjusting and Balancing Contractor Qualifications.
24. Coordination Drawings.

- I. Refer to other Division 23 sections for additional shop drawing requirements. Provide samples of actual materials and/or equipment to be used on the Project upon request of the Owner or Engineer.
- J. **Contractor to submit Mechanical/Electrical equipment coordination sheet with equipment submittal for all AHU's, ACCU's, and Fans. Reference chart at end of section. Provide copy to electrical subcontractor.**

1.14 COORDINATION DRAWINGS

- A. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:
 1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:
 - a. Wall and type locations.
 - b. Clearances for installing and maintaining insulation.
 - c. Locations of light fixtures and sprinkler heads.
 - d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
 - e. Equipment connections and support details.
 - f. Exterior wall and foundation penetrations.
 - g. Routing of storm and sanitary sewer piping.

BASIC MATERIALS AND METHODS	23 05 00 - 12
24214 - COPA New Lifeguard Facility	5-15-2025

- h. Fire-rated wall and floor penetrations.
 - i. Sizes and location of required concrete pads and bases.
 - j. Valve stem movement.
 - k. Structural floor, wall and roof opening sizes and details.
 - 2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
 - 3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
 - 4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.
- B. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.
- C. By submitting shop drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.15 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements in Special Project Requirements, in addition to the requirements specified in Division 23, indicate the following installed conditions:
- 1. Duct mains and branches, size and location, for both exterior and interior; locations of dampers, fire dampers, duct access panels, and other control devices; filters, fuel fired heaters, fan coils, condensing units, and roof-top A/C 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. Indicate actual inverts and horizontal locations of underground piping.
 - 3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 - 4. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
 - 5. Contract Modifications, actual equipment and materials installed.

BASIC MATERIALS AND METHODS	23 05 00 - 13
24214 - COPA New Lifeguard Facility	5-15-2025

- B. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.
- C. The Contractor shall maintain a set of clearly marked black line record "AS-BUILT" prints on the job site on which he shall mark all work details, alterations to meet site conditions and changes made by "Change Order" notices. These shall be kept available for inspection by the Owner, Architect or Engineer at all times.
- D. Refer to Division 1 for additional requirements concerning record drawings. If the Contractor does not keep an accurate set of as-built drawings, the pay request may be altered or delayed at the request of the Architect. Mark the drawings with a colored pencil. Delivery of as-built prints and reproducibles is a condition of final acceptance.
- E. The record prints shall be updated on a daily basis and shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed pipe or duct, locations of all concealed valves, controls and devices and any deviations from the work shown on the Construction Documents which are required for coordination. All dimensions shall include at least two dimensions to permanent structure points.
- F. Submit three prints of the tracings for approval. Make corrections to tracings as directed and delivered "Auto Positive Tracings" to the architect. "As-Built" drawings shall be furnished in addition to shop drawings.
- G. When the option described in paragraph F., above is not exercised then upon completion of the work, the Contractor shall transfer all marks from the submit a set of clear concise set of reproducible record "AS-BUILT" drawings and shall submit the reproducible drawings with corrections made by a competent draftsman and three (3) sets of black line prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The reproducible record "AS-BUILT" drawings shall have the Engineers Name and Seal removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

(NAME OF GENERAL CONTRACTOR)

BY: _____
(SIGNATURE)

(NAME OF SUBCONTRACTOR)

BY: _____

BASIC MATERIALS AND METHODS	23 05 00 - 14
24214 - COPA New Lifeguard Facility	5-15-2025

(SIGNATURE)

1.16 OPERATING MANUALS

- A. Prepare maintenance manuals in accordance with Division 1 and 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.

1.17 CERTIFICATIONS AND TEST REPORTS

- A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and schedule date for each test. This detailed completion and test schedule shall be submittal at least 90 days before the projected Project completion date.
- B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.
- C. Submit 4 copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.
- D. Certifications and test reports to be submitted shall include, but not be limited to those items outlined in Section of Division 23.

1.18 MAINTENANCE MANUALS

- A. Coordinate with Division 1 for maintenance manual requirements, unless noted otherwise bind together in "D ring type" binders by National model no. 79-883 or equal, binders shall be large enough to allow ¼" of spare capacity. Three (3) sets of all approved shop drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections and labeled for easy

BASIC MATERIALS AND METHODS	23 05 00 - 15
24214 - COPA New Lifeguard Facility	5-15-2025

reference and shall utilize the individual specification section numbers shown in the Mechanical Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 23 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

- B. Prepare maintenance manuals in accordance with Special Project Conditions, in addition to the requirements specified in Division 23, include the following information for equipment items:
1. Identifying names, name tags designations and locations for all equipment.
 2. Valve tag lists with valve number, type, color coding, location and function.
 3. Reviewed shop drawing submittals with exceptions noted compliance letter.
 4. Fabrication drawings.
 5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
 6. 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.
 7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions, servicing instructions and lubrication charts and schedules.
 8. Equipment and motor name plate data.
 9. Wiring diagrams.
 10. Exploded parts views and parts lists for all equipment and devices.
 11. Color coding charts for all painted equipment and conduit.
 12. Location and listing of all spare parts and special keys and tools furnished to the Owner.
 13. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.
- C. Refer to Division 1 for additional information on Operating and Maintenance Manuals.
- D. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer a minimum of 14 working days prior to the beginning of the operator training period.

1.19 OPERATOR TRAINING

- A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include 12 hours of on site training in three 4 hour shifts.

BASIC MATERIALS AND METHODS	23 05 00 - 16
24214 - COPA New Lifeguard Facility	5-15-2025

- B. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.
- C. Refer to other Division 23 Sections for additional Operator Training requirements.

1.20 FINAL COMPLETION

- A. At the completion of the work, all equipment and systems shall be tested and faulty equipment and material shall be repaired or replaced. Refer to Sections of Division 23 for additional requirements.
- B. Clean and adjust all air distribution devices and replace all air filters immediately prior to final acceptance.
- C. Touch up and/or refinish all scratched equipment and devices immediately prior to final acceptance.

1.21 CONTRACTOR'S GUARANTEE

- A. Use of the HVAC and Plumbing systems to provide temporary service during construction period will not be allowed without permission from the Owner in writing and if granted shall not be cause warranty period to start, except as defined below.
- B. Contractor shall guarantee to keep the entire installation in repair and perfect working order for a period of one year after its completion and final acceptance, and shall furnish free of additional cost to the Owner all materials and labor necessary to comply with the above guarantee throughout the year beginning from the date of issue of Substantial Completion, Beneficial Occupancy by the Owner or the Certificate of Final Payment as agreed upon by all parties.
- C. This guarantee shall not include cleaning or changing filters except as required by testing, adjusting and balancing.
- D. All air conditioning compressors shall have parts and labor guarantees for a period of not less than 5 years beyond the date of final acceptance.
- E. Refer to Sections in Division 23 for additional guarantee or warranty requirements.

1.22 TRANSFER OF ELECTRONIC FILES

BASIC MATERIALS AND METHODS	23 05 00 - 17
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Project documents are not intended or represented to be suitable for reuse by Architect/Owner or others on extensions of this project or on any other project. Any such reuse or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner's risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney's fees arising out of or resulting thereof.
- B. Because data stored in electric media format can deteriorate or be modified inadvertently, or otherwise without authorization of the data's creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.
- C. When transferring documents in electronic media format, Engineer makes no representations as to the long term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.
- D. Any reuse or modifications will be Contractor's sole risk and without liability or legal exposure to Architect, Engineer or any consultant.
- E. The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect's written consent.

It is agreed that "MEP" hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The contract documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement between Architect and Owner.

If the client, Architect/Owner, or developer of the project requires electronic media for "record purposes", then an AutoCAD based compact disc ("CD") will be prepared. The "CD" will be submitted with all title block references intact and will be formatted in a "plot" format to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.

- F. At the Architect/Owner's request, Engineer will prepare one "CD" of electronic media to assist the contractor in the preparation of submittals. The Engineer will prepare and submit the "CD" to the Architect/Owner for distribution to the contractor. All copies of the "CD" will be reproduced for a cost of reproduction fee of Five Hundred Dollars (\$500.00) per "CD".

BASIC MATERIALS AND METHODS	23 05 00 - 18
24214 - COPA New Lifeguard Facility	5-15-2025

The "CD" will be prepared and all title blocks, names and dates will be removed. The "CD" will be prepared in a ".dwg" format to permit the end user to revise the drawings.

- G. This Five Hundred Dollars (\$500.00) per "CD" cost of reproduction will be paid directly from the Contractor to the Engineer. The "CD" will be prepared only after receipt of the Five Hundred Dollars (\$500.00). The Five Hundred Dollars (\$500.00) per "CD" cost of reproduction is to only recover the cost of the manhours necessary to reproduce the documents. It is not a contractual agreement between the Contractor and Engineer to provide any engineering services, nor any other service.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide materials and equipment manufactured by a domestic United States manufacturer.
- B. Access Doors: Provide access doors as required for access to equipment, valves, controls, cleanouts and other apparatus where concealed. Access doors shall have concealed hinges and screw driver cam locks.
- C. All access panels located in wet areas such as restrooms, locker rooms, shower rooms, kitchen and any other wet areas shall be constructed of stainless steel.
- D. Access Doors: shall be as follows:
 - 1. Plastic Surfaces: Milcor Style K.
 - 2. Ceramic Tile Surface: Milcor Style M.
 - 3. Drywall Surfaces: Milcor Style DW.
 - 4. Install panels only in locations approved by the Architect.

PART 3 - EXECUTION

3.01 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected via reviewed submittals.
- B. Refer to equipment specifications in Divisions 2 through 16 for additional rough-in requirements.

3.02 MECHANICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

BASIC MATERIALS AND METHODS	23 05 00 - 19
24214 - COPA New Lifeguard Facility	5-15-2025

1. Coordinate mechanical systems, equipment, and materials installation with other building components.
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 architectural action markings on submittal, 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, resolve conflicts and route proposed solution to the Architect for review.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location and label.
11. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Provide roof curbs for all roof mounted equipment. Coordinate with roof construction for pitched roof. Provide roof curb to match roof slope. Refer to architectural drawings and details.
14. The equipment to be furnished under this Specification shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the product of the same manufacturer.
15. The architectural and structural features of the building and the space limitations shall be considered in selection of all equipment. No equipment shall be furnished which will not suit the arrangement and space limitations indicated.

BASIC MATERIALS AND METHODS	23 05 00 - 20
24214 - COPA New Lifeguard Facility	5-15-2025

16. Lubrication: Prior to start-up, check and properly lubricate all bearings as recommended by the manufacturer.
17. Where the word "Concealed" is used in these Specifications in connection with insulating, painting, piping, ducts, etc., it shall be understood to mean hidden from sight as in chases, furred spaces or suspended ceilings. "Exposed" shall be understood to mean the opposite of concealed.
18. Identification of Mechanical Equipment:
 - a. Mechanical equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Shop drawings shall include dimensions and lettering format for approval. Attachments shall be with escutcheon pins, self-tapping screws, or machine screws.
 - b. Tags shall be attached to all valves, including control valves, with nonferrous chain. Tags shall be brass and at least 1-1/2 inches in diameter. Nameplate and tag symbols shall correspond to the identification symbols on the temperature control submittal and the "as-built" drawings.

3.03 CUTTING AND PATCHING

- A. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
 1. Uncover Work to provide for installation of ill-timed Work.
 2. Remove and replace defective Work.
 3. Remove and replace Work not conforming to requirements of the Contract Documents.
 4. Remove samples of installed Work as specified for testing.
 5. Install equipment and materials in existing structures.
 6. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer/Owner's observation of concealed Work, without additional cost to the Owner.
 7. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers; refer to the materials and methods required for the surface and building components being patched; Refer to Section "DEFINITIONS" for definition of "Installer."
- C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, mechanical ducts and HVAC units, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work.

BASIC MATERIALS AND METHODS	23 05 00 - 21
24214 - COPA New Lifeguard Facility	5-15-2025

- 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.

3.04 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER

- A. The Owner will cooperate with the Contractor, however, the following provisions must be observed:
 - 1. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Sub-Contractors and the Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.
 - 2. During the construction of this project, normal facility activities will continue in existing buildings until renovated areas are completed. Plumbing, fire protection, lighting, electrical, communications, heating, air conditioning, and ventilation systems will have to be maintained in service within the occupied spaces of the existing building.

END OF SECTION 23 05 00

BASIC MATERIALS AND METHODS	23 05 00 - 22
24214 - COPA New Lifeguard Facility	5-15-2025

Mech/Elec. Equipment Coordination Sheet	
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SECTION 23 07 19
DIRECT EXPANSION PIPING SYSTEM INSULATIONS

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 insulating the following HVAC piping systems.
 - 1. Refrigerant suction (low pressure gas) piping.
 - 2. Refrigerant hot gas (discharge or high pressure gas) piping.
 - 3. Refrigerant liquid piping, for VRF/VRV and Heat Pump systems.
 - 4. Condensate drainage piping.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated, include thermal conductivity, water vapor permeance, thickness, and jackets (both factory and field applied if any).

1.04 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Installer Qualification: Only trained installers that are familiar with the products should be used.

1.06 DELIVERY STORAGE AND HANDLING

- A. Material to be delivered in new condition, free of defects and stored in a clean, dry space that provides protection against damage and contamination.

1.07 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 231400 "Hangers and Supports for HVAC Piping and Equipment".
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and space required for maintenance.

1.08 SCHEDULING

- A. Schedule insulation application after pressure testing and leak testing of systems. Insulation application may begin on segments that have satisfactory test results.

Part 2 – PRODUCTS

2.01 INSULATION MATERIALS

DIRECT EXPANSION PIPING SYSTEM INSULATIONS	23 07 19 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Flexible Elastomeric Foam: EPDM - Closed cell expanded rubber. Comply with ASTM C 534, Type I for tubular materials for refrigeration pipe sizes 1/4" and greater.
 - 1. Outdoor Use, Basis of Design Product: Provide Reftekk AC-SSPT (EPDM pre-split with lap seal and field applied Aeroflex Aerocoat) or comparable product by one of the following.
 - a. Aeroflex, EPDM SSPT with field applied Aerocel Aerocoat
 - b. Armacell, LLC, EPDM UT Solaflex, Pre-split with lap seal and with field applied Black PVC jacket
 - 2. Indoor Use, Basis of Design Product: Provide Reftekk AC-SSPT (EPDM pre-split with lap seal) or comparable product by one of the following.
 - a. Aeroflex, EPDM SSPT
 - b. Armacell, LLC, EPDM UT Solaflex, Pre-split with lap seal
 - 3. Applied to Annealed Coiled Tubing (Line Sets), Basis of Design Product: EPDM continuous tube.
- B. Elastomeric insulation shall not use CFC's or HFC's in the manufacturing process.
- C. Elastomeric insulation shall have a flame spread-index of 25 or less and a smoke-developed index of 50 or less when tested in accordance with ASTM E84 for all products through 2" thickness.
- D. Elastomeric insulation and elastomeric joining system shall be suitable of use from -70°F to 257°F continuous service temperature, per ASTM C 411.
- E. Elastomeric insulation shall have a maximum thermal conductivity of 0.235 Btu-in/h-ft²-°F at a mean temperature of 75°F when tested in accordance with ASTM C 177 or ASTM C 518.
- F. Elastomeric insulation shall have a maximum water vapor transmission of ≤0.03 perm-inch when tested in accordance with ASTM E 96, Procedure A, latest revision.
- G. Elastomeric insulation must exhibit long-term UV resistance in outdoor installation per ASTM G 7 and ASTM G 90.
- H. Elastomeric insulation must not contribute to external stress corrosion cracking when tested per ASTM C 692.

2.02 ADHESIVES, AND TAPES

- A. Flexible Elastomeric Adhesive for Indoor and Outdoor Application:
 - 1. Basis of Design Product: Provide Aeroflex AeroSeal contact adhesive or comparable product by one of the following.
 - a. Armacell, LLC HT 625 contact adhesive
- B. Flexible Elastomeric for LEED low VOC Application:
 - 1. Basis of Design Product: Provide Aeroflex AeroSeal LVOC
- C. Seaming tape to be 15-mil EPDM rubber with acrylic adhesive.

2.03 INSULATING PIPE HANGER SUPPORTS

DIRECT EXPANSION PIPING SYSTEM INSULATIONS	23 07 19 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Support the piping system using high density rigid foam insulating pipe hanger supports with an inner lining of EPDM rubber insulating tape and 15-mil exterior EPDM rubber jacket. Insulation density to be a minimum of 10 lb. / cu. ft. with a compressive strength of 284 PSI or greater, and a k-value of 0.312 or lower. Continuous use temperature range to be -70°F to 257°F with water absorption of 5% or less.
 - 1. Basis of Design Product: Provide Reftekk “Cush-A-Therm”, model UX insulated pipe support complete with steel channel insulation OD clamp or comparable product by one of the following.
 - a. Aeroflex USA, Aerofix-U with matching steel channel insulation OD clamp.
 - b. Armaflex LLC, Armafix IPH with matching steel channel insulation OD clamp.

2.04 METAL JACKETING

- A. Childers “Strap-On” jacketing. Provide preformed fitting covers on all elbows and tees.

Part 3 – EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and free of leaks and defects
 - 2. Verify that surfaces to be insulated are clean, dry and free of dirt, dust, grease, frost, and moisture.
 - 3. Work shall be performed at the installation temperatures recommended by the product manufacturer.
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Tape seams and lap seam tape overlaps shall be clean dry, free of dirt, dust, grease, frost and moisture.

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. All piping, valves and fittings scheduled to be insulated to have all insulation applied in strict accordance with the insulation manufacturers installation instructions and practices described in the National Commercial and Industrial Insulation Standards Manual. In case of conflict, the manufacturers installation guidelines and instruction will be used.
- B. Install insulation materials, accessories and finishes with smooth, straight, and even surfaces; free of voids, throughout the length of the piping including supports, fittings, valves and specialties.

DIRECT EXPANSION PIPING SYSTEM INSULATIONS	23 07 19 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

- C. Pipes located outdoors or in crawl spaces shall be insulated same as concealed piping; and in addition shall have a jacket of 0.016 inch thick, smooth aluminum with longitudinal modified Pittsburgh Z-Lock seam and 2 inch overlap. Jacketing shall be easily removed and replaced without damage. All butt joints shall be sealed with gray silicone. Galvanized banding is not acceptable.
- D. Install insulation materials, vapor barriers, vapor dams, jackets, and thicknesses required for each item of the pipe system as required.
- E. Install insulation with longitudinal seams oriented per the insulation manufacturers installation instructions for all horizontal runs.
- F. Keep insulation dry and clean during application and finishing. Do not apply insulation to operating systems.
- G. Install insulation with the least number of joints practical.
- H. Piping to be insulated with tubular preformed pipe insulation.
- I. Install insulation continuously through roof penetrations, wall penetrations and floor penetrations.
- J. Install insulation continuously through fire rated wall and fire rated floor penetrations complying with Penetration Fire-stopping details.
- K. Insulating Pipe Hanger Supports are to be installed at all pipe support and clamp locations. Insulating Pipe Hanger Supports are to be installed at the time of piping installation such that the pipe insulation system is installed in a continuous manner through the pipe support system.
- L. All insulation terminations, butt joints, longitudinal joints, and access points to be properly glued or sealed with the insulation manufacturers sealant system.
- M. Vapor dams to be installed every 12' to 18' per insulation manufacturers installation instructions, high point of piping run and at all insulation terminations (supports, valves, flanges and end of pipe runs)
- N. Provide sufficient clearance between insulated pipes to allow air circulation.
- O. Provide mitered insulation fittings at elbows to prevent compression of the insulation at the throat of the elbow and stretching on the outside of the bend.
- P. Do not compress the insulation at penetrations or structural members, such as joists or studs. Do not allow the insulation to be compressed by ceiling hanger wires.
- Q. Do not allow attachment of anything to the insulated piping that will reduce the effective thickness of the insulation, such as control wiring, cabling, telephone wiring, etc. When using insulation manufacturers recommended tape on joints, do not compress the insulation.
- R. Insulation should be installed such that butt joints are in slight compression. This prevents separation of the insulation joints over time or due to changes in temperature. Do NOT apply the insulation in a stretched condition.
- S. Insulation thickness to be the most restrictive of the following options.
 - 1. Liquid, suction, and discharge lines per state energy codes.
 - 2. In accordance with the thickness tables for piping insulation in the latest version of ASHRAE 90.1.
 - 3. In accordance with local building code requirements and Authority Having Jurisdiction.

DIRECT EXPANSION PIPING SYSTEM INSULATIONS	23 07 19 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

4. In accordance with the requirements of the manufacturers of the equipment being served by the insulated refrigerant piping system.
5. Sufficient thickness to prevent condensation on the surface of the insulation under all operating conditions.

PART 4 - SCHEDULES

4.01	LOW TEMPERATURE SURFACES	MINIMUM INSULATION THICKNESS BASED ON FIBERGLASS
A.	Condensate drain lines:	$\frac{3}{4}$ inch
B.	Drains receiving condensate:	1 inch
C.	Refrigerant Piping	
	(1) 1½" and smaller	1 inch
	(2) Larger than 1½ inch	1 inch

END OF SECTION 230719

DIRECT EXPANSION PIPING SYSTEM INSULATIONS	23 07 19 - 5
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 23 14 00 SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Pipe, and equipment hangers, supports, and associated anchors.
- B. Sleeves and seals.
- C. Flashing and sealing equipment and pipe stacks.

1.02 RELATED WORK

- A. Section 23 24 00 – Sound and Vibration Control.
- B. Section 23 26 00 - Piping Insulation.
- C. Section 23 28 00 - Equipment Insulation.
- D. Section 22 41 00 - Plumbing System.
- E. Section 23 53 00 – Refrigerant Piping

1.03 REFERENCES

- A. ANSI/ASME B31.1 - Power Piping.
- B. NFPA 13 - Standard for the Installation of Sprinkler Systems.
- C. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.

1.04 QUALITY ASSURANCE

- A. Supports for Sprinkler Piping: In conformance with NFPA 13.
- B. Supports for Standpipes: In conformance with NFPA 14.

1.05 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Division 1.
- B. Indicate hanger and support framing and attachment methods.

SUPPORTS AND ANCHORS	23 14 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch Malleable iron, adjustable swivel, split ring.
- B. Hangers for Pipe Sizes 2 to 4 Inches Carbon steel, adjustable, clevis.
- C. Hangers for Pipe Sizes 6 Inches and over: Adjustable steel yoke, cast iron roll, double hanger.
- D. All hangers, struts, supports and rods in areas exposed to the outdoors, such as but not limited to crawl spaces, service bays, wash bays, open shops and warehouses shall be marine grade 316 stainless steel.
- E. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for pipe sizes 6 inches and over.
- F. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
- G. Wall Support for Pipe Sizes 4 Inches and over: adjustable steel yoke and cast iron roll.
- H. Vertical Support: Steel riser clamp.
- I. Floor Support for Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.
- J. Floor Support for Pipe Sizes 6 Inches and over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
- K. Roof Pipe Supports and Hangers: 316 Stainless Steel Channel System as manufactured by Portable Pipe Hangers, Inc. or approved equal.
 - For pipes 2-1/2" and smaller – Type PP10 with roller
 - For pipes 3" through 8" – Type PS
 - For multiple pipes – Type PSE - Custom
- L. Copper Pipe Support and Hangers: Electro-galvanized with thermoplastic elastomer cushions; Unistrut "Cush-A-Clamp" or equal. Hangers: Plastic coated; Unistrut or equal.
- M. For installation of protective shields refer to specification section 231400-3.03.
- N. Shields for Vertical Copper Pipe Risers: Sheet lead.

SUPPORTS AND ANCHORS	23 14 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

- O. Pipe Rough-In Supports in Walls/Chases: Provide preformed plastic pipe supports, Sioux Chief "Pipe Titan" or equal.

2.02 HANGER RODS

- A. Galvanized Hanger Rods: Threaded both ends, threaded one end, or continuous threaded.

2.03 INSERTS

- A. Inserts: Malleable iron case of stainless steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.04 FLASHING

- A. Metal Flashing: 20 gage stainless steel.
- B. Lead Flashing: 4 lb./sq. ft. sheet lead for waterproofing; 1 lb./sq. ft. sheet lead for soundproofing.
- C. Caps: Steel, 20 gage minimum; 16 gage at fire resistant elements.
- D. Coordinate with roofing contractor/architect for type of flashing on metal roofs.

2.05 EQUIPMENT CURBS

- A. Fabricate curbs of stainless steel unless noted otherwise.

2.06 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: Form with 18 gage galvanized steel, tack welded to form a uniform sleeve.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Form with steel pipe, schedule 40.
- C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fireproofing: Prefabricated fire rated steel sleeves including seals, UL listed.
- D. Sleeves for Round Ductwork: Form with galvanized steel.
- E. Sleeves for Rectangular Ductwork: Form with galvanized steel.
- F. Fire Stopping Insulation: Glass fiber type, non-combustible, U.L. listed.

SUPPORTS AND ANCHORS	23 14 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

- G. Caulk: Paintable 25-year acrylic sealant.
- H. Pipe Alignment Guides: Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted, two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

2.07 FABRICATION

- A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- B. Design hangers without disengagement of supported pipe.
- C. Design roof supports without roof penetrations, flashing or damage to the roofing material.

2.08 FINISH

- A. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.01 INSERTS

- A. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Coordinate with structural engineer for placement of inserts.
- B. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- C. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.
- D. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab. Verify with structural engineer prior to start of work.

3.02 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as follows:

SUPPORTS AND ANCHORS	23 14 00 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

<u>PIPE SIZE</u>	<u>MAX. HANGER SPACING</u>	<u>HANGER DIAMETER</u>
(Steel Pipe)		
1/2 to 1-1/4 inch	6'-0"	3/8"
1-1/2 to 3 inch	10'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
(Copper Pipe)		
1/2 to 1-1/4 inch	5'-0"	3/8"
1-1/2 to 2-1/2 inch	8'-0"	3/8"
3 to 4 inch	10'-0"	3/8"
6 to 8 inch	10'-0"	1/2"
(Cast Iron)		
2 to 3 inch	5'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
(PVC Pipe)		
1-1/2 to 4 inch	4'-0"	3/8"
6 to 8 inch	4'-0"	1/2"
10 and over	4'-0"	5/8"

- B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- C. Place a hanger within 12 inches of each horizontal elbow and at the vertical horizontal transition.

SUPPORTS AND ANCHORS	23 14 00 - 5
24214 - COPA New Lifeguard Facility	5-15-2025

- D. Use hangers with 1-1/2 inch minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Install hangers with nut at base and above hanger; tighten upper nut to hanger after final installation adjustments.
- J. Portable pipe hanger systems shall be installed per manufactures instructions.

3.03 Insulated Piping: Comply with the following installation requirements.

- A. Clamps: Attach galvanized clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.
- B. Saddles: Install galvanized protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.
- C. Shields: Install protective shields MSS Type 40 on cold and chilled water piping that has vapor barrier. Shields shall span an arc of 180 degrees and shall have dimensions in inches not less than the following:

<u>NPS</u>	<u>LENGTH</u>	<u>THICKNESS</u>
1/4 THROUGH 3-1/2	12	0.048
4	12	0.060
5 & 6	18	0.060
8 THROUGH 14	24	0.075
16 THROUGH 24	24	0.105

- D. Piping 2" and larger provide galvanized sheet metal shields with calcium silicate at hangers/supports.
- E. Insert material shall be at least as long as the protective shield.
- F. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.04 EQUIPMENT BASES AND SUPPORTS

SUPPORTS AND ANCHORS	23 14 00 - 6
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Provide equipment bases of concrete.
- B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct support of steel members. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.05 FLASHING

- A. Provide flexible flashing and metal counter flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting 8 inches minimum above finished roof surface with lead worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter flash and seal.
- C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.
- D. Seal floor shower mop sink and all other drains watertight to adjacent materials.
- E. Provide curbs for mechanical roof installations 14 inches minimum high above roofing surface. Contact architect for all flashing details and roof construction. Seal penetrations watertight.

3.06 SLEEVES

- A. Set sleeves in position in formwork. Provide reinforcing around sleeves.
- B. Extend sleeves through floors minimum one inch above finished floor level. Caulk sleeves full depth with fire rated thermfiber and 3M caulking and provide floor plate.
- C. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with U.L. listed fire stopping insulation and caulk seal air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

END OF SECTION 23 14 00

SUPPORTS AND ANCHORS	23 14 00 - 7
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 23 17 00 MOTORS AND MOTOR CONTROLLERS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.
- B. The Basic Materials and Methods, Section 230500, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

- A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.
- B. WORK SPECIFIED ELSEWHERE:
 - 1. Painting
 - 2. Automatic temperature controls.
 - 3. Power control wiring to motors and equipment.

1.03 WARRANTY

Warrant the Work specified herein for one year and motors for five years beginning on date of substantial completion against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

1.04 SUBMITTALS

- A. SHOP DRAWINGS: Indicate size material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.
- B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures variations, and accessories.
- C. MOTOR NAMEPLATE INFORMATION: Manufacturer's name, address, utility and operating data.
- D. Refer to Division 1 for additional information.

1.05 DELIVERY AND STORAGE

- A. DELIVERY: Deliver clearly labeled, undamaged materials in the manufacturers'

MOTORS AND MOTOR CONTROLLERS	23 17 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

unopened containers.

- B. TIME AND COORDINATION: Deliver materials to allow for minimum storage time at the project site. Coordinate delivery with the scheduled time of installation.
- C. STORAGE: Store materials in a clean, dry location, protected from weather and abuse.

PART 2 - PRODUCTS

2.01 ELECTRIC MOTORS

- A. APPROVED MANUFACTURERS: Provide motors by a single manufacturer as much as possible.
 - 1. Baldur
 - 2. Marathon
 - 3. Siemens-Allis
 - 4. General Electric
 - 5. U.S. Motor
- B. TEMPERATURE RATING: Provide insulation as follows:
 - 1. CLASS B: 40 degrees C maximum.
 - 2. CLASS F:
 - a. Between 40 degrees C and 65 degrees C maximum.
 - b. Totally enclosed motors.
- C. STARTING CAPABILITY: As required for service indicated five starts minimum per hour.
- D. PHASES AND CURRENT: Verify electrical service compatibility with motors to be used.
 - 1. UP TO 1/2 HP: Provide permanent split, capacitor-start single phase with inherent overload protection.
 - 2. 3/4 HP AND LARGER: Provide squirrel-cage induction polyphase.
 - 3. Provide two separate windings on 2-speed polyphase motors.
 - 4. Name plate voltage shall be the same as the circuit's normal voltage, serving the motor.
- E. SERVICE FACTOR: 1.15 for multiphase; 1.35 for single phase.
- F. FRAMES: U-frames 1.5 hp. and larger.
- G. BEARINGS: Provide sealed re-graspable ball bearings; with top mounted oil mite lubrication fittings and bottom side drains minimum average life 100,000 hours typically, and others as follows:

MOTORS AND MOTOR CONTROLLERS	23 17 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

1. Design for thrust where applicable.
2. PERMANENTLY SEALED: Where not accessible for greasing.
3. SLEEVE-TYPE WITH OIL CUPS: Light duty fractional hp. motors or polyphase requiring minimum noise level.

H. ENCLOSURE TYPE: Provide enclosures as follows:

1. CONCEALED INDOOR: Open drip proof.
2. EXPOSED INDOOR: Guarded.
3. OUTDOOR TYPICAL: Type II. TEC.
4. OUTDOOR WEATHER PROTECTED: Type I. TEA.

I. OVERLOAD PROTECTION: Built-in sensing device for stopping motor in all phase legs and signaling where indicated for fractional horse power motors.

J. NOISE RATING: "Quiet" except where otherwise indicated.

K. EFFICIENCY: Minimum full load efficiency listed in the following table, when tested in accordance with IEEE Test Procedure 112A, Method B, including stray load loss measure.

NEMA Efficiency		
Motor Horsepower	INDEX Letter	Minimum Efficiency %
1800 RPM Synchronous Speed		
7.5-10	F	89.5
15-20	E	91.0
25-30	E	92.4
40	D	93.0
50	C	93.0
60	C	93.6
75	C	94.1
100-125	B	94.5
150-200	B	95.0
1200 RPM Synchronous Speed		
3-5	G	87.5
7.5	G	89.5
10	F	89.5
15	F	90.2
20	E	90.2
25-30	E	91.7
40-50	D	93.0
60	D	93.6
75	C	93.6
100-125	C	94.1

MOTORS AND MOTOR CONTROLLERS	23 17 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

2.02 MOTOR CONTROLLERS (STARTERS)

- A. All motor controllers (for equipment furnished under Division 23) shall be furnished under Division 23 and installed under Division 26 unless otherwise noted on the plans.
- B. Motor starters shall be furnished as follows.
1. GENERAL: Motor starters shall be Square D Company Class 8536 across-the-line magnetic type, full-voltage, non-reversing (FAVOR) starter. All starters shall be constructed and tested in accordance with the latest NEMA standards, sizes and horsepower. ICE sizes are not acceptable. Starters shall be mounted in a general purpose dead front, painted steel enclosure and surface-mounted. Provide size and number of poles as shown and required by equipment served. Provide two speed, two winding or two speed, single winding motor starter as required for two speed motors.
 2. CONTACTS: Magnetic starter contacts shall be double break solid silver alloy. All contacts shall be replaceable without removing power wiring or removing starter from panel. The starter shall have straight-through wiring.
 3. OPERATING COILS: Operating coils shall be 120 volts and shall be of molded construction. When the coil fails, the starter shall open and shall not lock in the closed position.
 4. OVERLOAD RELAYS: Provide manual reset, trip-free Class 20 overload relays in each phase conductor in of all starters. Overload relays shall be melting alloy type with visual trip indication. All 3 phase and single phase starters shall have one overload relay in each underground conductor. Relay shall not be field adjustable from manual to automatic reset. Provide 6 overload relays for two speed motor starters.
 5. PILOT LIGHTS: Provide a red running pilot light for all motor starters. Pilot lights shall be mounted in the starter enclosure cover. Pilot lights shall be operated from an interlock on the motor starter and shall not be wired across the operating coil.
 6. CONTROLS: Provide starters with HAND-OFF-AUTOMATIC switches. Coordinate additional motor starter controls with the requirements of Division 23. Motor starter controls shall be mounted in the starter enclosure cover.
 7. CONTROL POWER TRANSFORMER: Provide a single-phase 480 volt control power transformer with each starter for 120 volt control power. Connect the primary side to the line side of the motor starter. The primary side shall be protected by a fuse for each conductor. The secondary side shall have one leg fused and one leg grounded. Arrange transformer terminals so that wiring to terminals will not be located above the transformer.
 8. AUXILIARY CONTACTS: Each starter shall have one normally open and one normally closed convertible auxiliary contact in addition to the number of contacts required for the "holding interlock", remote monitoring, and control

MOTORS AND MOTOR CONTROLLERS	23 17 00 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

wiring. In addition, it shall be possible to field-install three more additional auxiliary contacts without removing existing wiring or removing the starter from its enclosure.

9. UNIT WIRING: Unit shall be completely pre-wired to terminals to eliminate any interior field wiring except for line and load power wiring and HVAC control wiring.
 10. ENCLOSURES: All motor starter enclosures shall be NEMA 1, general purpose enclosures for indoors and NEMA-4X 316 stainless steel when mounted exposed outdoors.
 11. POWER MONITOR: Provide a square "D" 8430 MPS phase failure and under-voltage relay, base and wiring required for starters serving motors 5 horsepower and larger. Set the under-voltage setting according to minimum voltage required for the motor to operate within its range.
- C. APPROVED MANUFACTURERS: Controller numbers are based on first named manufacturer. Provide one of the following manufacturer's.
1. Siemens.
 2. Square D.
 3. General Electric.
 4. Franklin-Cerus.

2.03 COMBINATION MOTOR STARTERS

- A. GENERAL: Combination motor starters shall consist of a magnetic starter and a fusible or non-fusible disconnect switch in a dead front, painted steel NEMA 12 enclosure indoors and NEMA 4X 316 stainless steel when located outdoors. Unless otherwise noted combination motor starters shall be surface-mounted. Size and number of poles shall as shown and required by equipment served. Combination motor starters shall be as specified for motor starters in Paragraph 2.01/B, except as modified herein.
- B. DISCONNECT SWITCH: Disconnect switches shall be as specified in Section 264900.
- C. APPROVED MANUFACTURERS: Controller numbers are based on first named manufacturer. Provide one of the following manufacturer's.
1. Siemens.
 2. Square D.
 3. General Electric.
 4. Franklin-Cerus.

PART 3 - EXECUTION

- 3.01** All equipment shall be installed in accordance with the manufacturers' recommendations and printed installation instructions.
- 3.02** All items required for a complete and proper installation are not necessarily indicated on the

MOTORS AND MOTOR CONTROLLERS	23 17 00 - 5
24214 - COPA New Lifeguard Facility	5-15-2025

plans or in the specifications. Contractors' price shall include all items required as per manufacturers' requirements.

3.03 INSTALLATION

- A. GENERAL: Install in a professional manner. Any part or parts not meeting this requirement shall be replaced or rebuilt without extra expense to Owner.
- B. Install rotating equipment in static and dynamic balance.
- C. Provide foundations, supports, and isolators properly adjusted to allow minimum vibration transmission within the building.
- D. Correct objectionable noise or vibration transmission in order to operate equipment satisfactorily as determined by the Engineer.

END OF SECTION 23 17 00

MOTORS AND MOTOR CONTROLLERS	23 17 00 - 6
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 23 24 00 SOUND AND VIBRATION CONTROL

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Vibration and sound control products.

1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract including General and Supplementary Conditions and Division One specification sections, apply to work of this section
- B. This section is Division 23 Basic Materials and Methods section, and is part of each Division 23 section making reference to vibration control products specified herein.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of vibration control products, of type, size, and capacity required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Vibration and sound control products shall conform to ASHRAE criteria for average noise criteria curves for all equipment at full load conditions.
- C. Except as otherwise indicated, sound and vibration control products shall be provided by a single manufacturer.

1.04 SUBMITTALS

- A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.
- B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Amber/Booth Company, Inc.
- B. Mason Industries, Inc.
- C. Kinetics Noise Control, Inc.

SOUND AND VIBRATION CONTROL	23 24 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

2.02 GENERAL

- A. Provide vibration isolation supports for equipment, piping and ductwork, to prevent transmission of vibration and noise to the building structures that may cause discomfort to the occupants.
- B. Model numbers of Amber/Booth products are included for identification. Products of the additional manufacturers will be acceptable provided they comply with all of the requirements of this specification.

2.03 FLOOR MOUNTED AIR HANDLING UNITS

- A. Provide Amber/Booth CAL-2, style C aluminum housed isolators sized for 2" static deflection. Cast iron or steel housings may be used provided they are hot-dip galvanized after fabrication
- B. If floor mounted air handling units are furnished with internal vibration isolation option, provide 2" thick Amber/Booth type NRC ribbed neoprene pads to address high frequency breakout and afford additional unit elevation for condensate drains. Ribbed neoprene pads shall be located in accordance with the air handling unit manufacturer's recommendations.

2.04 SUSPENDED AIR HANDLING UNITS

- A. Provide Amber/Booth type BSWR-2 combination spring and rubber-in-shear isolation hanger sized for 2" static deflection.
- B. If suspended air handling units are furnished with internal vibration isolation option, furnish Amber/Booth type BRD rubber-in-shear or NR AMPAD 3/8" thick neoprene pad isolation hangers sized for approximately 1/2" deflection to address high frequency break-out.

2.05 SUSPENDED FANS AND FAN COIL UNITS

- A. Provide Amber/Booth type HS spring hangers sized for 1" static deflection.

2.06 PIPING

- A. Provide spring and rubber-in-shear hangers, Amber/Booth type HRS in mechanical equipment rooms, for a minimum distance of 30 feet from isolated equipment for all chilled water and hot water piping 1-1/2" diameter and larger. Springs shall be sized for 1" deflection.
- B. Floor supported piping is required to be isolated with Amber/Booth type AW-1 open springs sized for 1" deflection.
- C. Furnish line size flexible connectors at supply and return of pumps, Amber/Booth style

SOUND AND VIBRATION CONTROL	23 24 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

2800 single sphere EPDM construction, connector shall include 150 lb. cadmium plated carbon steel floating flanges.

2.07 CORROSION PROTECTION

- A. All vibration isolators shall be designed and treated for resistance to corrosion.
- B. Steel components: PVC coated or phosphated and painted with industrial grade enamel.
Nuts, bolts, and washers: stainless steel.

PART 3 - EXECUTION

- 3.01** All equipment shall be installed in accordance with the manufacturer’s recommendations and printed installation instructions.
- 3.02** All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.
- 3.03** If internal isolation option is used on air handling units, the mechanical contractor shall verify proper adjustment and operation of isolators prior to start-up. All shipping brackets and temporary restraint devices shall be removed.
- 3.04** The vibration isolation supplier shall certify in writing that he has inspected the installation and that all external isolation materials and devices are installed correctly and functioning properly.

END OF SECTION

SOUND AND VIBRATION CONTROL	23 24 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 23 29 00 DUCT INSULATION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Ductwork system insulation.

1.02 RELATED SECTIONS

- A. Section 230500 - Basic Materials and Methods
- B. Section 231700 - Motors and Motor Controllers

1.03 QUALITY ASSURANCE

- A. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.
- B. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.
 - 1. Exception: Outdoor mechanical insulation may have flame spread index of 75 and smoke developed index of 150.
- C. Duct and plenum insulation shall comply with minimum R-value requirements of 2021 International Energy Conservation Code.
- D. Adhesive and other material shall comply with NFPA and NBFU Standards No. 90A and 90B.

1.04 SUBMITTALS

- A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.
- B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories. **Provide 8x11 sample of product along with submittal.**

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in unopened containers with manufacturer's stamp, clearly labeled with flame and smoke rating,

DUCT INSULATION	23 29 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

affixed showing fire hazard indexes of products.

- B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.01 GENERAL DESCRIPTION

- A. The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved before any insulation is installed.
- B. A sample quantity of each type of insulation and each type of application shall be installed and approval secured prior to proceeding with the main body of the work.

2.02 ACCEPTABLE MANUFACTURERS

- A. Glass fiber materials shall be manufactured by Knauf, Certain-Teed, Johns-Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer.
- B. Adhesives shall be manufactured by Minnesota Mining, Arabol, Benjamin-Foster, Armstrong or Insulmastic, Inc., and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.
- C. Ceramic fiber materials shall be as manufactured by Primer Refractories, A.P. Green Refractories or approved equal.

PART 3 - EXECUTION

3.01 GENERAL

- A. All insulation shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.
- B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

3.02 EXTERNAL DUCT INSULATION

- A. Fasten all longitudinal and circumferential laps with outward clinching staples 3" on center. On rectangular ducts over 24" wide apply as above and hold insulation in place on bottom side with mechanical pins and clips on 12" centers.

DUCT INSULATION	23 29 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

- B. Seal all seams and joints, fastener penetrations and other breaks in vapor barrier with 3 inch wide strips of white glass fabric embedded between two coats of vapor barrier mastic, Childers CP-30 or approved equal.
- C. All external duct insulation shall be Knauf Insulation Atmosphere Duct Wrap with ECOSE Technology, Johns Manville Microlite EQ duct wrap insulation with reinforced aluminum facing or approved equal.
- D. External duct wrap is required on all outside air ducts, supply and return air ducts that are not internally insulated. External duct wrap is also required on all exhaust and relief air ducts that are used in airside energy recovery systems. Any exhaust ductwork located in an unconditioned space shall also be provided with external duct wrap. Duct wrap shall be provided as follows:
 - 1. A minimum installed R-value of 6 when ducts are located in conditioned and unconditioned spaces, such as ceiling plenum space.
 - 2. A minimum installed R-value of 8 when ducts are located outside of the building.
- E. Any ductwork located in an air plenum that is comprised of materials that do not comply with the 25/50 flame and smoke rating per ASTM E 84 testing requirements shall be provided with a single layer of duct wrap to establish a noncombustible rating per ASTM E 136. Duct wrap products which are approved for such non-compliant combustible duct materials located in air plenums shall be 3M Fire Barrier Plenum Wrap 5A+ or Unifrax FyreWrap 0.5 Plenum. Insulation products for this application shall be installed in strict accordance with the manufacturer's instructions.

3.03 DUCT LINER

- A. Duct liner shall be kept clean and dry during transportation, storage, installation, and throughout the construction process care should be taken to protect the liner from exposure to the elements or damage from mechanical abuse.
- B. All portions of duct designed to receive duct liner shall be completely covered with liner as specified. The smooth, black, mat facing or acrylic-coated surfaces with flexible glass cloth reinforcement shall face the airstream. All duct liner shall be cut to assure tight, overlapped corner joints. The top pieces shall be supported by the sidepieces. Duct liner shall be installed following the guidelines in the NAIMA "Duct Liner Installation Standard".
- C. The duct liner shall be tested according to erosion test method in ASTM C 1071 and shall be guaranteed to withstand velocities in the duct system up to 6000 fpm without surface erosion.
- D. Duct liner shall be adhered to the sheet metal with full coverage of an approved

DUCT INSULATION	23 29 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

adhesive that conforms to ASTM C 916, and all exposed leading edges and transverse joints shall be coated with Permacote factory-applied or field-applied edge coating and shall be neatly butted without gaps. Shop or field cuts shall be liberally coated with Johns Manville SuperSeal[®] duct butter and Edge Treatment or approved adhesive.

- E. Metal nosings shall be securely installed over transversely oriented liner edges facing the airstream at forward discharge and at any point where lined duct is preceded by unlined duct.
- F. When velocity exceeds 4000 fpm (20.3 m/sec), use metal nosing on every leading edge. Nosing may be formed on duct or be channel or zee attached by screws, rivets or welds.
- G. The liner shall further be secured with Graham welding pins and washers on not more than 18 inch centers both vertical and horizontal surfaces, and the pins and washers shall be pointed up with adhesive.
- H. Duct liner shall be Knauf Insulation Atmosphere Duct Liner with ECOSE Technology, Johns Manville Linacoustic RC duct liner with factory-applied edge coating and acrylic coating on the mat surface of airstream side or approved equal. The liner shall meet the Life Safety Standards as established by NFPA 90A and 90B, FHC 25/50 and Limited Combustibility and the air stream surface coating should contain an immobilized, EPA-registered, anti-microbial agent so it will not support microbial growth as tested in accordance with ASTM G21 and G22. The duct liner shall conform to the requirements of ASTM C 1071, UL 2824, with an NRC not less than .70 as tested per ASTM C 423 using a Type "A" mounting, and a thermal conductivity no higher than 0.24 BTU•in/(hr•ft²•°F) at 75°F mean temperature.
- I. Line supply and return ductwork at connection of HVAC unit to a point of 15 feet upstream and downstream of the equipment and in return air boots. Attach with full cover coat of cement, duct dimensions up to 16 inches; provide stick clips or screws and cap for dimensions over 16 inches, spaced 16 inches o.c. maximum. Provide sheet metal liner cap over all leading edges of internal insulation exposed to air stream.
- J. Duct liner shall be provided as follows:
 - A. Minimum installed R-value of 6 when ducts are located in conditioned spaces.
 - B. Minimum installed R-value of 8 when ducts are located in unconditioned spaces, such as ceiling plenum space.
 - C. Minimum installed R-value of 12 or greater when ducts are located outdoors.

DUCT INSULATION	23 29 00 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

3.04 EXPOSED DUCTWORK LOCATED INDOORS

- A. Round duct routed exposed shall be double wall with solid inner liner with an R-value of R-6 or greater layer of glass mineral wool insulation as manufactured by United McGill Company model no. Acousti-27 or approved equal. Insulation density shall be a minimum of 1.5 PCF.

3.05 AIR DEVICE AND MISCELLANEOUS DUCT INSULATION

- A. The backside of all supply air devices shall be insulated with taped and sealed with external duct wrap equivalent to the insulation specified.
- B. The contractor shall install an additional layer of 2 inch thick external fiberglass duct wrap on any portion of the supply air, return air, outside air, or exhaust air system that has condensation forming during any period of operation. The insulation shall be taped and sealed and located until all evidence of the condensation had been eliminated at no additional cost to the owner.

END OF SECTION 23 29 00

DUCT INSULATION	23 29 00 - 5
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 23 53 00

REFRIGERANT PIPING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.
- B. The Basic Materials and Methods, Section 230500, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

PART 2 - PRODUCTS

2.01 GENERAL

Provide for the systems as shown. Submit shop drawings of piping systems showing all traps, pipe sizes, and accessories; drawing to be marked "Approved", and signed by a representative of the Application Engineering Department of the condensing unit manufacturer. Pipe sizes shall be as recommended by unit manufacturer. Refer to piping schematic on drawings.

2.02 MATERIAL

- A. PIPE: Copper ACR tubing.
- B. FITTINGS: Wrought copper streamlined sweat fitting.
- C. SOLDER: Sil-Fos, except on valves use solder recommended by valve manufacturer.

2.03 ACCESSORIES

All accessories shall be UL listed and rated in accordance with ARI Standard 710.

- A. On systems 7-1/2 tons and larger, each separate refrigerant circuit shall have a separate filter dryer. Each filter dryer shall have a replaceable core and a three valve bypass. The filter drier shall be full line size and installed in the refrigerant liquid line. The filter shall have a minimum 4-3/4 inches diameter shell with removable flange and gasket. Flange shall be tapped for 1/4 inch FPT access valve. Size filter-drier for maximum 2.0 psi pressure drop at evaporator operating temperature. Similar to Mueller Brass Company model Drymaster micro-guard refillable filter series SD-485 through SD19217 or Sporlan catch-all.

REFRIGERANT PIPING	23 53 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

- B. On systems less than 7-1/2 tons, the filter dryer shall be the sealed type sizes as above. One drier per refrigerant circuit.
- C. Liquid-Moisture Indicator shall be installed in liquid refrigerant line full line size similar to Mueller Brass Company model "Vuemaster" with soldered ends.
- D. Thermostatic expansion valve shall have adjustable super heat and be as manufactured by Sporlan.

2.04 EVACUATION

Evacuate moisture completely by applying a commercial vacuum pump for a minimum of 24 hours. Moisture indicator shall indicate a completely moisture-free condition at time of final inspection. The vacuum pump shall run until the system indicates a maximum of 35 degrees FDB. The system shall be flushed with the operating refrigerant and the vacuum pump connected and rerun to repeat the evacuation. Evaluation shall be performed under supervision of the Engineer.

2.05 FREON AND OIL

- A. Contractor shall leave the refrigeration system with a full charge of freon and oil and shall be responsible for the maintenance of a full charge of freon and oil in the systems for a period of one year from date of acceptance.
- B. Should any leaks in the refrigeration system occur during the guarantee period, the Contractor shall eliminate such leaks and recharge system to a full charge of freon and oil at no cost to the Owner.

PART 3 - EXECUTION

- 3.01 All equipment and piping shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.
 - A. All pipe joints and pipe fittings shall be properly cleaned prior to brazing.
 - B. An inert gas purge (e.g. nitrogen) shall be used during brazing to prevent oxides, which can contaminate system.
- 3.02 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

END OF SECTION

REFRIGERANT PIPING	23 53 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 23 58 54 "DX" FAN COIL UNIT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.
- B. The Basic Materials and Methods, Section 230500, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

PART 2 - PRODUCTS

2.01 FAN COIL UNITS

Fan coil units shall be factory built, manufactured as scheduled on drawings. Carrier, York, Trane or McQuay shall be considered as equal, if they comply with the specification and schedule. Special Note: Contractor shall field verify exact clearances required for air handling units. Units shall be field located as required and shop drawings shall indicate final location for approval by Architect/Engineer.

- A. Furnish and install fan coil units of the type, capacities, ratings and drive motor horsepower shown on the drawings.
- B. Units shall be factory fabricated, draw-thru type, and shall have fan section, cooling coil section, condensate drain pan, adjustable blower drive with motor on resilient mounted base, vee-belts with guard, filter section, and mixing box (if scheduled) assembled as integrated air handling units.
- C. REQUIREMENTS:
 - 1. Mill-galvanized steel, rigidly framed, braced, and reinforced; access panels each side of unit; minimum panel ga. - 18; minimum weight formed framing member 14 ga.
 - 2. Fan section, cooling coil section, and outlet frame throats shall be internally insulated at the factory with 1" thick, 3/4 PCF density, Neoprene coated fiberglass cemented in place with water-proof adhesive, having fire-retardant characteristics in accordance with NFPA 90A.
 - 3. Drain pan shall be not lighter than 14 ga.; extend completely under the coil section and be all-galvanized, foam insulated pan with drain connections.
 - 4. When the fan coil unit is installed above an accessible ceiling, the unit shall

DX" FAN COIL UNIT	23 58 54 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

incorporate a secondary drain pan. The secondary pan shall be fabricated from galvanized sheet metal, 16 gauge minimum with cross breaking sloped towards a drain. The sides shall be a minimum 2" tall and the corners shall be soldered watertight. The top edge shall have a 1/4" hem to provide additional rigidity and the secondary pan shall be supported at a minimum of six points. The pan shall extend on all sides a minimum of 3" beyond the sides of the unit casing. Route the secondary drain piping to a conspicuous location or install a float switch at the low point in the secondary pan. The secondary pan should be sloped a minimum of 1/8" per foot and supported so that the unit is not in contact with the bottom of the secondary pan.

5. The fan section, including wheels, shafts, bearings, drive, etc., shall be statically and dynamically balanced as an assembly, and the shaft shall not pass through the first critical speed, while accelerating from rest to operating speed. Submittal data shall state the first critical shaft speed. Shaft bearings shall be of vacuum de-gassed steel, and shall be selected for 200,000 hours average life.
6. Coil shall be as hereinafter specified.

2.02 COILS

- A. Cooling coils shall be cartridge type and, when mounted in air handling units, shall be removable from either end. Coils shall be constructed of copper tubes with aluminum fins and shall be designed for even distribution of air across the face of the coils; air shall not pass around coil frames: Coils shall have same end connection for DX or chilled water piping.
- B. DX refrigerant coils shall be counter-flow refrigerant to air, shall have inlet and outlet connections permanently marked shall have thermostatic expansion valves with adjustable super heat.
- C. Maximum face velocity across cooling coils shall be 500 FPM, unless noted otherwise on schedule.

PART 3 - EXECUTION

- 3.01** All HVAC equipment shall be installed as per manufacturers printed installation instructions.
- 3.02** All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.

END OF SECTION

DX" FAN COIL UNIT	23 58 54 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 23 67 10 AIR COOLED CONDENSING UNITS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.
- B. The Basic Materials and Methods, Section 230500, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

PART 2 - PRODUCTS

2.01 AIR-COOLED CONDENSING UNITS

- A. Air-cooled condensing unit shall be designed for use with split system having a remote direct-expansion (DX) cooling coil mounted in evaporator fan unit. Capacity shall be as called for on the drawings when matched to the appropriate evaporator coil.
- B. Condensing unit shall consist of high-efficiency hermetic compressor, air-cooled condenser with quiet fan, factory wired controls, refrigerant per schedule and refrigeration circuit and valves.
- C. Cabinet shall be heavy-gauge galvanized steel with bonding primer and baked-enamel finish coat. The entire cabinet shall be protected from rust.
- D. **Condenser coils and entire cabinet shall be factory coated with a 10,000 hour salt spray coating equivalent to Energy Guard's E-Guard DCC Cabinet Casing and DCC Green. Coatings shall meet ASTM B-117, ASTM G85, and ASTM D4587/4141 for UV Weathering.**
- E. Compressor shall be protected from excessive current and temperatures and shall be provided with a thermostatically controlled crankcase heater to operate only when needed for protection of the compressor. Compressor shall be spring-mounted on rubber isolators. Compressor shall be located in compartment isolated from condenser fan and coil. Provide a high-capacity dryer in the system to remove moisture and dirt.
- F. Condenser fan shall be directly connected to a weather-protected, quiet, high-efficiency motor. Fan guard shall be provided and shall be protected from rust by PVC finish. Condenser coil shall be aluminum fin with copper tube.

AIR COOLED CONDENSING UNITS	23 67 10 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

- G. Connections for refrigerant suction and liquid lines shall be extended outside the cabinet and provided with service valves with gauge connections.
- H. Power connections shall be made to the connectors located inside the electrical connection box.
- I. Standard operating and safety controls shall include high-pressure switch, low pressure switch, compressor overload service, and solid-state timed-off control.
- J. All components (parts and labor) of the sealed refrigeration circuit shall be warranted by the manufacturer for five years.

2.02 AUXILIARY EQUIPMENT

- A. Auxiliary equipment shall consist of refrigerant lines prepared for the unit involved. These lines shall be cleaned, dried, and pressurized at the factory.
- B. Low ambient kit to allow operation at outside temperature below 35 deg. F (2 deg. C) shall be provided.
- C. Expansion valve shall be provided with the evaporator coil.
- D. Provide thermostat to match the requirements of the job. Thermostat shall provide subbase with Heat-Cool-Off and Fan On-Auto switch. See section on controls for other related requirements.
- E. Provide polyethylene structural base designed for that service and intended to support the unit and eliminate vibration transmission.
- F. Provide hard-start kit with unit.
- G. Provide louvered guards for condenser coils.

2.03 ACCEPTABLE MANUFACTURERS

- A. Condensing unit shall be the make and model number shown on the drawings or acceptable equivalents by Lennox, Carrier, York, or Trane.

PART 3 - EXECUTION

3.01 All HVAC equipment shall be installed as per manufacturers printed installation instructions.

3.02 All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.

AIR COOLED CONDENSING UNITS	23 67 10 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

3.03 INSTALLATION

- A. Install the condensing unit on proper foundation as shown on the drawings, and in location that will not restrict the air entry or discharge from the unit.

- B. Install refrigerant lines as recommended by the manufacturer, taking care not to lose the refrigerant charge contained in the lines, or allow air to enter the lines or equipment. Locate the lines in such a way as to not obstruct access to the condensing unit or other equipment. Lines located underground or under concrete shall be installed in a PVC pipe conduit for protection.

- C. Provide electrical connections as required by the applicable codes. Provide control wiring required. All power wiring and control wiring shall be in conduit and located so as not to obstruct access to the unit or other equipment.

3.04 TESTING

- A. Operate the condensing unit and the system to assure that unit is operating properly and without excessive noise and vibration.

- B. Read and record the power draw and the refrigeration suction and liquid pressures as required by Balancing and Test, Section 239900.

END OF SECTION

AIR COOLED CONDENSING UNITS	23 67 10 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 23 88 10**AIR DISTRIBUTION DEVICES****PART 1 - GENERAL****1.01 WORK INCLUDED**

- A. Ceiling air diffusers.
- B. Wall registers and grilles.
- C. Louvers.
- D. Other air devices indicated on drawings and schedules.

1.02 RELATED SECTIONS

- A. Section 230500 – Basic Materials and Methods
- B. Section 238900 – Metal Ductwork
- C. Section 239100 – Ductwork Accessories
- D. Section 239900 – Testing, Adjusting and Balancing

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air distribution devices 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 distribution devices in accordance with ARI 650 "Standard for Air Outlets and Inlets".
 - 2. ASHRAE Compliance: Test and rate air distribution devices in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".
 - 3. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters".
 - 4. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
 - 5. NFPA Compliance: Install air distribution devices in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.04 SUBMITTALS

AIR DISTRIBUTION DEVICES	23 88 10 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Product Data: Submit manufacturer's technical product data for air distribution devices including the following:
 - 1. Schedule of air distribution devices indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
 - 2. Data sheet for each type of air distribution devices, and accessory furnished; indicating construction, finish, and mounting details.
 - 3. Performance data for each type of air distribution devices furnished, including aspiration ability, temperature and velocity traverses; throw and drop; and noise criteria ratings. Indicate selections on data.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air distribution devices, indicating materials and methods of assembly of components.
- C. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 1.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver air distribution devices 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 distribution devices 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.

1.06 WARRANTY

- A. Warrant the installation of the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from defective or nonconforming workmanship.

PART 2 – PRODUCTS

2.01 DIFFUSER ACCEPTABLE MANUFACTURERS

- A. Titus Company
- B. Price
- C. Nailor Industries
- D. Krueger

AIR DISTRIBUTION DEVICES	23 88 10 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

- E. Substitutions under provisions of Division 1.

2.02 GENERAL DESCRIPTION

- A. Unless otherwise indicated, provide manufacturer's standard air devices when shown of size, shape, capacity, type and accessories indicated on drawings and schedules, constructed of materials and components as indicated and as required for complete installation and proper air distribution.
- B. Provide air devices 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. Unless noted otherwise on drawings, the finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100 hour ASTM D117 Corrosive Environments Salt Spray Test without creepage, blistering, or deterioration of film. The paint must pass a 250 hour ASTM-870 Water Immersion Test. The paint must also pass the ASTM D-2794 Reverse Impact Cracking Test with a 50 inch pound force applied.
- D. Provide air device with border styles that are compatible with adjacent ceiling or wall system, and that are specially manufactured to fit into the wall construction or ceiling module with accurate fit and adequate support. Refer to architectural construction drawings and specifications for types of wall construction and ceiling systems.
- E. Provide integral volume damper with roll formed steel blades where indicated on drawings or schedules. Dampers shall be opposed blade design with a screw driver slot or a concealed lever operator for adjustment through the face of the air device.
- F. Air devices designated for fire rated systems shall be pre-assembled with UL classified radiation damper and thermal blanket. Fire rated air devices shall be shipped completely assembled; one assembly per carton. Each assembly shall be enclosed in plastic shrink wrap with installation instructions.

2.03 LOUVERS

- A. Except as otherwise indicated, provide manufacturer's rain resistant Hurricane rated louvers; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Provide louvers that have minimum free area, and maximum pressure drop of each type as listed in manufacturer's current data, complying with louver schedule. Louvers shall not have a velocity higher than 500 fpm at the specified airflow.
- C. 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

AIR DISTRIBUTION DEVICES	23 88 10 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

adequate support, for weatherproof installation. Refer to architectural construction drawings and specifications for types of substrate.

- D. Louvers shall be constructed of aluminum extrusions, ASTM B 221, Alloy 6063-T5. Weld units or use stainless steel fasteners.
- E. Louver Screens: On inside face of exterior louvers, provide 1/2" square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.
- F. Acceptable Manufacturers:
 - 1. Ruskin Manufacturing Company
 - 2. Greenheck Company
 - 3. Louvers and Dampers, Inc.
 - 4. Substitutions under provisions of Division 1.

PART 3 – EXECUTION

- 3.01** All interior surfaces of all air devices shall be painted flat black.
- 3.02** See floor plans for type, neck size and CFM of air for all air distribution devices.
- 3.03** Install all air distribution devices as detailed on plans and in accordance with manufacturer’s recommendations.

END OF SECTION 23 88 10

AIR DISTRIBUTION DEVICES	23 88 10 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 23 88 85 AIR FILTERS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.
- B. The Basic Materials and Methods, Section 230500, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

PART 2 - PRODUCTS

2.01 FILTERS

- A. The filters shall be AAF Flanders Mini-Pleat Filters or approved equal.
- B. APPROVED MANUFACTURERS: The following manufacturers are approved subject to specification compliance.
 - 1. AAF Flanders
 - 2. American Air Filter.
 - 3. Airguard Industries, Inc.
 - 4. Cambridge.

2.02 LOW VELOCITY RIGID BOX FILTER SECTION - MERV 13 FILTERS

- A. Filters shall be of the throwaway cartridge type in 24 inches X 24 inches with 4 inch frames. When installing multiple filters into slide-in frames tape adjacent filters together with duct tape to prevent bypassing of air around the filter. Media shall be rated at 500 feet per minute.
- B. Filtering media shall be formed of microglass paper with a water repellent binder type filtering media bonded to an open area media support grid folded into a non-creased radial pleat design. The filter pack shall be bonded to the inclosing frame to prevent air bypass. Average efficiency shall be 85% at 0.5 microns on ASHRAE test standard 52.2. Initial resistance shall not exceed 0.15 inches water gauge at 500 FPM face velocity.

PART 3 – EXECUTION

3.01 INSTALLATION

AIR FILTERS	23 88 85 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Install differential pressure switch to activate "Filter Dirty" light when pressure difference across filters reaches 0.5 inch W.G. (adjustable). Locate "filter dirty" lights in mechanical rooms with identifying label
- B. Install and relocate filters in the mechanical or the storage room in accordance with manufacturer's recommendations.
- C. Refer to Section 230500 for additional filter information.

END OF SECTION 23 88 85

AIR FILTERS	23 88 85 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 23 89 00 METAL DUCTWORK

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Low pressure ductwork.
- B. Medium and high pressure ductwork.
- C. Casings.
- D. Underground buried ducts.
- E. Kitchen hood ductwork.
- F. Laboratory fume hood exhaust ductwork.
- G. Duct cleaning.

1.02 RELATED SECTIONS

- A. Section 230500 - Basic Material and Methods.
- B. Section 231400 - Supports and Anchors.
- C. Section 232900 - Duct Insulation.
- D. Section 239100 - Ductwork Accessories.
- E. Section 238810 - Air Distribution Devices.
- F. Section 239900 - Testing, Adjusting and Balancing.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of metal ductwork products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firms with least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.
- C. Codes and Standards:

METAL DUCTWORK	23 89 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

1. SMACNA Standards: Comply with latest SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.
2. ASHRAE Standards: Comply with ASHRAE Handbook, Equipment Volume, Chapter 1 "Duct Construction", for fabrication and installation of metal ductwork.
3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems", NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems", and NFPA 96 Standard.
4. IECC 2021: Comply with the 2021 International Energy Conservation Code.

1.04 GENERAL DESCRIPTION

- A. Extent of metal ductwork is indicated on drawings and in schedules, and by requirements of this section.

1.05 SUBMITTALS

- A. Submit shop drawings, duct fabrication standards and product data under provisions of Division 1.
- B. Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work.
- C. The contract documents are schematic in nature and are to be used only for design intent. The contractor shall prepare sheet metal shop drawings, fully detailed and drawn to scale, indicating all structural conditions, all plumbing pipe and light fixture coordination, and all offsets and transitions as required to permit the duct to fit in the space allocated and built. All duct revisions required as a result of the contractor not preparing fully detailed shop drawings will be performed at no additional cost.

1.06 DEFINITIONS

- A. Duct Sizes: Inside clear dimensions. For lined ducts, maintain indicated clear size inside lining. Where offsets or transitions are required, the duct shall be the equivalent size based on constant friction rate.
- B. Low Pressure: Three pressure classifications: ½ inch WG positive or negative static pressure and velocities less than 1,000 fpm; 1 inch WG positive or negative static pressure and velocities less than 1,500 fpm, and 2 inch WG positive or negative static pressure and velocities less than 2,000 fpm. Low pressure ductwork shall be defined as all return, exhaust, and outside air ducts associated with constant volume air handling

METAL DUCTWORK	23 89 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

units with a scheduled external static pressure of less than 1.5", and all supply ductwork downstream of terminal units in variable volume systems.

- C. Medium Pressure: Three pressure classifications: 3 inch WG positive or negative static pressure and velocities greater than 2,000 fpm but less than 3,000 fpm, 4 inch WG positive static pressure and velocities greater than 3,000 fpm but less than 4,000 fpm, and 6 inch WG positive static pressure and velocities greater than 4,000 fpm. Medium pressure ductwork shall be defined as all supply ducts extending from variable volume air handling units to terminal units in variable volume systems with air handling units having a scheduled external static pressure of less than 4". The supply ductwork of constant volume air handling units having scheduled external static pressure greater than 2" and less than 4" shall be rated for medium pressure.
- D. High Pressure: 10 inch WG positive static pressure and velocities greater than 6,000 fpm.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protection: Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings, use sheet metal end caps on any lined duct exposed to the weather and use 3 mil vinyl wrap with duct tape on end pieces where stored inside.
- B. Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.01 DUCTWORK MATERIALS

- A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.
- B. Sheet Metal.: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 527, lockforming quality, with G 90 zinc coating in accordance with ASTM A 525; and mill phosphatized for exposed locations.
- C. Stainless Steel Sheet: Where indicated, provide stainless steel complying with ASTM A167; Type 316; with No. 4 finish where exposed to view in occupied spaces, No. 1 finish

METAL DUCTWORK	23 89 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

elsewhere. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.

- D. Aluminum Sheet: Where indicated, provide aluminum sheet complying with ASTM B 209, Alloy 3003, Temper H14.

2.02 MISCELLANEOUS DUCTWORK MATERIALS

- A. General: Non combustible and conforming to UL 181, Class 1 air duct materials.
- B. Flexible Ducts: Flexmaster U.S.A., Inc. Type 1M or approved equal, corrosive resistant galvanized steel formed and mechanically locked to inner fabric with factory wrapped insulation blanket with aluminum vapor barrier and an R-6 thermal conductance. Flexible duct shall have reinforced metalized outer jacket comply with UL 181, Class 1 air duct. Equivalent manufactures are Thermaflex.
- C. Sealants: Hard-Cast "iron grip" or approved equal, non-hardening, water resistant, fire resistive and shall not be a solvent curing product. Sealants shall be compatible with mating materials, liquid used alone or with tape or heavy mastic.
- D. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.
1. For exposed stainless steel ductwork, provide matching stainless steel support materials.
 2. For aluminum ductwork, provide aluminum support materials.

2.03 LOW PRESSURE DUCTWORK

- A. Fabricate and support in accordance with latest SMACNA Low Pressure Duct Construction Standards and ASHRAE handbooks, except as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by approved shop drawings. Obtain engineer's approval prior to using round duct in lieu of rectangular duct.
- C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide

METAL DUCTWORK	23 89 00 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

airfoil-turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

- D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.
- E. Use crimp joints with bead for joining round duct sizes 6 inch smaller with crimp in direction of airflow.
- F. Use double nuts and lock washers on threaded rod supports.

2.04 MEDIUM AND HIGH PRESSURE DUCTS

- A. Fabricate and support in accordance with SMACNA High Pressure Duct Construction Standards and ASHRAE handbooks, except as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Construct T's, bends, and elbows with radius of not less than 1½ times width of duct on centerline. Where not possible and where rectangular elbows are used, provide airfoil-turning vanes. Where acoustical lining is required, provide turning vanes of perforated metal with glass fiber insulation. Weld in place.
- C. Transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence.
- D. Fabricate continuously welded medium and high pressure round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
- E. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

2.05 CASINGS

- A. Fabricate casings in accordance with SMACNA Low Pressure Duct Construction Standards and SMACNA High Pressure Duct Construction Standards and construct for operating pressures indicated.
- B. Mount floor mounted casings on 4 inch high concrete curbs. At floor, rivet panels on 8 inch centers to angles. Where floors are acoustically insulated, provide liner of 18 gage

METAL DUCTWORK	23 89 00 - 5
24214 - COPA New Lifeguard Facility	5-15-2025

galvanized expanded metal mesh supported at 12 inch centers, turned up 12 inches at sides with sheet metal shields.

- C. Reinforce doorframes with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection. Provide clear wire glass observation ports, minimum 6 X 6 inch size.
- D. Fabricate acoustic casings with reinforcing turned inward. Provide 16 gage back facing and 22 gage perforated front facing with 3/32 inch diameter holes on 5/32 inch centers. Construct panels 3 inches thick packed with 4.5 lb./cubic foot minimum glass fiber media, on inverted channels of 16 gage.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Obtain manufacturer's inspection and acceptance of fabrication and installation of ductwork at beginning of installation.
- B. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- C. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- D. Connect terminal units to medium or high pressure ducts with four feet maximum length of flexible duct. Do not use flexible duct to change direction.
- E. Connect diffusers or troffer boots to low pressure ducts with 6 feet maximum, 4 feet minimum, length of flexible duct. Hold in place with strap or clamp.
- F. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- G. The interior surface of all ductwork shall be smooth. No sheet metal parts, tabs, angles, or anything else may project into the ducts for any reason, except as specified to be so. All seams and joints shall be external.

METAL DUCTWORK	23 89 00 - 6
24214 - COPA New Lifeguard Facility	5-15-2025

- H. All ductwork located exposed on roof shall be "crowned" to prevent water from ponding.
Ref: Insulation for additional requirements.
- I. Where ducts pass through floors, provide structural angles for duct support. Where ducts pass through walls in exposed areas, install suitable sheet metal escutcheons as closers.
- J. All angles shall be carried around all four sides of the duct or group of ducts. Angles shall overlap corners and be welded or riveted.
- K. All ductwork shall be fabricated in a manner to prevent the seams or joints being cut for the installation of grilles, registers, or ceiling outlets.

3.02 INSTALLATION OF FLEXIBLE DUCTS

- A. Determine the minimum length of flexible duct needed for each connection. Excess flex causing tight bends and increased pressure drops are not acceptable. Do not exceed 6'-0" extended length.
- B. Install in accordance with Section III of SMACNA's, "HVAC Construction Standards, Metal and Flexible".
- C. Cut outer vapor barrier and insulation. Fold back insulation and outer vapor barrier to expose inner core. Using sheet metal snips, cut the inner core.
- D. Connect the inner core to the tap or collar by pulling it a minimum of 1" over the collar.
- E. Where collars are less than 1" in length, i.e. diffusers, connect a separate collar to the existing collar and proceed as described in 3.02.C above.
- F. Wrap the core twice with UL181 Tape over the collar. Secure the connection by placing a clamp over the tap or collar, UL listed Panduit clamps for collars with beads and Stainless Steel clamps for collars without beads are acceptable.
- G. Roll the insulation and vapor barrier back over the collar or tap as described in 3.02.C above and wrap twice with UL181 Tape.
- H. Secure the outer vapor barrier with a clamp as described in 3.02.F above if desired.
- I. For Medium to High Pressure applications, use duct sealer for 3.02.F and 3.02.G in lieu of UL181 Tape.

METAL DUCTWORK	23 89 00 - 7
24214 - COPA New Lifeguard Facility	5-15-2025

- J. Flexible duct shall be hung with proper support to minimize sagging and snaking between supports. Maximum of 4'-0" between supports. Hanger material will be a minimum of 1 1/2" wide.
- K. Supports will be used before all vertical 90° bends to prevent sagging and ensure a 1.5 center line turn radius of flexible duct.

3.03 REQUIREMENTS FOR UNIT CASINGS

- A. Set plenum doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.

3.04 REQUIREMENTS FOR KITCHEN HOOD EXHAUST DUCT

- A. Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for cleanout.
- B. Provide access openings in each change in direction, located on sides of duct 1 1/2" minimum from bottom, and fitted with grease-tight covers of same material as duct
- C. Use stainless steel for ductwork exposed to view.

3.05 DUCTWORK APPLICATION SCHEDULE

AIR SYSTEM	MATERIAL
Low Pressure Supply	Steel, Aluminum
Return and Relief	Steel, Aluminum
General Exhaust	Steel, Aluminum
Outside Air Intake	Steel
Combustion Air	Steel

3.06 DUCTWORK HANGERS AND SUPPORTS

- A. All ductwork shall be properly suspended or supported from the building structure. Hangers shall be galvanized steel straps or hot-dipped galvanized rod with threads pointed after installation. Strap hanger shall be attached to the bottom of the ductwork, provide a minimum of two screws one at the bottom and one in the side of each strap on metal ductwork. The spacing, size and installation of hangers shall be in accordance with the recommendations of the latest SMACNA edition.

METAL DUCTWORK	23 89 00 - 8
24214 - COPA New Lifeguard Facility	5-15-2025

- B. All duct risers shall be supported by angles or channels secured to the sides of the ducts at each floor with sheet metal screws or rivets. The floor supports may also be secured to ducts by rods, angles or flat bar to the duct joint or reinforcing. Structural steel supports for duct risers shall be provided under this Division.

3.07 DUCT JOINTS AND SEAMS

- A. Seal all non-welded duct joints and seams with duct sealant as indicated. All longitudinal and transverse joints, seams and connections in metallic and non-metallic ducts shall be constructed as per specified in SMACNA HVAC Duct Construction Standards-Metal and Flexible. All longitudinal and transverse joints, seams and connections shall be sealed in accordance with the latest adopted International Energy Conservation Code edition.

END OF SECTION 23 89 00

METAL DUCTWORK	23 89 00 - 9
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 23 91 00 DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Volume control dampers.
- B. Round Duct Taps.
- C. Fire dampers.
- D. Combination fire and smoke dampers.
- E. Back draft dampers.
- F. Air turning devices.
- G. Flexible duct connections.
- H. Duct access doors.
- I. Duct test holes.

1.02 RELATED WORK

- A. Section 232400 – Sound & Vibration Control.
- B. Section 238900 – Metal Ductwork.

1.03 REFERENCES

- A. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- B. SMACNA - Low Pressure Duct Construction Standards.
- C. UL 33 - Heat Responsive Links for Fire-Protection Service.
- D. UL 555 - Fire Dampers and Ceiling Dampers.

1.04 SUBMITTALS

- A. Submit shop drawings and product data under provisions of Division 1.
- B. Provide shop drawings for shop fabricated assemblies indicated, including volume

DUCTWORK ACCESSORIES	23 91 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

control dampers duct access doors duct test holes. Provide product data for hardware used.

- C. Submit manufacturer's installation instructions under provisions of Section 01300, for fire dampers and combination fire and smoke dampers.

PART 2 PRODUCTS

2.01 VOLUME CONTROL DAMPERS

- A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards, and as indicated.
- B. Fabricate splitter dampers of material same gauge as duct to 24 inches size in either direction, and two gauges heavier for sizes over 24 inches.
- C. Fabricate splitter dampers of double thickness sheet metal to streamline shape. Secure blade with continuous hinge or rod. Operate with minimum 1/2 inch diameter rod in self aligning, universal joint, action flanged bushing, with set screw.
- D. Fabricate single blade dampers for duct sizes to 9-1/2 x 24 inch.
- E. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12 x 72 inch.
 - 1. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
 - 2. On outside air, return air, and all other dampers required to be low leakage type, provide galvanized blades and frames, seven inches wide maximum, with replaceable vinyl, EPDM, silicone rubber seals on blade edges and stainless steel side seals. Provide blades in a double sheet corrugated type construction for extra strength. Provide hat channel shape frames for strength and blade linkage enclosure to keep linkage out of the air stream. Construction leakage not to exceed 1/2%, based on 2,000 fpm and 4 inch static pressure.
- F. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.
- G. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Where rod lengths exceed 30 inches provide regulator at both ends.
- H. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

2.02 ROUND DUCT TAPS

DUCTWORK ACCESSORIES	23 91 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Taps to trunk duct for round flexible duct shall be spin-in fitting with locking quadrant butterfly damper, model no. FLD-B03 by Flexmaster or approved equal.

2.03 ACCEPTABLE MANUFACTURERS - FIRE DAMPERS AND COMBINATION FIRE AND SMOKE DAMPERS

- A. Greenheck
- B. Louvers and Dampers Inc.
- C. Ruskin.
- D. Nailor Industries.

2.04 FIRE DAMPERS

- A. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.
- B. Provide curtain type dampers of galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream.
- C. Fabricate multiple blade fire dampers per U.L. with 16 gauge minimum galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.
- D. Fusible links, UL 33, shall separate at 160 degrees F. Provide adjustable link straps for combination fire/balancing dampers.

2.05 COMBINATION FIRE AND SMOKE DAMPERS

- A. Fabricate in accordance with NFPA 90A, UL555 and UL 555S, and as indicated.
- B. Provide factory sleeve for each damper. Install damper operator on exterior of sleeve and link to damper operating shaft.
- C. Fabricate with multiple blades with 16 gauge galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.
 - 1. Operators shall be spring return electric type suitable to operate on 120 V AC, 60 cycle.

DUCTWORK ACCESSORIES	23 91 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

2. Operators shall be UL listed and labeled.

D. See smoke dampers for details and accessories to be included

2.06 SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.

B. Motorized Smoke Dampers: normally open with power on, close automatically when power is interrupted, UL-listed and labeled damper and damper operator. Unit shall close upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure, stainless steel springs with locking devices ensure positive closure for units mounted horizontally.

C. Electro thermal Link: Fusible link which melts when subject to local heat of 165 degrees F and from external electrical impulse; UL listed and labeled.

D. Each smoke damper and combination fire/smoke damper shall be equipped with end position indicators for remote indication of damper blade position.

E. Furnish each smoke damper with a duct mounted smoke detector and sensing tube for proper operation of smoke damper. Duct smoke detectors shall be of the photoelectronic type. Sensing tube shall run the entire width of the duct and comply with manufactures instructions. Smoke detector and sensing tube shall be furnished and factory installed by the damper manufacture.

2.07 ACCEPTABLE MANUFACTURERS - BACKDRAFT DAMPERS

A. Greenheck

B. American Warming and Vent.

C. Louvers and Dampers Inc.

D. Ruskin.

E. Substitutions: Under provisions of Division 1.

2.08 BACKDRAFT DAMPERS.

A. Gravity back draft dampers, size 18 x 18 inches or smaller, furnished with air moving equipment, may be air moving equipment manufacturers standard construction.

B. Fabricate multi-blade, parallel action gravity balanced back draft dampers of 16 gauge galvanized steel, or extruded aluminum, with blades of maximum 6 inch width, with felt

DUCTWORK ACCESSORIES	23 91 00 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.09 ACCEPTABLE MANUFACTURERS - AIR TURNING DEVICES

- A. Young Regulator.
- B. Titus.
- C. Tuttle and Bailey.
- D. Substitutions: Under provisions of Division 1.

2.10 AIR TURNING DEVICES

- A. On duct sizes less than 12 x 12, multi-blade device with blades aligned in short dimension; steel or aluminum construction; with individually adjustable blades, mounting straps.
- B. Multi-blade device with radius blades attached to pivoting frame and bracket, steel or aluminum construction, with worm drive mechanism with 18 inch long removable key operator.

2.11 ACCEPTABLE MANUFACTURERS - FLEXIBLE DUCT CONNECTIONS

- A. Metaledge.
- B. Ventglass.
- C. Substitutions: Under provisions of Division 1.

2.12 FLEXIBLE DUCT CONNECTIONS TO AIR MOVING EQUIPMENT

- A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards, and as indicated.
- B. UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 20 oz per sq yd, approximately 6 inches wide, crimped into metal edging strip.

2.13 ACCEPTABLE MANUFACTURERS - DUCT ACCESS DOORS

- A. Greenheck
- B. Ruskin.

DUCTWORK ACCESSORIES	23 91 00 - 5
24214 - COPA New Lifeguard Facility	5-15-2025

- C. Titus.
- D. Substitutions: Under provisions of Division 1.

2.14 DUCT ACCESS DOORS

- A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards and as indicated.
- B. Review locations prior to fabrication.
- C. Fabricate rigid and close-fitting doors of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover. Insulation shall be replaceable without field cutting or patching.
- D. Access doors smaller than 12 inches square may be secured with sash locks.
- E. Provide two hinges and two sash locks for sizes up to 18 inches square, three hinges and two compression latches with outside and inside handles for sizes up to 24 x 48 inches. Provide an additional hinge for larger sizes.
- F. Access doors with sheet metal screw fasteners are not acceptable.

2.15 DUCT TEST HOLES

- A. Cut or drill temporary test holes in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent test holes shall be factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions.
- B. Balancing Dampers
 - 1. Provide at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts and as required for air balancing. Use splitter dampers only where indicated.
 - 2. All regulators mounted on externally insulated ductwork shall have 16 gauge

DUCTWORK ACCESSORIES	23 91 00 - 6
24214 - COPA New Lifeguard Facility	5-15-2025

elevated platforms at least 1/8 inch higher than the thickness of the insulation. Damper shaft shall have Ventlock No. 607 bearing mounted on ductwork within elevated platform. If duct is inaccessible the operating handle shall be extended and the regulator installed on the face of the wall or ceiling. Where regulators are exposed in finished parts of the building, they shall be flush type, Ventlock No. 666. All regulators shall be manufactured by Ventlock, or approved equal.

3. All dampers in lined ductwork shall have bushing to prevent damper damage to liner.
 4. Provide cable extensions with adjustable regulators and cover plate for dampers located in locations not accessible such as behind sheetrock ceilings. Regulators shall be equivalent to Young's Regulator.
- C. Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- D. Demonstrate re-setting of fire dampers to authorities having jurisdiction and Owner's representative.
- E. Provide back draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- F. Provide flexible duct connections immediately adjacent to equipment in ducts associated with fans and motorized equipment. Provide at least one inch slack at all flexible duct connections.
- G. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated.
- H. Provide duct test holes where indicated and required for testing and balancing purposes.

END OF SECTION 23 91 00

DUCTWORK ACCESSORIES	23 91 00 - 7
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 23 99 00 TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Conditions of the contract and general requirements in Division 1 apply to work specified in all section of Division 23.
- B. All Division 23 specification sections, drawings, and general provisions of the contract apply to work of this section, as do other documents referred to this section.
- C. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.
- D. Requirements for submittals, shop drawings, and substitutions, Division 1, Section 013000 and 016000, apply to work specified in all sections of Division 23.
- E. The basic Materials and Methods, Section 230500, are included as a part of this Section as though written in full in this document.

1.02 REFERENCES AND STANDARDS

- A. The publications listed below from a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASSOCIATED AIR BALANCE CONCIL (AABC)

(2002) National Standards for Testing Adjusting Balancing of Environmental Systems

NATIONAL EVROMENTAL BALANCING BUREAU (NEBB)

(1998) National Standards for Testing Adjusting Balancing of Environmental Systems

(1994) Procedural Standards for the Measurement and Assessment of Sound and Vibration

- B. TAB shall be preformed in accordance with the requirements of the standard under which the TAB Firm's qualifications are approved, i.e., AABC or NEBB procedural standards, unless otherwise specifies herein. All recommendations and suggested practices contained in the TAB standard shall be considered mandatory. The provisions of the TAB Standard, including checklists, report forms, etc. Shall, as nearly as practical, be used to satisfy the Contract requirements. The TAB standard shall be used for all aspects of TAB,

TESTING, ADJUSTING, AND BALANCING	23 99 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

including qualifications, for the TAB Firm and Specialist and calibration of TAB instruments. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the TAB Standard, the manufacture’s recommendations shall be adhered to. All quality assurance provisions of the TAB Standard such as performance guarantees shall be part of this contract. For systems or system components not covered in the TAB standard TAB procedures shall be developed by the TAB Specialist. Where new procedures, requirements, etc. applicable to the Contact requirements have been published or adopted by the body responsible for the TAB Standard used (AABC or NEBB), the requirements and recommendations contained in these procedures and requirements shall be considered mandatory.

- C. The TAB contractor shall submit all questions regarding interpretations and questions regarding these standards in writing or as required by documents to the A/E team who shall provide formal reply in ka reasonable time. Decisions of the A/E team shall be final.

1.03 DEFINITIONS AND SIMILAR TERMS

- A. In some instances, terminology differs between the Contract TAB Standard primarily because the intent of this section is to use the industry standards specified, along with the additional requirements listed herein to produce optimal results. The following table of similar terms is provided for clarification only. Contract requirements take precedent the corresponding AABC or NEBB where differences.

<u>CONTRACT TERM</u>	<u>AABC TERM</u>	<u>NEBB TERM</u>
TAB Standard	National Standard Testing and Balancing Heating, Ventilating, and Air Conditioning System	Procedural Standards for Testing Adjusting Environmental System
TAB Specialist	TAB Engineer	TAB Supervisor
System Readiness Check	Construction Phase Inspection	Field Readiness Check & Preliminary Field Procedures

1.04 QUALIFICATIONS

- A. The TAB of the air conditioning systems will be performed by an independent, impartial technical firm whose operations are limited only to the field of professional TAB, and is not a part or subsidiary of any other project contractor or subcontractor, to include, but not limited to General Contractor, and Mechanical; Contractor. The TAB work will be done under the direct supervision of qualified Professional Engineer employed as a full time employee of TAB firm.

TESTING, ADJUSTING, AND BALANCING	23 99 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

- B. The TAB agency shall be either a member of AABC or certified by the NEBB and certified in all categories and functions where measurements or performance are specified on the plans and specifications.
- C. QUALIFICATIONS OF CONTRACTOR PERSONAL: Submit evidence to show that the people who shall be in charge of correcting deficiencies for balancing the systems are qualified. The Owner and Engineer reserve the right to require that the originally approved personal be replaced with other qualified personnel if, in the Owner and Engineer's opinion, the original personnel are not qualified to properly place the system in condition for balancing.
- D. QUALIFICATIONS OF TAB FIRM

The certification shall be maintained for the entire duration of specified herein. If, for any reason, the firm losses subject certification during this period, the Contractor shall immediately execute each certifying agency's applicable Performance Guaranty, then immediately notify the Contracting Officer and submit another TAB firm for approval, at no additional cost to Project Owner, Architect, Engineer, or their designated representatives. Any firm that has been the subject to disciplinary action by either the AABC or the NEBB within the five years preceding the contract award shall not be eligible to perform any duties related to the HVAC systems including TAB. All work specified in this section and in other related sections to be performed by the TAB firm shall be considered invalid if the TAB firm losses its certification prior to contract completion and must be performed by an approved successor, at no additional cost to Project Owner, Architect, Engineer, or their designated representative. The TAB firm shall have an occupied office within 100 miles of the project site.

E. QUALIFICATIONS OF TAB FIRM PERSONAL:

1. A minimum of one registered Professional Engineer, licensed in the State the work is performed, is required to be in permanent employment of the firm.
2. The TAB Specialist shall be either a member of AABC or an experienced technician of the firm certified by NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason the Specialist losses subject certification during this period, the Contractor shall immediately execute each certifying agency's applicable Performance Guaranty, then immediately notify the Contracting Officer and submit another TAB Specialist for approval, at no additional cost to Project Owner, Architect, Engineer, or their designated representatives. Any individual that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding the contract award shall not be eligible performed any duties related to the HVAC systems, including TAB. All work specified in this section and other related sections to be performed by the TAB Specialist shall be considered invalid if the TAB Specialist losses

TESTING, ADJUSTING, AND BALANCING	23 99 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

certification prior to the contract completion and must be performed by an approved successor, at no additional cost to the Project Owner, Architect, Engineer, or their designated representatives.

3. Personal used on the job site shall be either Professional Engineers or technicians, who shall have been permanent, full time employees of the firm for a minimum of six months prior to the start of work for that specified project.
4. Evidence shall be submitted to show that the personal who actually balanced the systems are qualified. Evidence showing that the personnel have passed the tests required by the Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) shall be required.

F. ACCEPTABLE TAB FIRMS SHALL INCLUDE:

1. PHI Service Agency (361-248-4861)
2. Engineering Air Balance Company (210-736-9494)
3. Testing Specialties (210-492-8885)
4. TCx Synergy (361-960-3475)

1.05 SCOPE OF WORK

- A. The Contractor will contract with a professional TAB firm under the provisions of paragraph 1.04 of this section.
- B. The TAB firm will be responsible for inspecting, adjusting, balancing, and logging the data on the performance of fans, dampers in the duct system, and air distribution devices. The Contractor and the various subcontractors of the equipment installed shall cooperate with the TAB firm to furnish necessary data on the design and proper applications of the system components and provide labor and material required to eliminate deficiencies or poor performance.
- D. The work included in this section consists of furnishing labor, instruments, and tools required in testing, adjusting, and balancing the HVAC systems, as described in these specifications or shown on accompanying drawings. Services shall include checking equipment performance, taking specified measurements, recording and reporting the results. The items requiring testing, adjusting, and balancing include the following (as applicable to contract drawings):

AIR SYSTEMS

Air Handling Units
Packaged Units

TESTING, ADJUSTING, AND BALANCING	23 99 00 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

Exhaust Fans
Diffusers, Registers, & Grilles
Coils (Air Temperature)

DX Refrigerant Systems

Refrigerant Pressures Suction/Liquid
Refrigerant Temperature Measurements
(Sat Suction, Suction Line, SuperHeat, Liquid Sat, Liquid Line
Subcooling Temp, and Discharge Line Temp)

PLUMBING SYSTEMS

Recirc Pumps
Mixing Valves
Circuit Setters

1.06 SUBMITTALS AND RELATED DOCUMENTS:

- A. The name of the selected AABC or NEBB certified firm shall be submitted to the Engineer for approval within 30 days after contract award.
- B. Within 30 days after the award of contract, the TAB firm shall submit for approval an organizational chart and proof of current certification which shall identify all AABC or NEBB certified Supervisors or Specialist. The TAB firm shall submit a company resumes listing personal and project experience in air and hydronic system balancing. TAB firm will also provide information showing successful completion for three similar scope projects for which the firm is being contracted.
- C. Within 30 days after the award of contract, the TAB firm will submit for approval the name of the TAB Specialist and/or Professional Engineer, who will have direct supervision of all TAB related labor through completion of project.
- D. Within 30 days after the award of contract the TAB firm shall submit TAB procedures and agenda proposed to be used.
- E. Within 30 days after the award of contract, but prior to TAB field measurements, the TAB firm shall submit sample report forms, sample report forms, which shall include minimum data required by either the AABC or NEBB National Standards.
- F. Within 15 days of notification of approval of TAB firm and TAB Specialist by engineer, TAB firm shall conduct a Design Review of contract drawings and submit a Design Review report.
- G. Proposed date and time for execution of Systems Readiness Inspection shall be submitted no later than 7 days prior to inspection. A copy of the Systems Readiness Inspection Report

TESTING, ADJUSTING, AND BALANCING	23 99 00 - 5
24214 - COPA New Lifeguard Facility	5-15-2025

shall be signed by the TAB Specialist and shall bear the seal of the Professional Society or National Association used as the TAB Standard.

- H. Proposed date and time to begin field measurements, making adjusting, ext., for the TAB report, shall be submitted with the Systems Readiness Inspection Report.
- I. Six (6) copies of the completed TAB Report shall be submitted for approval no later than 7 days after the execution of TAB. All copies of TAB Report shall be signed by the TAB Specialist and shall bear the seal of the Professional Society or National Association used as the TAB Standard.
- J. Proposed date and time to begin TAB Completion Verification, shall be submitted with the TAB Report. Six (6) copies of TAB Completion Verification Report shall be submitted no later than 7 days after execution of TAB verification.
- K. Proposed date and time for execution of Opposite Season Inspection shall be submitted no later than 7 days prior to inspection.

1.07 INSTRUMENTATION

- A. All instruments used for measurements shall be accurate and calibrated. TAB firm shall submit list of all instruments, to include gauges, thermometers, flow measuring hoods, and other balancing devices to be used in balancing the system. The list will indicate name of equipment, function, model number, serial number, date of the last calibration, and date calibration is due. TAB firm shall submit copies of calibration certificates for all test instruments used showing all devices were properly calibrated before proceeding with system balancing. All instruments will be within one year of calibration for duration of the project. If duration of project exceeds the tenure of instrument calibration, then said instrument must be recalibrated, and copy of calibration certificate sent to Engineer, before the instrument is placed into continued use.

1.08 TAB PREPARATION AND COORDINATION

- A. It is the intent of this specification section to provide for a completely tested, adjusted, and balanced (TAB) installation without overlaps or omissions between the installing contractor and the TAB contractor. The installing contractors are those who perform the installation of this work and make all preparations for the TAB contractor who performs the testing, adjusting, and balancing described herein.
- B. The contractor Manager or General Contractor performing the General construction work shall coordinate the work of the contractors performing the Mechanical, Electrical, Automatic Temperature Control, and TAB work to provide complete properly tested, adjusted, and balanced systems. The Construction Manager or General Manager shall require and provide a start-up report for each piece of equipment furnished.

TESTING, ADJUSTING, AND BALANCING	23 99 00 - 6
24214 - COPA New Lifeguard Facility	5-15-2025

- C. The contractor performing the HVAC work shall coordinate all Mechanical work, including Sheet Metal work and Automatic Temperature Controls, to provide a complete, properly tested adjusted and balanced system throughout. He shall furnish progress reports regarding this phase of the work on a regular basis as directed. At such time as the systems are started up, the Contractor performing the Mechanical work shall provide TAB Contractor with documentation that the duct systems have been tested to the satisfaction of the Duct Leak Test Specifications. The Mechanical Contractor shall insure that all comments are installed and operating, and the major components such as fans, pumps, refrigeration machines, and the like are capable of producing the scheduled capacity requirements. The requirement does not relieve the Mechanical Contractor of any other requirements specified elsewhere. Should any of these components or systems not be capable of producing these requirements, he shall make corrections within the limits of his responsibility or as otherwise authorized and shall certify in writing that the systems are ready for final testing and balancing by the Tab contractor.
- D. The contractor performing the Electrical work shall work coordinate all electrical work to provide complete, properly tested, adjusted and balanced mechanical systems throughout the project. He shall furnish progress reports on a regular basis as directed. He shall certify in writing when each system is electrically operable, including the check for proper rotation of equipment.
- E. The Contractor performing the Automatic Temperature Controls work shall coordinate all controls work to provide complete, properly tested, adjusted and balanced mechanical systems throughout the project. He shall furnish progress reports on a regular basis as directed. He shall certify in writing when each system is operational from an Automatic Temperature Controls standpoint. This contractor shall also provide to TAB contractor all necessary submittal information, software, and/or personal complete, properly tested, adjusted and balanced mechanical systems.
- F. The TAB contractor shall from the award of contract, begin preparation.

PART 2-PRODUCTS (NOT USED)

PART 3- EXECUTION

3.01 SERVICES OF THE CONTRACTOR

- A. The drawing and specifications have indicated valves, dampers, and miscellaneous adjustment devices for the purpose of adjustment to obtain optimum operating conditions, install these devices in a manner that leaves them accessible, provide access as requested by the TAB firm.
- B. Have systems complete and in operational readiness prior to notifying the TAB firm the project is ready for their services, and certify in writing to the Construction Manager that such a condition exists.

TESTING, ADJUSTING, AND BALANCING	23 99 00 - 7
24214 - COPA New Lifeguard Facility	5-15-2025

- C. As a part of the Work of this Section, make changes in the sheaves, belts, and dampers or the addition of dampers required for correct balance of new work as required by TAB firm, at no additional cost to owner.
- D. Fully examine the existing system to be balanced, to determine, whether or not sufficient volume dampers, balancing valves, thermometers, gauges, pressure in the duct systems, means of determining water flow, and other means of taking data needed for proper water and air balancing are existing. Submit to the Engineer in writing a listing of omitted items considered necessary to balance existing systems. Submit the list and proposal as a cost add item.
- E. Verify that fresh air louvers are free of blockage, coils are clean and fresh air ducts to each air handling unit has individually adjustable volume regulating dampers.
- F. Provide correct, repair, or replace deficient items or conditions found during the testing, adjusting, and balancing period.
- G. In order that systems may be properly tested, balanced, and adjusted as specified, operate the systems at no expense for the Owner at the length of time necessary to properly verify their completion and readiness for TAB period.
- H. Project Contract completion schedules shall allow time for allowance to permit the successful completion of TAB services to Owner's final inspection and expectance. Complete, operational readiness, prior to commencement of TAB services, shall include the following services of the Contractor:
 - 1. Construction status of building shall permit the closing of doors, window, ceilings, installed and penetrations complete, to obtain project operating conditions.
 - 2. AIR DISTRIBUTION SYSTEMS:
 - a. Verify installation for conformity to design. Supply, return, and exhaust ducts terminated and pressure tested for leakage as specified.
 - b. Volume and fire dampers properly located and functional. Dampers serving requirements of minimum and maximum outside air, return and relief shall provide tight closure and full opening, smooth and free operation.
 - c. Supply return, exhaust and transfer grilles, registers and diffusers.
 - d. Air handling systems, units and associated apparatus, such as heating and cooling coils, filter sections, access doors, ect., shall be blanked and sealed to eliminate excessive bypass or leakage of air.
 - e. Fans (supply and exhaust) operating and verified for freedom from vibrations, proper fan rotation and belt tension; overload heater elements shall be of proper size and rating ; record motor amperage and voltage and verify that these functions do not exceed nameplate ratings.
 - f. Furnish or revise fan drives or motors as necessary to attain the specified air volumes.
 - 3. WATER CIRCLULATING SYSTEMS

TESTING, ADJUSTING, AND BALANCING	23 99 00 - 8
24214 - COPA New Lifeguard Facility	5-15-2025

- a. Position valves pertinent to system design and require operation to permit full flow of water through system components. Operate systems under full flow conditions until circulating water is clean. Remove and clean strainers as required during this cycle of operation.
 - b. Record each pump motor amperage and voltage. Readings shall not exceed nameplate rating.
 - c. Verify, on new equipment, electrical starter overload heater elements to be of proper size and rating.
 - d. Ensure that water circulating systems shall be full of water and free of air; expansion tanks set for proper water level, and air vents installed at high points of systems and operating freely. Advise Owner of deficiencies.
 - e. Check and set operating temperatures of heat exchangers to design requirements.
4. AUTOMATIC CONTROLS
- a. Verify that control components are installed in accordance with project documents and functional, electrical interlocks, damper sequences, air and water resets, fire and freeze stats.
 - b. Controlling instruments shall be functional and set for design operating conditions. Factory pre-calibration of room thermostats and pneumatic equipment will not be acceptable.
 - c. The temperature shall be regulation shall be adjusted for proper relationship between the controlling instruments and calibrated by the TAB Contractor. Advise Owner of deficiencies or malfunctions.

3.02 SERVICES OF THE TAB FIRM

- A. The TAB firm will act as liaison between the Owner, Engineer, and Contractor and inspect the installation of mechanical piping system, sheet metal work, temperature controls and other component parts of the heating, air conditioning and ventilating systems being retrofitted, repaired, or added under this Contract. The re-inspection of the Work will cover that part related to proper arrangement and adequate provision for the testing and balancing and will be done when the Work is 80 percent complete.
- B. Upon completion of the installation and start –up of the mechanical equipment, to check, adjust, and balance system components to obtain optimum conditions in each conditioned space in the building. Prepare and submit to the Owner complete reports on the balance and operations of the systems.
- C. Measurements and recorded readings of air, water and electricity that appear in the TAB reports will be done by the permanently employed technicians or engineers of the TAB firm.
- D. Make an inspection in the building during the opposite season from that in which the initial adjustments were made. At the time, make necessary modifications to the initial adjustments required to produce optimum operation of system components to effect the

TESTING, ADJUSTING, AND BALANCING	23 99 00 - 9
24214 - COPA New Lifeguard Facility	5-15-2025

proper conditions as indicated on the Drawings. At time of opposite season check-out, the Owner's representative will be notified before readings and adjustments are made.

- E. In fan systems, the air quantities indicated on the Drawings may be varied as required to secure a maximum temperature variation of two degrees with each separately controlled space, but the total air quantity indicated for each zone must be obtained. It shall be the obligation of the Contractor to furnish or revise fan drive and motors if necessary, without cost to the Owner, to attain the specified air volumes.
- F. The various existing water circulating systems shall be cleaned, filled, purged, of air, and put into operation before hydronic balancing.

3.03 PROFESSIONAL REPORT

- A. Before the final acceptance of the report is made the TAB will furnish the Owner the following data to be approved by the Owner and Engineer.
 - 1. Summary of main supply, return and exhaust duct pilot tube traverses and fan settings indicating minimum value required to achieve specified air volumes.
 - 2. A listing of the measured air quantities at each outlet corresponding to the temperature tabulation as developed by the Engineer and TAB firm.
 - 3. Air quantities at each return and exhaust air handling device.
 - 4. Static pressure readings entering and leaving each supply fan exhaust fan, filter, coil, balancing dampers and other components of the systems included in the retrofit Work. These readings will be related to performance curves in terms of the CFM handled if available,
 - 5. Motor current readings at each equipment motor on load side of capacitors. The voltages at the time of the reading shall be listed.
 - 6. The final report shall certify test methods and instrumentation used, final velocity reading obtained, temperatures, pressure drops, RPM of equipment, amperage of motors, air balancing problems encountered, recommendations and uncompleted punch list items. The test results will be recorded on standard forms.
 - 7. A summary of actual operating conditions shall be included with each system outlining normal and ventilation cycles of operation. The final report will act as a reference of actual operating conditions for the Owner's operating personal.

3.03 BALANCING AIR CONDITIONING SYSTEM

A. GENERAL

- 1. Place all equipment into full operation, and shall continue the operating during each working day of balancing and testing. If the air conditioning system is balanced during OFF-Peak cooling seasons Balancing Contractor shall return to rebalance air side system as required to put system in proper balance at that time.
- 2. The contractor shall submit detailed balancing and recording forms for approval. After the approval by the Architect, prepare complete set of forms for recording test

TESTING, ADJUSTING, AND BALANCING	23 99 00 - 10
24214 - COPA New Lifeguard Facility	5-15-2025

data on each system. All Work shall be done under the supervision of Registered Professional Engineer. All instruments used shall be accurately calibrated to within 1% of scale and maintained in good working order.

3. Upon completion of the balancing and testing, the Balancing Contractor shall compile the test data in report forms, and forward five copies to the Architect for evaluation
 4. The final report shall contain logged results of all tests, including such data as
 - a. Tabulation of air volume at each outlet.
 - b. Outside dry bulb and wet bulb temperature.
 - c. Inside dry bulb and wet bulb temperature in each conditioned space room or area.
 - d. Actual fan capacities and static pressures. Motor current and voltage readings at each fan.
- B. AIR SYSTEMS: Perform the following operations as applicable to system balance and test:
1. Check fan rotation.
 2. Check filters (balancing shall be done with clean filters).
 3. Test and adjust blower rpm to design requirements.
 4. Test and record motor full load amperes.
 5. Test and record system static pressures, suction and discharge.
 6. Test and adjust system for design cfm, return air and outside air (+2%). Change out fan sheaves as required to balance system.
 7. Test and record entering air temperatures, db and wb.
 8. Test and record leaving air temperature, db and wb
 9. Adjust all zones to design cfm (+2%).
 10. Test and adjust each diffuser, grille, and register to within 5% of design.
- C. WATER SYSTEMS: Perform the following operations as applicable to system balance and test:
1. Check pump operation
 2. Check operation of all mixing valves.
 3. Test water flow rate at all pumps. Adjust balancing valves as required.
 4. Record water temperature entering and leaving the pump and water heater.
 5. Record pump suction and discharge pressures.
- D. DX SYSTEMS:
1. Test and record suction and discharge pressures at each compressor and record ambient air temperature entering the condensing coils.
 2. Test and record unit full load amps and voltage.
 3. Test and record staging and unloading of unit required by sequence of operation or drawing schedule.
- E. Automatic temperature controls shall be calibrated and all thermostats and dampers, adjusted so that the control system is in proper operating condition, subject to approval of the Architect.

TESTING, ADJUSTING, AND BALANCING	23 99 00 - 11
24214 - COPA New Lifeguard Facility	5-15-2025

- F. The Air Balance Contractor shall report to Engineer all air distribution devices or other equipment that operate noisily so that corrective measures may be implemented by the Contractor at no additional cost to the owner.

END OF SECTION 23 99 00

TESTING, ADJUSTING, AND BALANCING	23 99 00 - 12
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 26 01 00 ELECTRICAL GENERAL PROVISIONS

PART 1 GENERAL

1.01 SCOPE:

- A. The Contractor shall execute all work as hereinafter specified, as shown on the drawings or as necessary to provide complete and functioning systems. All items of labor, material or equipment not required in detail by the specifications or drawings, but incidental to or necessary for the complete installation and proper operation of all phases of work described herein, or reasonably implied in connection therewith, shall be furnished as if called for in detail by the specifications or drawings.

1.02 LAWS AND ORDINANCES:

- A. All work and materials shall conform to the requirements of the federal, state, and local laws and ordinances having jurisdiction at the jobsite. The installation shall be in strict accordance with the latest edition of the National Electrical Code (NEC). The Contractor at no increase in contract price shall make all modifications to the work, which may be required by an authority having legal jurisdiction over the work.

1.03 LICENSES, FEES AND PERMITS:

- A. The Contractor shall have a Master Electrician license issued by or acceptable to the city in which the work is to be performed. Additionally, and at all times while work is being performed, for every five or less craftsman working on the project site, at least one craftsman shall have a Journeyman Electrician license issued by or acceptable to the city in which the work is to be performed.

1.04 THE DRAWINGS AND SPECIFICATIONS:

- A. The drawings and specifications shall be interpreted together, and any and all work included in either, though not in both, shall be part of the contracted work. The drawings are diagrammatic but shall be followed as closely as actual construction of the project and existing job site conditions will permit. Any changes due to equipment supplied, conflict with the work of other trades or to make this work conform to the National Electrical Code shall be made by the Contractor at no increase in contract price.

1.05 SITE CONDITIONS:

- A. Before submitting his bid, the Contractor shall visit the site and familiarize himself with all existing conditions and his bid shall be based on accepting conditions as they exist.

1.06 MATERIALS AND EQUIPMENT:

ELECTRICAL GENERAL PROVISIONS	26 01 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

- A. All materials and equipment furnished by the Contractor shall be new. Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such materials and equipment. Where two or more units of the same item are required, they shall be products of a single manufacturer. The Contractor shall unload and properly store all electrical materials and equipment delivered to the jobsite.

1.07 UTILITY CONNECTIONS AND SERVICE:

- A. The Contractor shall make arrangements for connection with the electrical utility company that will serve the jobsite and shall comply with all the rules, regulations and requirements of the utility company. The Contractor shall examine the site, confer with the utility company and verify the requirements for connections prior to bidding the work. The Contractor shall verify with the utility company the exact location of service tie-in points, cable routes, etc. Failure of the Contractor to contact the utility company and obtain such information prior to bidding the work shall not be considered as a basis for additional compensation. Where outages to existing electrical service are required, the Contractor shall coordinate the timing and duration of such outages with Owner's representative.
- B. The Contractor shall furnish and install a meter enclosure for the utility company meter. The enclosure and installation shall be in accordance with utility company requirements.

1.08 SAFETY:

- A. It shall be the responsibility of the electrical Contractor to initiate, maintain, and supervise all safety precautions required by local, state, and federal laws, including OSHA.

1.09 SUBMITTALS:

- A. Submittals for Approval:
 - 1. Submit in accordance with Section 013000 except as otherwise stated herein.
 - 2. Within 30 calendar days after award of contract, the Contractor shall furnish seven (7) sets of drawings and data as described herein for Engineer approval. No item of equipment or material shall be ordered or shipped to the job site until the Engineer has given written approval of the submittal data.
 - 3. The submittal data shall be bound in a 3-ring binder with dividers. The binder shall include a cover and a table of contents with the contractors name as well as the name of the project. All data shall be divided by specification section.
 - 4. The submittal data for each item shall include descriptive literature, performance data, shop drawings technical literature and any other necessary data to readily identify that the equipment will meet the requirements of the drawings and specifications.
 - 5. One complete submittal of drawings and data shall be made for all required items. Partial or incomplete submittals will be returned without comment. All copies

ELECTRICAL GENERAL PROVISIONS	26 01 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

furnished shall be manufacturer's original copies of good quality, legible photocopies or blue line prints. Copies transmitted by facsimile machine are not acceptable.

6. Submittal documents shall be job specific. Where manufacturer's standard drawings or catalog sheets are provided, they shall be marked to show specifically what is being furnished. Drawings shall be marked to show Owner's name, plant location, project description and equipment designation.
7. Substitutions for specified products shall be in compliance with Paragraph 1.10.
8. The Contractor shall review all manufacturers' submittals for completeness, accuracy and compliance with project specifications before submitting to Engineer.
9. The Engineer will review the complete submittal package and return five (5) sets to the Contractor with individual items marked in one of the following three forms:

Reviewed as submitted
Reviewed with comments
Disapproved

Items that are disapproved shall be corrected as required and shall be resubmitted to the Engineer for approval.

- B. Approval of submittals, etc. shall not be construed as releasing the Contractor from further responsibility, but rather as a means to coordinate the work and to aid in the proper selection and installation of the materials and equipment. All materials and equipment shall be subject to final acceptance by the Engineer at completion of the project.

- C. Submittal of Record Data:

1. Record Data: Provide seven (7) sets of record data books containing information listed below. The material shall be bound into appropriately sized 3 ring binders, organized with dividers and index sheets. The binders shall be appropriately labeled with the Owner's name, project name and location. The data books shall include:
 - a. Certified as-built shop drawings for all fabricated equipment.
 - b. Approved product data for all items required in Paragraph 1.09A.
 - c. Spare parts lists
 - d. Test records.
2. Record Drawings: Provide one (1) set of project drawings marked neatly and legibly in colored pencil to show any significant deviation between actual conditions and original design layout.
3. Operation and Maintenance Data: Provide seven (7) sets of manufacturer's operation and maintenance data on equipment and components. The data shall be organized into loose-leaf binders with dividers and master index.

1.10 SUBSTITUTIONS:

ELECTRICAL GENERAL PROVISIONS	26 01 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Requirements for Substitutions: It is the intention of the drawings and specifications to establish a definite standard when a particular manufacturer's product is mentioned. Written request for substitutions of equivalent products will be considered provided all the following conditions are met. Substitutions for specified products will not be permitted unless all of the following conditions are met:
1. Written request shall be received in the Engineer's office ten (10) days prior to the day of bid opening. Requests after ten days prior to the day of bid opening will not be considered.
 2. Request shall include complete technical data, i.e. product data sheets, curve, ratings, etc.
 3. Request shall include a complete written comparison of differences and similarities between the proposed and specified product. Provide a written comparison for each substitution being requested.
 4. Space and clearance requirements are adequate for products mentioned. It is the responsibility of the Contractor to verify space and clearance requirements for products proposed for substitution.
 5. If modifications to the drawings and specifications are necessary for the proper installation of a product proposed for substitution, the request shall explain such in detail, accompanied by drawings if necessary.
- B. Approval: If the above has been complied with, and in the Engineer's opinion the product proposed for substitution is equivalent to that mentioned, the product will be approved for substitution and all prospective bidders will be so notified.

1.11 PROTECTION:

- A. All new work, equipment and materials shall be protected at all times to prevent damage or breakage, either in transit, storage, installation or testing. All openings shall be closed with caps or plugs during installation. All materials and equipment shall be covered and protected against dirt, water, chemical or mechanical injury. This shall include the erection of all required temporary shelters, cribbing of any apparatus above floor construction and covering of apparatus in incomplete buildings with tarpaulins or other protective covering. Temporary electric heaters shall be installed to keep apparatus dry. All rotating equipment and/or machinery shall be properly lubricated and rotated on a regular basis. All electrical materials and equipment damaged during handling, storage, and installation, until the Owner has accepted the project, shall be repaired or replaced by the Contractor with no increase in contract price.

1.12 COORDINATION:

- A. The Contractor shall not hinder and/or delay any work being accomplished by other construction companies at or near the general construction site; nor shall the

ELECTRICAL GENERAL PROVISIONS	26 01 00 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

Contractor impede normal operation of the Owner at any time except as otherwise indicated.

1.13 WORKMANSHIP:

- A. All labor shall be performed in the best and most workmanlike manner by mechanics skilled in their particular trades. All installations shall be complete in both effectiveness and appearance whether finally enclosed or left exposed. The Engineer reserves the right to direct the removal or replacement of any item which, in his opinion, does not present a reasonably neat or workmanlike appearance, providing that same can be properly installed in an orderly way by usual methods for such work. All specialties and appurtenances shall be installed to conform to the manufacturer's recommendations unless otherwise specified.

1.14 EQUIPMENT BY OTHERS:

- A. This Contractor shall make electrical connections to equipment installed by other trades. The mechanical contractor shall install all motor driven equipment and motors furnished under this contract.
 - 1. The Contractor shall verify the electrical requirements of equipment and appliances furnished by others with data provided by the successful vendor or vendors. The Contractor shall provide the proper sized circuits, circuit breakers, starters, disconnect switches, receptacles, etc. as required to connect this equipment. If changes are required to electrical systems shown on the drawings, the Contractor shall make these changes at no additional cost to Owner.

1.15 CUTTING AND REPAIRING:

- A. The Contractor shall coordinate the work to eliminate cutting of the construction except as specified. Where it becomes necessary to cut through the construction to permit the installation of work or the repair of defective work, it shall be done by mechanics skilled in the trade of erecting the type of work involved. The Contractor without additional compensation shall pay the cost of cutting and repairing. No cutting shall be done to any structural members unless the Engineer grants specific permission, in writing.

1.16 SLEEVES, INSERTS, SUPPORTS, ANCHOR BOLTS, FLASHING AND FOUNDATIONS:

- A. Furnish and install all sleeves, inserts, supports, anchor bolts, flashing, counter flashing and foundations required for the proper installation of the proposed work.

1.17 CLEANING:

- A. All debris resulting from the construction shall be removed from the project site daily. Upon completion of the project, unused materials and equipment shall be removed from the project site. All visible labels, dirt overspray, paint, grease, and stains shall

ELECTRICAL GENERAL PROVISIONS	26 01 00 - 5
24214 - COPA New Lifeguard Facility	5-15-2025

be removed from all electrical equipment. Labels indicating testing laboratory approval or giving parts numbers shall be left in place.

1.18 TESTING:

- A. The Contractor shall test the entire wiring system for proper voltage level and balance, and for short circuits and grounds in accordance with established methods upon completion of work. The system shall operate satisfactorily in every respect. This Contractor shall make all corrections to accomplish such.

1.19 INSPECTIONS:

- A. The Contractor shall cooperate with and provide assistance to the Engineer or the Engineer's Inspector in making periodic and final inspections of the work. This assistance shall include, but not necessarily be limited to, the furnishing of labor, tools, etc. to operate equipment and demonstrate its proper functioning. Also included shall be the removal of outlet, junction box and panel covers, etc. as necessary for the Engineer to inspect the work.

1.20 GUARANTEE:

- A. Any defects from imperfect or improper materials or faults arising from improper workmanship that may appear within a period of twelve (12) months from the date of final acceptance of the system shall be amended and made good by the Contractor at his own cost. Any defects or faults shall be attended to within ten (10) days after receiving written notice from the Engineer. Failure to promptly attend to said defects or faults shall be sufficient cause for the Owner to correct the problem with the Owner's forces or the forces of others and invoice the Contractor for any and all charges, including management and overhead, related to correcting said problem.

END OF SECTION 26 01 00

ELECTRICAL GENERAL PROVISIONS	26 01 00 - 6
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 26 06 00 GROUNDING

PART 1 GENERAL

1.01 SUMMARY:

A. Section Includes:

1. Solid grounding of electrical systems, equipment, machine frames, enclosures, appliances and structures.
2. Basic requirements for grounding for protection of life, equipment, circuits, and systems.
3. Grounding requirements specified in this Section may be supplemented in other sections of these Specifications.

1.02 REFERENCES:

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

1. B3 Standard Specification for Soft or Annealed Copper Wire.
2. B8 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.
3. B33 Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes.

B. National Fire Protection Association (NFPA):

1. 70 National Electrical Code
2. 78 Lightning Protection Code

C. Underwriters Laboratories Inc. (UL)

1. 467 UL Standard for Safety Grounding and Bonding Equipment.

1.03 SUBMITTALS – FOR APPROVAL:

- A. Procedure:** Submit in accordance with Section 013000 and 260100.
- B. Product Data:** Submit for grounding conductors, ground rods, clamps, connectors, wells and insulating materials.

1.04 SUBMITTALS – RECORD DATA:

GROUNDING	26 06 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Submit in accordance with Section 013000.
- B. Product Data: Approved, as furnished data as listed above.
- C. Test Reports

1.05 QUALITY ASSURANCE:

- A. Items provided under this Section shall be listed or labeled by UL.
- B. Regulatory Requirements:
 - 1. National Electrical Code (NEC): Provide components and installation as required by National Fire Protection Association (NFPA) 70, Article 250.

PART 2 PRODUCTS

2.01 GENERAL:

- A. Provide products in quantities, sizes and ratings to comply with the NEC or the design drawings, whichever requirements are more stringent.
- B. Conductor Materials: Copper
- C. Connector Materials: Copper or bronze, tin-plated where required for corrosion resistance.

2.02 CONDUCTORS:

- A. Grounding Electrode Conductor: Soft drawn copper, Class B stranded per ASTM B-8, 600 volt TW, THW or THWN insulation. Size per NEC 250.
- B. Equipment Grounding Conductor: Soft drawn copper, Class B stranded per ASTM B-8 except that conductor sizes Nos. 12 and 10 AWG used in lighting and receptacle branch circuits may be solid conductor. All conductors shall have 600 volt, TW, THW or THWN insulation.
- C. Grounding Grid Conductor: Medium hard drawn bare copper, Class B stranded per ASTM B-8, No. 2/0 AWG or as otherwise indicated on the drawings.
- D. Color Code: Insulation color shall be green, except that sizes No. 2 AWG and larger may be black with green colored tape spirally applied over all visible surfaces within enclosures.

2.03 WIRE CONNECTORS:

GROUNDING	26 06 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Terminal Lugs: Copper alloy, tin-plated, compression type, Burndy type, YA, NEMA 1 hole for sizes No. 6 through No. 1/0 AWG. Burndy type YGHA, NEMA 2 hole pad for sizes No. 2/0 AWG and larger.
- B. Split Bolt Connectors: Burndy SERVIT, type KS
- C. Taps and Splices:
 - 1. Grounding Grid below Grade: Exothermic type (Cadweld) or compression type (Burndy Hyground).
 - 2. Above Grade: Compression type.

2.04 CONDUIT CONNECTORS:

- A. Conduit Clamps: Burndy type GAR or GD.
- B. Grounding Bushings: 0-Z/GEDNEY

2.05 GROUNDING ELECTRODES:

- A. Ground Rods: $\frac{3}{4}$ inch diameter, 10 feet long, copper clad steel with high strength sheath, molten welded to core.
- B. Rod Connectors:
 - 1. Exothermic type: Cadweld
 - 2. Mechanical type: Burndy type GAR or GD
- C. Test Wells: (Not Required)

2.06 INSULATING MATERIALS:

- A. Tape: Scotch 33+ vinyl plastic.
- B. Mastic Pads: Scotch EZ – Seal

PART 3 EXECUTION

3.01 INSTALLATION:

- A. General:
 - 1. Provide grounding of systems, equipment and structures in accordance with NEC Article 250, the requirements of the authority having jurisdiction and the design drawings.

GROUNDING	26 06 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

B. Service Entrance:

1. Provide a main bonding jumper between the service neutral conductor, the service equipment ground bus and the service equipment enclosure.
2. Provide a grounding electrode conductor to connect the service neutral conductor to the main grounding electrode.

C. Building Steel and Piping:

1. Provide bonding jumper from the service neutral to the building steel and metallic piping systems.

E. Equipment Grounding:

1. Provide a green insulated equipment grounding conductor in all branch circuits and feeder conduits. Size conductor in accordance with NEC 250 unless otherwise indicated on the drawings.
2. Connect the equipment grounding conductor to panelboard or switchgear ground bus and to all metallic raceways, outlet boxes, lighting fixtures, equipment enclosures, appliances and motor frames.
3. Where metallic raceways are installed, both the raceway and the internal equipment grounding conductor shall be utilized for equipment grounding.

F. Grounding Grid:

1. Excavate and backfill for main grounding grid conductor. Locate conductors at least 3 feet away from foundation. Conductor depth shall be 18 to 24 inches below finished grade.
2. Install ground rods vertically in undisturbed soil so that the top of the rod is 18 to 24 inches below finished grade, except that in test wells the top of rods shall be 6 to 8 inches below grade. Space rods a minimum of 10 feet apart.
3. Make underground cable to cable connections using either exothermic or compression type connections.
4. Provide test wells where indicated on the drawings. Install top of test well flush with finished grade or pavement. Use only bolted type rod connectors in test wells.
5. In addition to equipment grounding conductor connections, make connections from the grounding grid to the following items using green, insulated conductors:

GROUNDING	26 06 00 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

- a. Electrical equipment ground busses
 - b. Electrical equipment enclosures
 - c. Motor frames
 - d. Steel support frames for electrical equipment
 - e. Building steel frame
6. Grounding conductors stubbed up from below grade shall be enclosed in a 1-inch Schedule 40 PVC protective sleeve.

G. Conduit:

- 1. Provide grounding bushings where metallic conduits connect to non-metallic enclosures or stub-up into open-bottom, floor-mounted enclosures.
- 2. Provide conduit grounding clamps where metallic conduit stub-ups are connected to non-metallic underground conduits.

H. Testing:

- 1. Perform a "Fall of Potential" grounding test as described by ANSI/IEEE Standard 81.
 - a. Provide ground resistance measurements prior to and after the grounding electrode system is installed.
 - b. Ground resistance shall be 5 ohms or less.
 - c. Provide additional grounding electrodes a minimum of 10 feet apart to achieve 5 ohms or less.
 - d. Provide a signed grounding report to the Engineer and Owner on the Contractor's letterhead with date, time, and resistance measurements of when the tests were completed.

END OF SECTION 26 06 00

GROUNDING	26 06 00 - 5
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 26 07 50 ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 SUMMARY:

A. Section Includes:

1. Equipment nameplates and labels
2. Warning and caution signs
3. Operational instruction signs
4. Identification labeling of conduits, cables

B. Related Sections:

1. Additional identification requirements are specified in other Sections of Division 26.

1.02 REFERENCES:

A. Code of Federal Regulations (CFR)

1. 29CFR1910.145 Specification for Accident Prevention Signs

B. National Fire Protection Association (NFPA)

1. 70 National Electrical Code

1.03 SUBMITTALS FOR APPROVAL:

A. Procedure: Submit in accordance with Section 013000 and 260100.

B. Product Data: Submit for each type of product used on project.

C. Schedules: Nameplate engraving schedule.

PART 2 PRODUCTS

2.01 ELECTRICAL IDENTIFICATION PRODUCTS:

A. Engraved Nameplates and Signs:

ELECTRICAL IDENTIFICATION	26 07 50 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

1. Material: 3 ply plastic laminate, matte-finish, 0.125 inch thickness, white with black center core except that material used for warning signs shall be red with white center core. Provide punched mounting holes for mechanical fasteners.
2. Size: Minimum size to be 1 inch by 2.5 inches, rectangular shape with square corners.
3. Engraving: Accurately align lettering and engrave into center core. Lettering shall be normal block style. Character size shall be 3/8 inch high for grouped equipment and load designation and 1/4 inch for individual equipment, loads and devices.

B. Warning Signs:

1. Fiberglass reinforced polyester, non-adhesive backed, indoor-outdoor with punched mounting holes, Brady B-120.
2. Polyester overlaminated with plastic coating, adhesive-backed, indoor-outdoor, Brady B-302.
3. High Voltage warning signs to read "Danger-High Voltage-Keep Out."
4. Provide identical signs for each application.

PART 3 EXECUTION

3.01 INSTALLATION:

A. General:

1. Provide labels and signs in accordance with NEC requirements.
2. Install labels and signs at locations for best convenience of viewing without interference with operation and maintenance of equipment.
3. All nameplates and signs used on the project shall be of similar size, style and appearance.

B. Equipment Nameplates:

1. Provide engraved identification nameplates for each of the following:
 - a. Panelboards
 - b. Circuit breakers
 - c. Switches
 - d. Contactors
 - e. Pull and junction boxes
2. Nameplate legends shall include the equipment identification number as indicated on the design drawings and an appropriate service description.

ELECTRICAL IDENTIFICATION	26 07 50 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

3. Nameplates for switchgear assemblies, panelboards, and separately enclosed breakers, switches, starters and contactors shall include the operating voltage.
4. Attach engraved nameplates to equipment with self-tapping, stainless steel, round head screws. Use adhesive attachment only where the substrate material is not suitable for screw attachment.

C. Warning Signs:

1. Voltage warning signs where required by the NEC, where indicated on drawing and as follows:
 - a. Equipment Rooms: On all doors to equipment rooms containing equipment or circuits over 600 volts or containing exposed live parts. Minimum size shall be 7 inches x 10 inches.
 - b. Pull Boxes: On removable covers for all pull and junction boxes containing circuits over 600 volts.
 - c. Equipment: On front and rear compartment access doors and covers enclosing live parts. Signs provided as part of equipment that meet these requirements are acceptable.
 - d. Fences: On each gate and on each side of fences that enclose equipment or circuits over 600 volts or exposed live parts. Minimum size shall be 10 inches by 14 inches. Locate at intervals not exceeding 30 feet.
2. Multiple Source Signs:
 - a. Where enclosures contain voltages from more than one source which are not interrupted by opening the local unit disconnecting means, provide an engraved nameplate bearing the following (or similar) legend:

“WARNING – MULTIPLE ELECTRICAL SOURCES EXIST WITHIN THIS ENCLOSURE”

OR

“WARNING – VOLTAGE MAY BE PRESENT WITH DISCONNECT SWITCH OPEN”
3. Hazardous Operation:
 - a. Where operation of an electric switch or control device may create an unsafe or undesirable operating condition, provide an engraved plastic sign with appropriate warning statement.

D. Multiple Services:

ELECTRICAL IDENTIFICATION	26 07 50 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

1. Where multiple services exist, provide each service disconnect with an additional sign which states the name and location of other service disconnects.

E. Conduits:

1. Identify conduits at each termination and at all transitions from exposed to concealed or underground installation.
2. Mark conduits legibly with a permanent marker pen to indicate conduit per circuit number.

F. Cables:

1. Identify cables in pull and junction boxes, vaults, manholes and where entering switchgear panelboard assembly.
2. Provide an engraved plastic nameplate or other suitable permanent tag for each cable or cable assembly. Attach with self-locking nylon cable tie.
3. Cable identification shall include circuit number and phase as indicated on drawings.

END OF SECTION 26 07 50

ELECTRICAL IDENTIFICATION	26 07 50 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 26 12 30 WIRE & CABLE

PART 1 GENERAL

1.01 SUMMARY:

- A. Section includes copper wire, cable, associated connectors, and termination hardware used on systems operating at 600 volts or less.

1.02 REFERENCES:

- A. American Society for Testing and Materials (ASTM)
 - 1. B8 Concentric-Lay-Stranded Copper Conductor, Hard, Medium Hard, Or Soft.
- B. National Electrical Contractor Association (NECA)
 - 1. Standard of Installation
- C. National Fire Protection Association (NFPA)
 - 1. 70 National Electrical Code
- D. Underwriters Laboratories Inc. (UL)
 - 1. 44 Rubber-Insulated Wires and Cables
 - 2. 83 Thermoplastic-Insulated Wires and Cables
 - 3. 486A Wire Connectors and Soldering Lugs for Use With Copper Conductors
 - 4. 486C Splicing Wire Connectors
 - 5. 510 Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
 - 6. 1569 Metal-Clad Cables

1.03 SUBMITTALS – FOR APPROVAL:

- A. Procedures: Submit in accordance with Section 013000 and 260100.
- B. Product Data: Submit for each type of wire and cable, terminal lugs, connectors, and cable fittings.

1.04 SUBMITTALS – RECORD DATA:

- A. Procedure: Submit in accordance with Section 013000.
- B. Product Data: Approved, as furnished data as listed above.

WIRE & CABLE	26 12 30 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

1.05 QUALITY ASSURANCE:

- A. Furnish wire, cable, associated connectors, and termination hardware bearing UL label.

PART 2 PRODUCTS

2.01 BUILDING WIRE:

- A. Single conductor, soft drawn, annealed copper conductor, Class B stranded except that sizes No. 10 AWG and smaller used for lighting and power branch circuits may be solid. Insulation shall be 600 volt, type THHN/THWN per UL 83 or type XHHW per UL 44.

2.02 TYPE MC CABLE: Metal Clad Cable type MC multi-conductor cabling as manufactured by AFC Cable Systems or equivalent having the following construction features:

- A. Conductor: Bare, soft annealed copper, Class B stranded per ASTM B-8.
- B. Insulation: Polypropylene tape assembly with 600 volt, 90°C (dry) type THHN insulation with printed number and color identification.
- C. Neutral conductor: White – 120v circuits; Gray – 480Y277v circuits
- D. Grounding conductor: Green insulated copper ground conductor.
- E. Assembly: Three insulated conductors with grounding conductor, non-hygroscopic fillers and overall binder tape per UL 1569.
- F. Sheath: High strength, lightweight galvanized interlocking steel strip and color coded on the out side for easy identification.
- G. U.L rated 1569

2.03 CONNECTORS AND TERMINALS:

- A. Insulated Crimp Type Connectors and Terminals: Nylon insulated, Burndy INSULINK and INSULUG, or Thomas & Betts Sta-Kon.
- B. Split Bolts: High-conductivity copper alloy, Burndy SERVIT or Thomas & Betts Split-Bolt.
- C. Two Bolt Connectors: High-conductivity copper alloy, Burndy OKLIP, Type KVS or Blackburn 2BU.
- D. Compression Terminals: Copper, long barrel, Burndy HYLUG or Thomas & Betts Color-Keyed.

WIRE & CABLE	26 12 30 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

- E. Bolted Terminals: Cast copper alloy, Burndy QIKLUG or Thomas & Betts Locktite.
- F. Spring Wire Connectors: Insulated, twist-on type, Ideal Wire Nut or 3M Scotchlok. Push-in type connectors are prohibited.

2.04 CABLE TERMINATIONS:

- A. Type MC Cable: Steel set screw connectors

2.05 MISCELLANEOUS COMPONENTS:

- A. Tape: UL 510
 - 1. Vinyl Plastic: 3M Scotch 33+ or Scotch 88.
 - 2. Varnished Cambric (VC): 3M Irvington 2920.
 - 3. Friction: Black friction tape.
- B. Pulling Lubricants: Ideal Yellow 77 or Polywater Type J.
- C. Wire Markers:
 - 1. Individual Wires: Heat shrink, machine printed, Raychem.
 - 2. Multi-Conductor Cables or Groups of Wires as a Cable: Nylon tie on marker, Thomas & Betts Nylon I.D. Ties, Ty-Raps.
- D. Wire and Cable Ties: Thomas & Betts Ty-Raps.

PART 3 EXECUTION

3.01 APPLICATION:

- A. Wire and Cable:
 - 1. THWN-THHN for power wiring through No. 250 AWG and control wiring in conduit. XHHW for sizes above No. 250 AWG in conduit.
 - 2. TW or THW for equipment grounding conductor.
 - 3. Type MC cable for fixture wires no longer than 6' and in accordance with NEC Article 334.
 - 4. No. 12 AWG minimum for power circuits and No. 14 AWG minimum for control circuits unless noted otherwise on drawings.
- B. Splices and Taps:
 - 1. Use insulated spring wire connectors for lighting and receptacle branch circuits No. 10 AWG and smaller. Push-in type connectors are prohibited.

WIRE & CABLE	26 12 30 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

2. Use solderless pressure connectors for branch circuit conductors No. 8 AWG and larger.
3. Do not make splices or taps in feeder circuits or control circuits.

C. Terminals:

1. Use copper compression terminals, NEMA 1 hole for sizes No. 4 AWG and smaller, NEMA 2 hole for sizes No. 2 AWG and larger.
2. Use insulated, ring tongue terminals for signal and control conductors.

3.02 INSTALLATION:

A. Install wire and cable in accordance with the NECA Standard of Installation.

B. Installation in Conduit:

1. Swab conduits completely and thoroughly before pulling in conductors.
2. Pull all conductors into conduit at same time.
3. Use suitable wire pulling lubricant for building wire No. 4 AWG and larger.
4. Do not pull in conductors until conduit system is completed. Do not pull through boxes, fittings or enclosures where a change of conduit alignment or direction occurs.
5. Limit pulling tension to maximum values as recommended by manufacturer.
6. Do not combine circuits into a common conduit other than as indicated on the drawings.

C. Direct Burial Cable:

1. Trench and backfill for direct burial cables. Minimum depth of installation shall be 24 inches.
2. Terminate and ground metallic cable sheath with suitable fittings.

D. Compression Connectors and Terminals:

1. Install on wire and cable with approved tool and die to recommended compression pressure. Do not cut strands from conductors to fit lugs or terminals.

E. Bolted Connectors and Terminals:

1. Torque to manufacturer's recommended foot-pounds for size and class of connector.
2. Where manufacturer's published torquing requirements are not indicated, tighten connectors and terminals to comply with UL 486A torque values.

WIRE & CABLE	26 12 30 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

3. Use galvanized steel bolts, nuts, split-lock washers and flat washers on terminal connections.
- F. Wiring in Enclosures:
1. Form and tie conductors in panelboards, cabinets, control panels, motor controllers, wireways, and wiring troughs in a neat and orderly manner.
 2. Use Thomas & Betts wire and cable ties of appropriate size and type.
 3. Limit spacing between ties to not more than 6 inches.
- G. Taping:
1. Above Ground and Dry Locations: Fill voids and irregularities with half-lapped layers of VC (two minimum) or electrical insulation putty. Insulate with three half-lapped layers of vinyl plastic and one half-layer of friction tape.
 2. In damp or wet locations, wrap insulated spring wire connectors with 2 layers of vinyl plastic tape.

3.03 COLOR CODING:

- A. Power Wiring: Provide color coding for single and multi-conductor power circuits as follows:

<u>Voltage</u>	<u>ΦA</u>	<u>ΦB</u>	<u>ΦC</u>	<u>Neutral</u>
240 volts and below	Black	Red	Blue	White
250 – 600 volts	Brown	Purple	Yellow	Gray

1. For specified insulation and jackets not manufactured with integral colors, use conductors with black insulation or jacket and color-coding tape.
 2. Color code conductors entering boxes, troughs, cabinets, and other enclosures.
 3. Color code conductors in wireways, trenches, and other locations where conductors are continuously accessible at intervals not exceeding 5 feet.
- B. Insulated Equipment Ground: Green.
- C. Isolated Ground conductor: Green with Yellow tracer.

3.04 WIRING IDENTIFICATION

- A. Control Circuits: Install a permanent wire label at each termination. Identifying numbers shall match approved schematic and wiring diagrams.
- B. Feeder and Branch Circuits: Install a permanent wire label at each termination. Identifying numbers shall include source panel designation and circuit number.

WIRE & CABLE	26 12 30 - 5
24214 - COPA New Lifeguard Facility	5-15-2025

3.05 FIELD TESTS:

- A. Test conductors after installation is complete and prior to connection to equipment.
- B. Perform insulation resistance test on each conductor phase-to-ground with adjacent conductors grounded and test conductor disconnected from equipment. Applied potential shall be 1000 volts dc for one minute. Minimum acceptable test values shall be 50 megohms. Investigate deviations in test values between adjacent phases.
- C. Verify tightness of bolted connections with a calibrated torque wrench. Torque values shall be terminal lug manufacturer's recommendations.

END OF SECTION 26 12 30

WIRE & CABLE	26 12 30 - 6
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 26 13 60 RACEWAYS

PART 1 GENERAL

1.01 SUMMARY:

A. Section Includes:

1. Rigid Galvanized Steel Conduit (RGS)
2. PVC-Coated Rigid Steel Conduit (CRGS)
3. Rigid Aluminum Conduit (RAC)
4. Electrical Metallic Tubing (EMT)
5. PVC Conduit (PVC)
6. Flexible Conduit
7. Associated Fittings
8. Wireways
9. Pull and Junction Boxes

1.02 REFERENCES:

A. American National Standards Institute (ANSI):

1. C80.1 Rigid Steel Conduit – Zinc Coated
2. C80.3 Electrical Metallic Tubing – Zinc Coated
3. C80.5 Rigid Aluminum Conduit

B. National Electrical Manufacturers Association (NEMA):

1. TC 2 Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80)
2. TC 3 PVC Fitting for Use with Rigid PVC Conduit and Tubing
3. TC 13 Electrical Nonmetallic Tubing (ENT)
4. TC 14 Filament-Wound Reinforced Thermosetting Resin Conduit and Fittings.

C. National Fire Protection Association (NFPA):

1. 70 National Electrical Code

D. Underwriters Laboratories Inc. (UL):

1. 1 Flexible Metal Conduit
2. 5 Surface Metal Raceways and Fittings
3. 5A Nonmetallic Surface Raceways and Fittings
4. 6 Rigid Metal Conduit
5. 360 Liquid-Tight Flexible Steel Conduit
6. 514B Fittings for Conduit and Outlet Boxes
7. 797 Electrical Metallic Tubing

RACEWAYS	26 13 60 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

- | | | |
|-----|------|---|
| 8. | 870 | Wireways, Auxiliary Gutters, and Associated Fittings |
| 9. | 886 | Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations |
| 10. | 1660 | Liquid-Tight Flexible Nonmetallic Conduit |

1.03 SUBMITTALS – FOR APPROVAL:

- A. Procedure: Submit in accordance with Section 013000 and 260100.
- B. Product Data: Submit for each type of conduit, fitting, connector, pull and junction box, and wireway used on the project.

1.04 SUBMITTALS – RECORD DATA:

- A. Procedure: Submit in accordance with Section 013000.
- B. Product Data: Approved, as furnished data as listed above.

PART 2 PRODUCTS

2.01 RIGID GALVANIZED STEEL (RGS):

- A. Conduit: Conduit including elbows, couplings, and nipples shall be standard weight zinc-coated steel, rigid threaded conduit; shall meet the requirements of ANSI C80.1; and shall be hot-dipped galvanized inside, outside and over threads and lacquered inside.
- B. Fittings: Conduit fittings and accessories for use with RGS conduit shall be cast malleable iron or ferrous alloy, hot-dipped galvanized or zinc-electro-plated and lacquered. Fittings shall have threaded hubs and gasketed covers. Fittings shall be the product of Crouse-Hinds, Appleton or Gedney or an equal.
- C. Boxes: Device and outlet boxes for use with RGS conduit shall be cast malleable iron, hot-dipped galvanized or zinc-electro-plated and lacquered. Boxes shall have threaded hubs and gasketed covers. Boxes shall be the product of Crouse-Hinds, Appleton, Gedney or equal.
- D. Fasteners and Supports: All clamps, straps, framing and supporting materials shall be Type 316 stainless steel. Bolts, nuts, screws, washers, etc. shall be 316 stainless steel. Cadmium-plated or zinc-plated fasteners and hardware will not be acceptable.

2.02 POLYVINYL CHLORIDE (PVC - SCHEDULE 40):

- A. Conduit: Conduit, elbows and couplings shall be Schedule 40 rigid polyvinyl chloride (PVC) conduit per NEMA TC 2 with a 90° UL rating, and shall be the standard product of Krayloy or Carlon or approved equal.

RACEWAYS	26 13 60 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

- B. Fittings: Fittings and accessories for use with Schedule 40 PVC conduit shall conform to NEMA TC 3 and shall be of the same material and manufacturer as the conduit.

2.03 PVC COATED STEEL CONDUIT (CRGS):

- A. Conduit: Prior to coating, all conduits, elbows, couplings, nipples etc. shall be standard weight rigid, threaded steel and shall be hot dipped galvanized inside and out and over the ends. The conduit shall meet the requirements of ANSI C80.1, UL 6, and NEMA RN-1, 1980.
- B. Fittings: Prior to coating, fittings shall be cast malleable iron, hot dipped galvanized, Appleton Form 35 or Crouse-Hinds or equivalent with cast cover and neoprene gasket.
- C. Boxes: Device and outlet boxes for use with PVC coated conduit shall be cast malleable iron, hot dipped galvanized with threaded hubs and gasketed cast covers or device plates. Boxes shall be the product of Appleton or Crouse-Hinds.
- D. PVC Coating: Conduit, fittings, boxes and accessories shall be Plasti-Bond 2 coated, as produced by Robroy Industries Inc. or an approved equal. Before coating, the galvanized surfaces shall be coated with an epoxy-acrylic primer. Exterior surfaces shall have a 40 mil PVC coating applied by dip method. Interior surfaces of conduits, fittings, boxes, etc. shall have a fusion bonded phenolic coating with a thickness of 4-6 mils.
- E. Fasteners and Supports: U-bolts, conduit clamps, straps, modular framing channels shall be 1-5/8" x 1-5/8" minimum section dimensions, Type 316 stainless steel, and shall be the product of Unistrut. Fasteners and attachment hardware shall be Type 316 stainless steel.

2.04 RIGID ALUMINUM CONDUIT:

- A. Conduit: Conduit, including elbows, couplings and nipples shall be standard weight, threaded, rigid aluminum 6063 alloy, with a copper content not to exceed 0.20%. The conduit shall have a silicon or lacquer coating inside.
- B. Fittings: Fittings, accessories and device boxes for aluminum conduit systems shall be the standard threaded type as manufactured by Crouse-Hinds, Appleton, or equal. Both fittings and covers shall be aluminum containing less than 0.4 of 1% copper. All screws shall be stainless steel. Covers shall be gasketed.
- C. Fasteners: All straps and clamps used to support aluminum conduit shall be hot-dipped galvanized steel or malleable iron, with a 40 mil fused PVC coating, Plastibond, Ocal or equivalent. Strut type framing channels shall be either PVC coated galvanized steel or fiberglass.
- D. Hardware: Nuts, bolts, screws, washers, etc. shall be stainless steel. Galvanized or cadmium-plated hardware will not be acceptable for use with aluminum conduit.

2.05 ELECTRICAL METALLIC TUBING (EMT):

RACEWAYS	26 13 60 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Conduit: Conduit, including elbows, couplings, and nipples shall be hot dipped galvanized steel inside and out with an organic corrosion resistant coating applied to the inside.
- B. Fittings and Boxes: Conduit fittings, boxes, and accessories for use with EMT conduit shall be cast malleable iron or ferrous alloy, hot-dipped galvanized or zinc-electro-plated and lacquered. Fittings shall be compression type. Setscrew fittings are not acceptable. Fittings shall be the product of Crouse-Hinds, Appleton, OZ Gedney or an equal.
- C. Fasteners and Supports: All clamps, straps, framing and supporting materials shall be hot-dipped galvanized steel or malleable iron.

2.06 LIQUID-TIGHT FLEXIBLE METAL CONDUIT:

- A. Flexible Conduit: Flexible conduit shall have a spiraled, flexible, galvanized steel inner core and an outer jacket of neoprene. Sizes 3/8" through 4" shall have a continuous, internal copper ground. Liquid-tight connectors shall be galvanized steel or malleable iron with neoprene sealing gaskets, external ground lugs and insulated throats. Connectors shall be Appleton type STB or Gedney or equal.

2.07 WIREWAYS:

- A. Sheet Metal:
 - 1. Indoor, dry locations: NEMA 1, sheet steel per UL 870 with hinged cover per NEMA ICS 6. Finish being manufacturer's standard gray enamel.
 - 2. Outdoor and damp locations: NEMA 3R, galvanized sheet steel per UL 870 with hinged cover per NEMA ICS 6.
- B. Non-Metallic:
 - 1. NEMA 4X, Robroy Industries fiberglass trough with gasketed cover attached with non-metallic fasteners.
- C. Fittings and Accessories: Include couplings, hubs, elbows, adapters, end caps and other fittings to match and mate with type of wireway furnished as required for a complete system.

PART 3 EXECUTION

3.01 APPLICATION:

- A. General:
 - 1. All field wiring shall be installed in conduit except as otherwise indicated.
 - 2. Minimum conduit size shall be 1/2-inch nominal diameter.

RACEWAYS	26 13 60 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

B. Exposed:

1. Conduit installed outdoors exposed shall be rigid galvanized steel.
2. Conduit installed indoors exposed and below 7 feet shall be rigid galvanized steel. Exposed conduit above 7 feet installed indoors may be EMT.

C. Underground:

1. Conduit installed underground shall be Schedule 40 PVC. See section 3.02-E for additional requirements.
2. Elbows used for underground conduit stub-ups from below grade shall be PVC coated rigid galvanized steel, non-metallic Schedule 80 PVC, or Rigid Galvanized Steel completely taped with non-corrosive protective tape.

D. Concealed:

1. Conduit installed concealed above lay-in ceilings and in dry wall construction shall be EMT.

E. Flexible Connections:

1. Indoor-dry areas: Flexible metal conduit.
2. Indoor-wet, damp areas: Liquid-tight, flexible metal conduit.
3. Outdoors: Liquid-tight, flexible metal conduit.

3.02 INSTALLATION:

A. General:

1. Installation Methods: Conduit shall be installed concealed in walls or above ceiling or underground as indicated on the drawings.
2. Cleaning: All conduit systems shall be completed and shall be swabbed clean before conductors are pulled in.
3. Field cuts: Do not cut conduit with pipe cutters.
4. Bends: Field made bends and offsets shall be made with a hickey or conduit bending machine. Crushed or deformed raceways shall not be installed. The maximum number of 90° bends, or equivalent between pulling points in any conduit run shall be three. Pull and junction fittings and/or boxes shall be provided as necessary to satisfy this requirement.
5. Protection: The ends of all conduit runs shall be closed immediately after installation to prevent the accumulation of water, dirt and other foreign material.
6. Locknuts: Conduits shall be fastened to all sheet metal boxes and cabinets with two locknuts. Locknuts shall have sharp edges for digging into the wall of

RACEWAYS	26 13 60 - 5
24214 - COPA New Lifeguard Facility	5-15-2025

metal enclosures. Bushings shall be installed on the ends of all conduits and shall be the insulating type.

7. Conduit couplings shall be threaded type for RGS or RA conduit and compression type for EMT conduit. Set-screw couplings are not acceptable.
8. Spare conduits: Spare conduits shall have a pull cord installed. The pull cord shall be plastic with a minimum tensile strength of 200 pounds. Not less than 12 inches of slack shall be left at each end of the pull cord.
9. Supports: Supports shall be provided a minimum of every 10' and within 3' of all enclosures. In addition, conduits shall be rigidly supported between couplings, on either side of bends and at terminations and fittings.
10. Boxes: Boxes shall be provided in the raceway system as indicated on the drawings and also wherever required for pulling of wires or making connections. Unless otherwise shown on the drawings, boxes installed in normally wet locations or on the outside of exterior surfaces shall be NEMA 3R, Type 316 stainless steel construction. Boxes shall be furnished with hinged and gasketed doors and stainless steel back panels. Each box shall have the volume required by the NEC for the number of conductors enclosed in the box. All boxes shall be securely anchored in place.
11. Flexible Connections: Flexible connections of short length shall be provided for equipment subject to vibration, noise transmission or movement. A separate ground conductor shall be provided across all flexible connections. Flexible conduit connections shall be rigidly and securely supported in an approved manner at intervals not exceeding 24 inches in length and within 12 inches of each conduit termination. Lengths of not more than 36 inches may be installed without such supports where flexibility is required.
12. Identification: Identify conduits in accordance with Section 260750.
13. PVC: PVC conduit joints shall be solvent cement welded and shall be watertight. All PVC conduits shall have a separate grounding conductor installed. Where transition is made to the metallic conduit or enclosures, the grounding conductor shall be bonded to the metal conduit or enclosure.
14. Penetrations through walls, floors, and roof: All penetrations shall be sealed with a UL listed fire sealant equal to Dow Corning #3-6548.

B. Exposed Conduit:

1. Routing: Exposed conduit shall be run straight and true to structure lines. Changes in direction of runs shall be made with fittings or symmetrical bends. Conduit in damp locations or outdoors shall be exposed to the air on all sides and shall not be installed tight against walls, ceilings and structural members, etc. Clamp backs and/or offsets shall be used as necessary to maintain uniform clearances.

RACEWAYS	26 13 60 - 6
24214 - COPA New Lifeguard Facility	5-15-2025

2. Supports: Acceptable supporting and clamping materials for exposed conduit include one-hole straps and clamp back, "U" bolts, parallel or right angle conduit clamps, modular 316 stainless steel channels as manufactured by Unistrut or equal. Perforated steel tape, stamped steel one- and two-hole straps shall not be used. Conduits shall be supported in accordance with NEC 346-12.
3. Obstructions: Conduit shall be routed so as not to create any tripping or head banging hazard and so as not to create any obstruction to Owner's operation and maintenance activities.
4. Hubs: Watertight conduit hubs shall be installed where conduits enter the tops or sides of sheet metal or non-metallic enclosures.
5. Drains: Drain fittings shall be installed at low points throughout the conduit system where condensation is likely to occur.

C. PVC Coated Conduit:

1. PVC coated conduit requires special care to minimize damage to the PVC coating during cutting, threading, bending and installation. Contractor shall install conduit in accordance with manufacturer's recommended installation procedures.
2. Contractor shall be responsible for providing strap wrenches, cutting dies, vises, and other special tools required to install PVC coated conduit. Standard pipe wrenches, chain wrenches or channel locks shall not be used. Conduit bending equipment shall have the proper diameter shoes or dies to allow for the thickness of the PVC coating.
3. PVC coated conduit shall be supported with Type 316 stainless steel clamps, straps, hangers and supports. Attachment hardware shall be Type 316 stainless steel.
4. All PVC coated conduit and fittings that have teeth marks, cuts, nicks or are otherwise damaged shall be repaired by coating damaged area with a liquid PVC touch-up compound. Spray-type compound is not acceptable.
5. Unistrut channel supports and related accessories for use with PVC coated conduit shall be Type 316 stainless steel.

D. Aluminum:

1. Aluminum conduit shall not be installed in direct contact with earth, concrete, steel, copper, brass or bronze. Where aluminum conduit comes into contact with dissimilar metals or passes through concrete walls or floors, it shall be wrapped with 2 layers, half-lapped, of corrosion preventative pipe tape, Scotch 50 or equal.

RACEWAYS	26 13 60 - 7
24214 - COPA New Lifeguard Facility	5-15-2025

2. Aluminum conduit threads shall have a Penetrox, No-Ox-I'd or equal, applied when installed.

E. Underground Conduit:

1. Under Landscaping (i.e. sod or grass):
 - a. Underground conduits 2" and larger shall be laid in sand and covered with a 4" red concrete cap. The conduit shall be surrounded by a minimum of 3-inches of virgin sand (top, bottom, and sides).
 - b. The top of concrete cap shall be a minimum of 24 inches below grade.
 - c. Communication conduits shall be buried a minimum of 36" to top of conduit.
 - d. Provide red caution tape 12" below finish grade over all conduits.
 - e. Unless otherwise indicated, electrical conduits must go below conflicts, such as yard piping, if the minimum depth cannot be met. Backfill for all trenches shall be compacted to original density.
2. Under Paved Areas (i.e. Parking Lot, Driveways, and Roads):
 - a. Underground communication conduit runs shall be buried a minimum 36" below grade to top of conduit. Provide red caution tape 12" below finish grade over all conduits.
 - b. Underground power conduit runs shall be buried the minimum depth per the National Electric Code. Provide red caution tape 12" below finish grade over all conduits.
 - c. Unless otherwise indicated, electrical conduits must go below conflicts, such as yard piping, if the minimum depth cannot be met. Backfill for all trenches shall be compacted to original density.
3. Separation: Minimum separation between the outside edges of adjacent conduits shall be 3 inches.
4. Elbows: All elbows shall be long radius type.
5. Spacers: Conduit spacers shall be installed at 5 feet on centers.
6. Expansion Fittings: Provide expansion fittings in aboveground, vertical portion of each underground conduit stub-up.

END OF SECTION 26 13 60

RACEWAYS	26 13 60 - 8
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 26 14 00 WIRING DEVICES

PART 1 GENERAL

1.01 SUMMARY:

A. Section Includes:

1. Receptacles
2. Ground Fault Circuit Interrupter Receptacles
3. Snap Switches
4. Wall Plates

1.02 REFERENCES:

A. National Electrical Manufacturers Association (NEMA):

1. WD1-83 General Requirements for Wiring Devices
2. WD-5 Specific Purpose Wiring Devices

B. National Fire Protection Association (NFPA):

1. 70 National Electrical Code

C. Underwriters Laboratories Inc. (UL):

1. 20-86 Standard for Safety General Use Snap Switches
2. 94-91 Standard for Safety Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
3. 498091 Standard for Safety Attachment Plugs and Receptacles

1.03 SUBMITTALS:

- A. Procedures: Submit for approval and record purposes in accordance with Section 013000 and 260100.
- B. Product Data: Submit for each type of device used on project.

1.04 QUALITY ASSURANCE:

- A. Items provided under this section shall be listed and labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).
1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
 2. Terms "listed" and "labeled" shall be defined as they are in National Electrical Code, Article 100.
- B. Regulatory Requirements:

WIRING DEVICES	26 14 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

1. National Electrical Code: Components and installation shall comply with NFPA 70.

PART 2 PRODUCTS

2.01 WIRING DEVICES:

- A. General: Provide wiring devices, in types, characteristics, grades, colors, and electrical ratings for applications indicated which are UL listed and which comply with NEMA WD 1 and other applicable UL and NEMA Standards.
- B: Receptacles, General Use Duplex Receptacles: 125 volt, 15 or 20 amp, heavy duty, grounding type, **TAMPER RESISTANT**, by Hubbell, Leviton, or P&S. Device color shall be selected by the Architect.
- C: Ground-Fault Circuit Interrupter (GFCI) Receptacles: 125 volt, 15 or 20 amp, heavy duty, grounding type "non feed-through" conforming to UL 498 and UL 943 by Hubbell, Leviton, or P&S. Device color shall be selected by the Architect.
- D: Snap Switches: 120/277 volt, 20 ampere, quiet rated, heavy duty, complying with UL 20 and NEMA WD1 by Hubbell, Leviton, or P&S. Device color shall be selected by the Architect.

2.02 WIRING DEVICE ACCESSORIES:

- A. Wall Plates:
 1. Single and combination, of types, sizes, and with ganging and cutouts as required by devices.
 2. Provide plates which mate and match with wiring devices to which attached.
 3. Provide metal screws for securing plates to devices with screw heads colored to match finish of plates.
 4. Provide plates possessing following additional construction features.
 - a. Device plates: Nylon. Color to match device
 - b. Device plates for surface mounted, 4 inch sq boxes: 1/2 inch stainless steel covers.
 - c. Weatherproof covers for exterior devices or devices in damp locations: Raintight while in use, UL listed, molded UV stabilized poly-carbonate with stainless steel screws and mounting gaskets. Tay Mac Corporation safety outlet enclosure, or equal.

PART 3 EXECUTION

3.01 INSTALLATION:

- A. Install wiring devices and accessories as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.

WIRING DEVICES	26 14 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

- B. Coordinate with other Work, including painting, electrical boxes and wiring installations, as necessary to interface installation of wiring devices with other Work.
- C. Install wiring devices only in electrical boxes that are clean; free from building materials, dirt and debris.
- D. Mounting Heights: Unless otherwise indicated or directed, boxes for wiring devices shall be mounted so that the centerline of the device is at the following height above finished floor (AFF) or above finished grade (AFG).

DEVICE	FINISHED AREAS	UNFINISHED AREAS
Snap switches	48"	48"
Convenience Receptacles	18"	18"

- E. Install wiring devices after wiring work is completed.
- F. Install wall plates after painting work is completed.
- G. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A. Use properly scaled torque indicating hand tool.
- H. Do not use terminals on wiring devices (hot or neutral) for feed-through connections, looped or otherwise. Make circuit connections via wire connectors and pigtails.
- I. Ground receptacles with insulated green ground wire from device ground screw to bolted outlet box connection.

3.02 PROTECTION:

- A. Protect installed components from damage. Replace damaged items prior to final acceptance.

3.03 FIELD QUALITY CONTROL:

- A. Testing: Prior to energizing circuits, test wiring for electrical continuity and for short circuits. Ensure proper polarity of connections is maintained. Subsequent to energizing, test wiring devices and demonstrate compliance with requirements, operating each operable device at least six (6) times.
- B. Test receptacles with Hubbell 5200, Woodhead 1750 or equal for correct polarity, proper ground connection and wiring faults.

WIRING DEVICES	26 14 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

- C. Test ground fault interrupter operation with both local and remote fault simulations in accordance with manufacturer's recommendations.

END OF SECTION 26 14 00

WIRING DEVICES	26 14 00 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

26 24 16 PANELBOARDS

PART 1 GENERAL

1.01 SCOPE:

- A. Furnish and install panelboards as specified herein and as indicated on the drawings.
- B. Panelboard types included in this Section are:
 - 1. Power distribution panelboards
 - 2. Lighting and appliance panelboards

1.02 REFERENCES:

- A. National Electrical Contractors Association (NECA)
 - 1. Standard of Installation
- B. National Electrical Manufacturers Association (NEMA)
 - 1. AB 1 Molded Case Circuit Breakers
 - 2. PB 1 Panelboards
 - 3. PB1.1 General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- C. Underwriters Laboratories Inc. (UL)
 - 1. 50 Cabinets and Boxes
 - 2. 67 Panelboards

1.03 SUBMITTALS - FOR APPROVAL:

- A. Procedure: Submit in accordance with Section 013000, 26 01 00, and as stated herein.
- B. Product Data:
 - 1. Descriptive bulletins
 - 2. Enclosure outline drawing with complete dimensions
 - 3. Breaker layout drawing
 - 4. Component list
 - 5. Conduit entry/exit locations
 - 6. Assembly ratings including:
 - a. Short circuit current
 - b. Voltage
 - c. Continuous current
 - 7. Cable terminal sizes.
 - 8. Installation Instructions

1.04 SUBMITTALS – RECORD DATA:

- A. Procedure: Submit in accordance with Section 013000.
- B. The following information shall be submitted for record purposes:
 - 1. Final (as-built) drawings and information for items listed in Paragraph 1.03
 - 2. Installation, operation and maintenance instruction
 - 3. Spare parts list

1.05 QUALIFICATIONS:

- A. The manufacturer of the panelboard shall be the manufacturer of the major components within the assembly, including circuit breakers.
- B. For the equipment specified herein, the manufacturer shall be ISO 9000, 9001 or 9002 certified.

1.06 DELIVERY, STORAGE, AND HANDLING:

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS:

- A. Cutler-Hammer
- B. Square D
- C. Siemens
- D. ABB

2.02 RATINGS:

- A. Panelboards rated 240 Vac or less shall have short circuit ratings as indicated on the drawings or as herein scheduled, but not less than 10,000 amperes RMS symmetrical.
- B. Panelboards rated 480 Vac shall have short circuit ratings as indicated on the drawings or as herein scheduled, but not less than 14,000 amperes RMS symmetrical.
- C. Panelboards shall be labeled with a UL short circuit rating. All panelboards shall be fully rated. Series ratings shall not be used.

2.03 CONSTRUCTION:

- A. Interiors shall be completely factory assembled devices. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.
- B. Trims for lighting and appliance panelboards shall be supplied with a hinged door covering all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Doors shall have a semiflush, cylinder lock and catch assembly. Doors over 48 inches in height shall have auxiliary fasteners.
- C. Distribution panelboard trims shall cover all live parts. Switching device handles shall be accessible.
- D. Surface trims shall be same height and width as box. Flush trims shall overlap the box by 3/4 inch on all sides. Trims shall be secured to box with concealed clamps.
- E. A directory card with a clear plastic cover shall be supplied and mounted on the inside of each door in a metal frame.
- F. All locks shall be keyed alike.

2.04 BUS:

- A. Main bus bars shall be tin-plated copper, sized in accordance with UL standards to limit temperature rise on any current carrying part to a maximum of 65° C above an ambient of 40° C maximum.
- B. A bolted ground bus shall be included in all panels.
- C. Full-size (100%-rated) insulated neutral bars shall be included for panelboards indicated to have a neutral bus. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection. 200%-rated neutrals shall be supplied for panels designated on drawings with oversized neutral conductors.

2.05 DISTRIBUTION PANELBOARDS:

- A. Distribution panelboards including circuit breakers contained therein shall have fully rated interrupting ratings as indicated on the drawings. Panelboards shall have bolt-on, molded case circuit breakers as indicated below.
- B. Molded case circuit breakers shall provide circuit overcurrent protection with inverse time and instantaneous tripping characteristics. Ground fault protection shall be provided where indicated.
- C. Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break, over-center switching mechanism that is mechanically trip-free. Automatic

tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be non-welding silver alloy and arc extinction shall be accomplished by means of arc chutes. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.

- D. Where indicated, circuit breakers shall be current limiting.
- E. Circuit breakers below 600-ampere shall have thermal-magnetic trip units and inverse time-current characteristics.
- F. Circuit breakers 600-ampere through 1200-ampere shall be provided with microprocessor-based RMS sensing trip units.
 - 1. Each molded case circuit breaker microprocessor-based tripping system shall consist of three (3) current sensors, a trip unit, and a flux-transfer shunt trip. The trip unit shall use microprocessor-based technology to provide the adjustable time-current protection functions. True RMS sensing circuit protection shall be achieved by analyzing the secondary current signals received from the circuit breaker current sensors and initiating trip signals to the circuit breaker trip actuators when predetermined trip levels and time delay settings are reached.
 - 2. Interchangeable rating plugs shall establish the continuous trip ratings of each circuit breaker. Rating plugs shall be fixed or adjustable as indicated. Rating plugs shall be interlocked so they are not interchangeable between frames, and interlocked such that a breaker cannot be closed and latched with the rating plug removed.
 - 3. The microprocessor-based trip unit shall have thermal memory capabilities to prevent the breaker from being reset following an overload condition until after a preset time delay.
 - 4. When the adjustable instantaneous setting is omitted, the trip unit shall be provided with an instantaneous override. Internal ground fault protection adjustable pick-up ratings shall not exceed 1200 amperes. Provide neutral ground fault current sensor for four-wire loads.
 - 5. Breakers shall have built-in test points for testing the long-time delay, instantaneous, and ground fault functions of the breaker, by means of a 120-volt operated test set. Provide one test set capable of testing all breakers 600-ampere and above.
 - 6. System coordination shall be provided by the following microprocessor-based, time-current curve shaping adjustments:
 - Adjustable long-time pick-up
 - Adjustable short-time pick-up and delay, with selective curve shaping
 - Adjustable instantaneous pick-up
 - Adjustable ground fault pick-up and delay, with selective curve shaping.

- G. Where indicated, provide circuit breakers UL listed for application at 100% of their continuous ampere rating in their intended enclosure.
- H. Provide shunt trips, bell alarms, and auxiliary switches as indicated on the drawings.
- I. Circuit breakers supplying air conditioning branch circuits shall be UL listed as type HACR.

2.06 LIGHTING AND APPLIANCE PANELBOARDS:

- A. The minimum integrated short circuit rating for branch circuit panelboards shall be indicated on the drawings.
- B. Bolt-in type, heavy-duty, quick-make, quick-break, single- and multi-pole circuit breakers of the types specified herein, shall be provided for each circuit with toggle handles that indicate when unit has tripped.
- C. Circuit breakers shall be thermal magnetic type with common type handle for all multiple pole circuit breakers. Circuit breakers shall be minimum 100-ampere frame and through 100-ampere trip sizes shall take up the same pole spacing. Circuit breakers shall be UL listed as type SWD for lighting circuits and HACR for air conditioning branch circuits.
 - 1. Circuit breaker handle locks shall be provided for all circuits that supply exit signs, emergency lights, energy management and control system (EMCS) panels and fire alarm panels.

2.07 ENCLOSURE:

- A. General: Enclosures shall be at least 20 inches wide and made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided. Enclosures shall be provided with blank ends.
- B. Rating: Indoor enclosures -NEMA type 1 enclosures except where other enclosure requirements are indicated. Outdoor enclosures - NEMA type 3R Stainless Steel enclosures except where other enclosure requirements are indicated.

2.08 FINISH:

- A. Surfaces of the trim assembly shall be properly cleaned, primed, and a finish coat of the manufacturers standard paint color shall be applied.

2.09 MISCELLANEOUS DEVICES

- A. Provide TVSS system integral to distribution panelboards and appliance panelboards where indicated on drawings. Reference section 266710 for specifications on TVSS units.

PART 3 EXECUTION

3.01 EXAMINATION:

- A. Confirm installation space and clearance requirements for panelboards in accordance with NEC requirements.

3.02 INSTALLATION:

- A. General: Install panelboards as indicated on the drawings and in accordance with manufacturer's published instructions, NEMA PB 1.1, and NECA "Standard of Installation".
- B. Mounting Heights: Top of trim 6 feet 2 inches above finished floor, except as otherwise indicated.
- C. Mounting:
1. Plumb and rigid without distortion of box.
 2. Mount flush panels uniformly flush with wall finish.
- D. Circuit Directory: Typed directory indicating final circuit connections. Obtain approval before installing.
- E. Install filler plates in unused breaker spaces.
- F. Provisions for Future Circuits at Flush Panelboards:
1. Stub four 1-inch empty conduits from panel into accessible ceiling space or space designated to be ceiling space in future.
 2. Stub four 1-inch empty conduits into raised floor space or below slab other than slabs on grade.
- G. Wiring in Panel Gutters: Train conductors neatly in groups, bundle, and wrap with wire ties after completion of load balancing.

3.03 IDENTIFICATION:

- A. Identify field-installed wiring and components and provide unit nameplate in accordance with Section 26 07 50.
- B. Provided one (1) 8-1/2"x11" stainless steel nameplate engraved with one-line diagram and year installed. One-line diagram shall include panel voltages, amps, AIC ratings, and feeder sizes. Nameplate shall be mounted to the exterior door of the main distribution panel.

3.04 GROUNDING:

- A. Connections: Make equipment grounding connections for panelboards as required in Section 260600.
- B. Provide ground continuity to main electrical ground bus.
- C. Provide isolated ground bars for panels serving sensitive electronic equipment and as indicated on panel schedules.

3.05 CONNECTIONS:

- A. Tighten electrical connectors and terminals, including grounding connections, in accordance with manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A.

3.06 FIELD TESTING:

- A. Inspect for compliance with drawings and specifications.
- B. Inspect for defects, damaged or missing parts.
- C. Operate each breaker a minimum of three (3) times to insure proper operation.
- D. Perform insulation resistance test on complete assembly at 1000 Vdc. Disconnect any solid-state devices prior to testing. Minimum acceptable test results are 100 megohms.

3.07 CLEANING:

- A. Upon completion of installation, inspect interior and exterior of panelboards.
- B. Remove paint splatters and other spots, dirt, and debris.
- C. Touch up scratches and mars of finish to match original finish.
- D. Clean interior of panelboard.

3.08 FIELD ADJUSTMENTS:

- A. Balancing Loads: Prior to final acceptance, conduct load-balancing measurements and circuit changes as follows:
 - 1. Perform measurements during period of normal working load as advised by Owner.
 - 2. Advise Engineer of load imbalances exceeding 20% or of loads exceeding 80% of circuit ratings. Reconnect branch circuit loads as directed by Engineer.

3. Perform load-balancing circuit changes outside the normal occupancy/working schedule of the facility. Make special arrangements with Owner to avoid disrupting critical circuits.
4. Recheck loads after circuit changes during normal load period. Record load readings before and after changes and submit test records.

END OF SECTION 26 24 16

SECTION 26 43 13 SURGE PROTECTION DEVICES

PART 1 - GENERAL

1.1 SCOPE

- A. This section describes the materials and installation requirements for surge protective devices (SPD) for the protection of all AC electrical circuits.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Other sections that may relate to the work in this section include, but are not limited to, the following:
 - 1. Section 26 24 13.11 – Switchboards
 - 2. Section 26 24 16 – Low-Voltage Panelboards

1.3 SUBMITTALS

- A. Submit shop drawings and product information for approval and final documentation in the quantities listed according to the Conditions of the Contract. All transmittals shall be identified by customer name, customer location, and customer order number.
- B. Submittals shall include UL 1449 4th Edition Listing documentation verifiable by visiting www.UL.com, clicking “Certifications” link, searching using UL Category Code: VZCA.
 - 1. Short Circuit Current Rating (SCCR)
 - 2. Voltage Protection Ratings (VPRs) for all modes
 - 3. Maximum Continuous Operating Voltage rating (MCOV)
 - 4. I-nominal rating (I-n)
 - 5. SPD shall be Type 1 UL listed and labeled
- C. Upon request, an unencapsulated but complete SPD formally known as TVSS shall be presented for visual inspection.
- D. Minimum of ten (10) year warranty

1.4 RELATED STANDARDS

- A. IEEE C62.41.1, IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits,
- B. IEEE C62.41.2, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits,
- C. IEEE C62.45, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits.
- D. National Electrical Code: Article 285
- E. UL 1283 - Electromagnetic Interference Filters
- F. UL 1449, Fourth Edition – Surge Protective Devices

1.5 LISTING REQUIREMENTS

SURGE PROTECTION DEVICES	26 43 13 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

- A. SPD shall bear the UL Mark and shall be Listed to most recent editions of UL 1449 and UL 1283. "Manufactured in accordance with" is not equivalent to UL listing and does not meet the intent of this specification.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engage a firm with at least ten (10) years experience in manufacturing transient voltage surge suppressors.
- B. Manufacturer shall be ISO 9001 or 9002 certified.
- C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (10) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- D. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Handle and store equipment in accordance with manufacturer's Installation and Maintenance Manuals. One (1) copy of this document to be provided with the equipment at time of shipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide an externally mounted transient voltage suppressors by Siemens or pre-approved equal. Approved manufacturers are as follows:
 1. ABB
 2. ADP
 3. THOR
 4. Eaton
 5. Schneider

2.2 SURGE PROTECTIVE DEVICE FEATURES

- A. SPD shall be UL 1449 listed and labeled with 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.
- B. SPD shall be UL 1449 labeled as Type 1 intended for use without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal over-temperature controls. SPDs relying upon external or supplementary installed safety disconnects do not meet the intent of this specification.
- C. SPD shall be UL 1449 labeled with 20kA I-nominal (I-n) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.
- D. Suppression components shall be heavy duty 'large block' MOVs, each exceeding 30mm diameter.

SURGE PROTECTION DEVICES	26 43 13 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

- E. Standard 7 Mode Protection paths: SPD shall provide surge current paths for all modes of protection: L-N, L-G, L-L, and N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems.
- F. If a dedicated breaker for the SPD is not provided in the switchboard, the service entrance SPD shall include an integral UL Recognized disconnect switch. A dedicated breaker shall serve as a means of disconnect for distribution SPD's.
- G. SPD shall meet or exceed the following criteria:
1. Minimum surge current capability (single pulse rated) per phase shall be:
 - a. Service Entrance applications:
 - 1.) Siemens Model TPS3 12 with Maximum 7-Mode surge current capability shall be 250kA per phase.
 - b. Distribution applications:
 - 1.) Siemens Model TPS3 09 with Maximum surge current capability of 100kA per phase
 2. UL 1449 Listed Voltage Protection Ratings (VPRs) shall not exceed the following:

<u>VOLTAGE</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>
208Y/120V	700V	700V	700V
480Y/277V	1500V	1500V	1500 V

- I. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) for L-N, L-G, and N-G modes of protection (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
208Y/120	25%	150V
480Y/277V	20%	320V

- J. Service Entrance SPD shall be complimentary UL 1283 listed for EMI/RFI filtering with minimum attenuation of -50dB at 100kHz.
- K. SPD shall have a warranty for a period of ten (10) years, incorporating unlimited replacements of suppressor parts if they are destroyed by transients during the warranty period.
- L. Service Entrance SPDs shall be equipped with the following diagnostics:
1. Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
 2. Audible alarm with on/off silence function and diagnostic test function (excluding branch).
 3. Form C dry contacts
 4. Optional – Surge Counter
 5. No other test equipment shall be required for SPD monitoring or testing before or after installation.
- M. Distribution Panels SPDs shall be equipped with the following diagnostics:
1. Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
 2. Audible Alarm & Dry Contacts
 3. No other test equipment shall be required for SPD monitoring or testing before or after installation.

SURGE PROTECTION DEVICES	26 43 13 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

PART 3 - EXECUTION

3.2 INSTALLATION

- I. The installation shall meet the following criteria:
1. Install per manufacturer's recommendations and contract documents.
 2. Install units plumb, level and rigid without distortion
 3. One primary suppressor shall be installed external to the service entrance in accordance with manufacturer instructions.
 4. Service Entrance SPD shall be installed on the line or load side of the main service disconnect.
 5. Service Entrance SPD ground shall be bonded to the service entrance ground.
 6. At Service Entrance or Transfer Switch, a UL approved disconnect switch shall be provided as a means of servicing disconnect if a 60A breaker is not available.
 7. One SPD shall be installed external to each designated distribution panelboard.
 8. At Distribution, MCC and Branch, SPD shall have an independent means of servicing disconnect such that the protected panel remains energized. A 30A breaker (or larger) may serve this function.
 9. SPD shall be installed per manufacturer's installation instructions with lead lengths as short (less than 24") and straight as possible. Gently twist conductors together.
 10. Installer may reasonably rearrange breaker locations to ensure short & straightest possible leads to SPDs.
 11. Before energizing, installer shall verify service and separately derived system Neutral to Ground bonding jumpers per NEC.

3.3 ADJUSTMENTS AND CLEANING

- A. Remove debris from SPD and wipe dust and dirt from all components.
- B. Repaint marred and scratched surface with touch up paint to match original finish.

3.4 TESTING

- A. Check tightness of all accessible mechanical and electrical connections to assure they are torqued to the minimum acceptable manufacture's recommendations.
- B. Check all installed panels for proper grounding, fastening and alignment.

3.5 WARRANTY

- A. Equipment manufacturer warrants that all goods supplied are free of non-conformities in workmanship and materials for one year from date of initial operations, but not more than eighteen months from date of shipment.

END OF SECTION 26 43 13

SURGE PROTECTION DEVICES	26 43 13 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 26 44 10 DISCONNECT SWITCHES

PART 1 GENERAL

1.01 SCOPE

- A. The Contractor shall furnish and install the low-voltage fused and non-fused switches as specified herein and as shown on the contract drawings.

1.02 RELATED SECTIONS

1.03 REFERENCES

- A. The switches and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of NEMA and UL.

1.04 SUBMITTALS -- FOR REVIEW/APPROVAL

- A. Procedure: Submit in accordance with Section 013000, 260100, and as stated herein.
- B. The following information shall be submitted to the Engineer:
 - 1. Master drawing index
 - 2. Dimensioned outline drawing
 - 3. Conduit entry/exit locations
 - 4. Switch ratings including:
 - a. Short-circuit rating
 - b. Voltage
 - c. Continuous current
 - 5. Fuse ratings and type
 - 6. Cable terminal sizes.

1.05 SUBMITTALS -- FOR INFORMATION

- A. When requested by the Engineer the following product information shall be submitted:
 - 1. Descriptive bulletins
 - 2. Product sheets.

1.06 SUBMITTALS--FOR CLOSEOUT

- A. The following information shall be submitted for record purposes:

DISCONNECT SWITCHES	26 44 10 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

1. Final as-built drawings and information for items listed in section 1.04

1.07 QUALIFICATIONS

- A. For the equipment specified herein, the manufacturer shall be ISO 9000, 9001 or 9002 certified.

1.08 NOT USED

1.09 DELIVERY, STORAGE AND HANDLING

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

A. FIELD MEASUREMENTS

- A. Contractor shall field verify all dimensions prior to installation. Installation of all switches shall comply with the National Electric Codes clearance and mounting height requirements.

B. OPERATION AND MAINTENANCE MANUALS

- A. Three (3) copies of these instruction manuals shall be submitted with the closeout documents listed in section 1.06.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Square D
- B. ABB
- C. Siemens
- D. Eaton

2.02 DISCONNECT SWITCHES

- A. Provide switches as shown on drawings, with the following ratings:
- 1. 30 to 1200 amperes
 - 2. 250 volts AC, DC; 600 volts AC (30A to 200A 600 volts DC)
 - 3. 2, 3, 4, and 6 poles
 - 4. Non-Fusible and Fusible
 - 5. Copper/aluminum standard mechanical lugs.

DISCONNECT SWITCHES	26 44 10 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

B. Construction

1. Switchblades and jaws shall be plated copper.
2. Switches shall have a handle that is easily pad lockable in the OFF position.
3. Switches shall have defeat-able door interlocks that prevent the door from opening when the handle is in the ON position.
4. Switch assembly and operating handle shall be an integral part of the enclosure base.
5. Fusible switches rated 100A to 1200A shall have reinforced fuse clips.
6. Switch blades shall be readily visible in the OFF position.
7. Switch operating mechanism shall be non-teasible, positive quick-make/quick-break type (except 30A plug fuse-type).
8. Fusible switches shall be suitable for service entrance equipment.
9. Switches shall have line terminal shields.
10. All exterior switches shall be heavy-duty type.
11. All interior switches shall be general-duty type unless otherwise noted.

C. Enclosures

- A. Exterior: All enclosures shall be NEMA 3R Stainless Steel rainproof unless otherwise noted.
- B. Interior: All enclosures shall be NEMA 1 unless otherwise noted.

D. Fuses

1. Fuses shall be dual element, current limiting type such as Bussmann Low-Peak Yellow or equal.

2.04 NAMEPLATES

- A. Manufacturers nameplates shall be front cover mounted, contain a permanent record of switch type, ampere rating, and maximum voltage rating.

PART 3 EXECUTION

3.01 EXAMINATION

- A. All switches shall be cleaned free of debris after installation and prior to final acceptance by the owner. Remove all miscellaneous paint markings, grease and tar.

3.02 FACTORY TESTING

DISCONNECT SWITCHES	26 44 10 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.

3.03 INSTALLATION

- A. The equipment shall be installed per the manufacturer's recommendations.

END OF SECTION 26 44 10

DISCONNECT SWITCHES	26 44 10 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 26 51 00 LUMINAIRES

PART I GENERAL

1.01 SUMMARY:

A. Section Includes:

1. Lighting fixtures
2. Lamps
3. Ballasts
4. Emergency lighting units

1.02 REFERENCES:

A. American National Standards Institute (ANSI):

1. C78 Series Lamps
2. C82.1-97 Electric Lamp Ballast - Line Frequency Fluorescent Lamp Ballast
3. C82.2-84 Fluorescent Lamp Ballasts - Methods of Measurements
4. C82.4-92 Ballasts for High Intensity Discharge and Low-Pressure Sodium Lamps (Multiple Supply Type)
5. C82.11-93 High Frequency Fluorescent Lamp Ballasts

B. Institute of Electrical and Electronics Engineers (IEEE):

1. C62.11-93 IEEE Recommended Practice on Metal Oxide Surge Arresters for Alternating Current Power Circuits

C. National Fire Protection Association (NFPA):

1. 70 National Electrical Code

D. Underwriters Laboratories Inc. (UL):

1. 844-95 Electric Lighting Fixtures for Use in Hazardous (Classified) Locations
2. 924-95 Emergency Lighting and Power Equipment
3. 935-95 Fluorescent Lamp Ballast
4. 1029-94 High Intensity Discharge Lamp Ballasts
5. 1570-95 Fluorescent Lighting Fixtures
6. 1571-95 Incandescent Lighting Fixtures
7. 1572-97 High Intensity Discharge Lighting Fixtures

1.03 DEFINITIONS:

LUMINAIRES	26 51 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

- A. Emergency Lighting Unit: Fixture with integral emergency battery power supply and means for controlling and charging battery. Emergency units are available with integral lamps only.
- B. Fixture: Complete lighting unit, exit sign, or emergency lighting unit. Fixtures include lamps and parts required to distribute light, position and protect lamps, and connect lamps to power supply. Internal battery powered exit signs and emergency lighting units also include battery and means for controlling and recharging battery. Emergency lighting units are available with and without integral lamp heads and lamps.
- C. Luminaire: Fixture.
- D. Average Life: Time after which 50% will have failed and 50% will have survived under normal conditions.
- E. Total Harmonic Distortion (THD): The root mean square (RMS) of all the harmonic current components divided by total fundamental (60 hz) current.

1.04 SUBMITTALS:

- A. Procedures: Submit in accordance with Section 01300, 16010, and as stated herein.
- B. Product Data:
 - 1. Describe fixtures, lamps, ballasts, and emergency lighting units. Arrange product data for fixtures in order of fixture designation. Include data on features and accessories and the following information:
 - a. Outline drawings of fixtures indicating dimensions and principal features.
 - b. Electrical ratings and photometric data with specified lamps and certified results of independent laboratory tests.
 - c. Data on batteries and chargers of emergency lighting units.
- C. Shop Drawings:
 - 1. Detail nonstandard fixtures indicating dimensions, weights, methods of field assembly, components, features, and accessories.
- D. Supplies:
 - 1. Submit sample of fixture if different than specified.
- E. Miscellaneous:

LUMINAIRES	26 51 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

1. Warranty for rechargeable battery.
2. Coordination drawings for fixtures that require coordination with other equipment installed in the same space.

F. Substitutions to Specified Product

1. Prior approval requests will include the following :
 - a. Full submittal data, by type, clearly highlighted and arrowed to identify the specific proposed manufacturer's nomenclature
 - b. Full submittal data of lamps of proposed manufacturer
 - c. Full submittal data of ballast/driver (LED) data of proposed manufacturer
 - d. LED lumen data shall include:
 - i. Lumen output
 - ii. L70 and L90 testing
 - iii. Confirmation of independent test lab data ITL
 - iv. Color temperature and CRI with quantity of McAdam Ellipse steps
 - v. Data shall include sphere and goniometer results for total lumen, total power, luminaire efficacy, CRI and junction temperature for the specified color temperature
 - vi. Make and brand of LED diode should be clearly identified on submittal data
 - vii. LED dimming shall be equal in range and quality to the specified drivers, Quality of dimming to be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experience in a commercial environment.
 - viii. All substitutions must meet specified fixtures certifications (UL,ETL,CE,CSA,RoHS,DLC, Energy Star)
2. Provide lighting calculations with the prior approval request based on reflectance values and light loss factors provided by the engineer and displayed on lighting calculation drawings. (may be unique by area) Calculations shall be shown on one sheet with dimensions as shown on construction set. Data will be submitted electronically in dxf format on a flash drive and with printed calculations on Architectural E size sheets to scale with construction set sheets.
 - a. Discrepancies between prior approval data calculations and the original design calculations will result in immediate disqualification of review due to time based constraints on the bid process

LUMINAIRES	26 51 00 - 3
24214 - COPA New Lifeguard Facility	5-15-2025

3. Prior approval request may require a sample of both the proposed and specified fixtures provided by the alternate manufacturer at NO additional cost to the project. Samples of both specified and proposed must be provided within 10 working days of request.
4. Energy calculations (Comcheck) must be provided with specification sheets including lamp and ballast data supporting input wattages highlighted in yellow and clearly identified by type. Input voltages must coincide with panel schedules. This data will be submitted under separate cover with the prior approval request
5. All data will be submitted electronically and in a bound format
 - a. Bound data will be secured in hard binder with 3" rings for ease of review.
 - b. Types will be marked with a tab by type and indexed for ease of reference
6. LED warranty information MUST be included by type and marked in RED to clearly identify the manufacturer's warranty terms. Warranty data MUST meet or exceed the specified manufacturers terms
7. Prior approvals MUST be received and acknowledged to the specifiers office no less than 15 days prior to bid.
8. ALL prior approval data must be submitted in one package with complete information. Information that is incomplete will be rejected without review.
9. The prior approval will be returned marked approved or rejected by type with no explanation. If any specification is deemed not equal the review will be stopped and the type rejected with no explanation.
10. Lumen output for the proposed fixture must be highlighted in yellow for clear identification
11. All inverter systems that supply power to LED fixtures must have pure PWM sine wave function and work with any type of lighting load.

1.05 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver lighting fixtures in factory-fabricated containers or wrappings, which properly protect fixtures from damage.
- B. Store lighting fixtures in original packaging. Store inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity; laid flat and blocked off ground.

LUMINAIRES	26 51 00 - 4
24214 - COPA New Lifeguard Facility	5-15-2025

- C. Handle lighting fixtures carefully to prevent damage, breaking, and scarring of finishes. Do not install damaged units or components; replace with new.

1.06 QUALITY ASSURANCE:

- A. Items provided under this section shall be listed and labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).
 - 1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
 - 2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.
- B. Regulatory Requirements:
 - 1. National Electrical Code: Components and installation shall comply with NFPA 70.
- C. Coordinate fixtures mounting hardware and trim with ceiling system.

PART 2 PRODUCTS

2.01 FIXTURES, GENERAL:

- A. Comply with requirements specified in Paragraphs below and lighting fixture schedule.

2.02 FIXTURE COMPONENTS, GENERAL:

- A. Metal Parts: Free from burrs, sharp corners and edges.
- B. Sheet Metal Components: Steel, except as indicated. Form and support components to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating and free from light leakage under operating conditions. Arrange to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers and other pieces to prevent accidental falling during relamping and when secured in operating position.
- D. Reflecting Surfaces: Minimum reflectances as follows, except as otherwise indicated:
 - 1. White Surfaces: 85%
 - 2. Specular Surfaces: 83%
 - 3. Diffusing Specular Surfaces: 75%
 - 4. Laminated Silver Metallized Film: 90%
- E. Lenses, Diffusers, Covers, and Globes: 100% virgin acrylic plastic or water white, annealed crystal glass except as indicated.

LUMINAIRES	26 51 00 - 5
24214 - COPA New Lifeguard Facility	5-15-2025

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat and UV radiation.
2. Lens Thickness: 0.125 inch, minimum.

2.03 SUSPENDED FIXTURE SUPPORT COMPONENTS:

- A. Single-Stem Hangers: ½-inch steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.
- B. Twin-Stem Hangers: Two, ½-inch steel tubes with single canopy arranged to mount single fixture. Finish same as fixture.
- C. Rod Hangers: ¼-inch diameter cadmium plated, threaded steel rod.
- D. Hook Hanger: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord and locking-type plug.

2.04 LED LIGHTING FIXTURES AND LED LAMPS

- A. All LED products must be UL, ETL and/or CSA listed
- B. All LED products must have LM-79 and LM-80 testing noted on specification sheet by an independent test lab
 1. See note P this section
- C. All LED products should be identified as L70 and/or L90 ratings based on independent test lab data
- D. All outdoor pole mounted products must have surge suppression within each fixture.
 1. See note P this section
- E. All outdoor and wet location listed products must clearly state the IP rating carried on the fixture based on independent test lab data
- F. All LED products must be serviceable for accessible for field repair needs
- G. All outdoor lighting color rendering should be within a 7 step McAdams Ellipse. All outdoor lighting should be 4000 kelvin unless specifically noted
 1. See note P this section

LUMINAIRES	26 51 00 - 6
24214 - COPA New Lifeguard Facility	5-15-2025

- H. All indoor lighting color rendering should be within a 3 step McAdams ellipse. All indoor lighting should be 4000-4100 kelvin unless specifically noted
 - 1. See note P this section
- I. All control systems that interface with an LED product will be supported by a project “integrator” until project completion. This includes contact with the installer prior to installation, availability during installation, and final checkout and startup after installation. The quantity of days required for startup will be based on the manufacturer/agents discretion and need.
 - 1. The project integrator must be capable of performing low voltage and dmx terminations. High voltage terminations are performed solely by the electrical subcontractor.
 - 2. Reporting of final startup completion of the controls system back to the engineer is mandantory.
- J. Invitation to attend the training with the owners representative should be made to the engineer no less than 5 days prior to training
- K. Signature confirmation of training and startup is required within 5 business days after completion back to the engineers office.
 - 1. A follow up call will be made to the owner 30-45 days after the startup and training of the controls system by the manufacturers representative to ensure all systems are operating to design specification. A 3 hour onsite system fine tuning at no additional cost to the owner is inclusive if requested by the owner at that time for additional training and programming.
- L. All LED drivers should be capable of 0-10 volt controls and DMX control and shall dim to 1% of total lumen output . Where specifically specified the dimming driver may be required to dim to .1% of lumen output , otherwise known as “dim to dark”
- M. Driver manufacturers must have a 5 year history producing dimmable electronic LED drivers for the North American market.
- N. Ambient driver tiemperatures must be within -20 degrees to 50 degrees C (-4 degrees to 122 degrees F)
- O. Driver must limit inrush current.
 - 1. Base specification: meet or exceed NEMA 410 driver inrush standard of 430 amp per 10 amps load with a maximum of 370 amps/2 seconds

LUMINAIRES	26 51 00 - 7
24214 - COPA New Lifeguard Facility	5-15-2025

2. Preferred specification : Meet or exceed 30ma's at 277 VAC for up to 50 watts of load and 75A at 240us att 277 VAC for 100 watts of load
3. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A
4. No visible change in light output with a variation of plus/minus 10% line voltage input.
5. Total harmonic distortion less than 20%, and meet ANSI C82.11 maximum allowable THD requirements at full output. THD shall at no point in the dimming curve allow imbalance current to exceed full output THD
6. See note P this section.

P. Any exceptions are at the engineers discretion based on project needs and applicability.

2.05 FLUORESCENT FIXTURES:

- A. Fixtures: Conform to UL 1570.
- B. Ballasts: Electronic type. Conform to UL 935, ANSI C82.11 and NFPA 70.
 1. Certification: By Electrical Testing Laboratory (ETL).
 2. Labeling: By Certified Ballast Manufacturers Association (CBM).
 3. Type: Class P, 0.95 P.F. minimum.
 4. Sound Rating: "A" rating, except as indicated otherwise.
 5. Voltage: Match connected circuits.
 6. Temperature: Start and operate at minimum of 50° F.
 7. THD: 10 percent maximum.
- C. Low Temperature Ballast: Start and maintain operation at a minimum of 0° F.
- D. T-8 Lamp Ballasts: Full-light output type, compatible with energy-saving lamps. Following are required average input wattages when tested according to ANSI C82.2.
 1. 39 or less when operating one F32T8 lamp.
 2. 62 or less when operating two F32T8 lamps.
 3. 95 or less when operating three F32T8 lamps.
 4. 114 or less when operating four F32T8 lamps.
- E. Recessed fluorescent fixtures shall have 100% acrylic prismatic lenses with a minimum thickness of 0.125 inch unless otherwise indicated.

2.06 HIGH INTENSITY DISCHARGE (HID) FIXTURES:

- A. Fixtures: Conform to UL 1572.

LUMINAIRES	26 51 00 - 8
24214 - COPA New Lifeguard Facility	5-15-2025

- B. Ballasts: Conform to UL 1029 and ANSI C82.4. Provide ballasts with following features, except as otherwise indicated.
 - 1. Constant wattage autotransformer (CWA) or regulator, high-power-factor type.
 - 2. Voltage rating matches system voltage.
 - 3. Single-Lamp Ballasts: Minimum starting temperature of -30°C .
 - 4. Normal ambient operating temperature is 40°C .
 - 5. Open circuit operation will not reduce average life.
 - 6. Noise Suppression: Manufacturer's standard epoxy encapsulated model designed to minimize audible fixture noise.

2.07 INCANDESCENT FIXTURES:

- A. Conform to UL 1571.

2.08 FIXTURES FOR HAZARDOUS LOCATIONS:

- A. Conform to UL 844 or provide units that have Factory Mutual Engineering and Research Corporation (FM) certification for indicated class and division of hazard.

2.09 EXIT SIGNS:

- A. Conform to UL 924.
 - 1. Sign Colors: Conform to local code.
- B. Self-Powered Exit Signs (Battery Backup): Integral automatic high/low trickle charger in self-contained power pack.
 - 1. Battery: Sealed, maintenance-free, nickel cadmium type 1.5 hour minimum emergency run time.

2.09 EMERGENCY LIGHTING UNITS:

- A. Conform to UL 924. Provide self-contained units with features and characteristics as indicated on the drawings.

2.10 LAMPS:

- A. Conform to ANSI C78 series applicable to each type of lamp.
- B. Fluorescent Lamps: Color temperature of 3500°K .

LUMINAIRES	26 51 00 - 9
24214 - COPA New Lifeguard Facility	5-15-2025

2.11 FINISH:

- A. Steel Parts: Manufacturer's standard finish applied over corrosion-resistant primer, free of streaks, runs, holidays, stains, blisters and defects. Remove fixtures showing evidence of corrosion during project warranty period and replace with new fixtures.
- B. Other Parts: Manufacturer's standard finish.

PART 3 EXECUTION

3.01 INSTALLATION:

- A. Set units plumb, square and level with ceiling and walls, in alignment with adjacent fixtures, and secure according to manufacturer's printed instructions and approved submittals.
- B. Mounting heights specified or indicated shall be to the bottom of fixture for ceiling-mounted fixtures and to the center of fixture for wall-mounted fixtures.
- C. Obtain approval of the exact mounting for lighting fixtures on the job prior to commencing installation and, where applicable, after coordinating with the type, style and pattern of ceiling being installed.
- D. Where recessed fixtures are supported by ceiling support grid, install additional support wires near each corner of the fixture.
- E. Make branch circuit wiring connections with conductors having an insulation temperature rating suitable for the fixture.
- F. Ground and bond fixtures in accordance with Section 16060.
- G. Install lamp units according to manufacturer's instructions and fixture schedule.

3.02 FIELD QUALITY CONTROL:

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Give 7-days notice of dates and times for field tests.
- C. Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source.
- D. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation.

LUMINAIRES	26 51 00 - 10
24214 - COPA New Lifeguard Facility	5-15-2025

1. Duration of supply.
2. Low battery voltage shut-down.
3. Normal transfer to battery source and retransfer to normal.
4. Low supply voltage transfer.

E. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.03 ADJUSTING AND CLEANING:

- A. Clean fixtures upon completion of installation. Use methods and materials recommended by manufacturer.
- B. Adjust aimable fixtures to provide required light intensities.
- C. Set and adjust photocells and/or time switches for proper operation as directed by Owner.

3.04 PRE-CONSTRUCTION JOBSITE VISIT:

- A. Pre-construction On-site Services to be provided by Lighting/Controls vendor/supplier:

The project electrical contractor shall contact Lighting vendor/supplier to schedule a jobsite meeting prior to the installation of the lighting control system. Purpose of the meeting is to review submittals and installation documentation provided by the system manufacturer. Discussion should include wiring conventions and specific wiring requirements. Installation of specific devices is also to be addressed.

Prior to start-up Lighting manufactures representative shall send a field service technician to visit the jobsite to confirm progress and answer any additional questions. Start-up date is to be confirmed at the time of this visit. Training agenda shall be provided to the contractor/distributor. Contractor/distributor shall confirm with the owner's representative and specifying engineer attendance at lighting system demonstrations and for training. Contractor/distributor shall provide to field service technician programming information as required for start- up such as but not limited to zone assignments, time schedules for operation, presets for all control stations, programming sequences for dynamic LED fixtures, emergency operation, blink-warn, and system override. Programming information is required for system set-up and pre-start-up.

- B. Lighting Control System Start-up and Training

1. Prior to energizing lighting control system the following must be completed:

No component of the lighting control system shall be energized until a factory certified field service engineer has approved the installation of the system by the

LUMINAIRES	26 51 00 - 11
24214 - COPA New Lifeguard Facility	5-15-2025

project electrical contractor. The electrical contractor/distributor shall contact the Lighting vendor/supplier at least 3 weeks prior to the requested start-up date to schedule a field service technician to be at the jobsite. Request shall be in writing and shall include filled out start-up request form and dated jobsite photos of the dimmer and/or relay panels.

Lighting Control system is defined as the dimmer/relay panel(s) and all associated control stations and related accessories.

The electrical contractor is responsible to install the entire lighting control system, all power feeders, all load wiring, and control wiring. Equipment shall be installed according to the manufacturer's instructions, contract documents, and national and local codes and regulations.

Equipment shall be plumb and level to the finished floor. All components of the lighting control system shall be clean, free of dust and paint spatters. Components shall be unmarred or damaged. All cable shall be dressed, neatly routed, and labeled. All conduit shall be securely attached to the dimmer/relay panel.

Start-up services are not provided in conjunction or in association with any commissioning of lighting or other related control systems.

2. System Start-up

Each dimmer/relay shall be tested by the electrical contractor (with a multi-meter) to confirm what voltage is being passed and to confirm that no voltage is being passed when the circuit is open.

A representative of the owner shall be present to observe the testing/demonstration of the dimmer/relay panels. Each individual dimmer/relay panel shall be load tested with all circuits on while under load for a minimum of 1 hour.

Where external devices are to be attached to the dimmer/relay panel including photocell, occupancy sensor, time clock, DMX controller, and/or control stations, operation of each device should be verified at the panel and specific circuits that are programmed to be controlled by the external device(s).

Where control signals originate from the dimmer/relay panel for control of lighting fixtures, the control signal shall be tested by the electrical contractor to confirm that it is being delivered to each lighting fixture. Proper operation of the lighting fixtures shall be confirmed as part of the system testing/demonstration.

3. Training

Training shall be provided for the owner's representative and contractor. Prior to start-up the owner's representative and electrical contractor/distributor shall acknowledge receipt of training agenda. The electrical contractor/distributor shall confirm that the specifying engineer has been contacted and been invited to attend

LUMINAIRES	26 51 00 - 12
24214 - COPA New Lifeguard Facility	5-15-2025

the system demonstration and/or training. All product and lighting control system documentation and operation's manuals shall be provided by electrical contractor/distributor at the time of training.

Training is to include, but not be limited to: basic operation of lighting control system, set-up of system and control panels, operation of control stations, programming of system, basic de-bugging, and overall system testing. At completion of training session all attendees shall sign the start-up technician's field service report to confirm participation in the training session.

Completed field service report shall be submitted to the electrical contractor/distributor and specifying engineer.

3.05 Follow-up Contact Services

Approximately 90 days following the initialization of the lighting control system the Lighting/controls vendor/supplier shall contact the electrical contractor/distributor to confirm that the system is operating correctly and answer any questions that have come-up since system initialization.

3.06 Extended Follow-up Contact On-site Services

Approximately 300 days following initialization of the lighting control system the Lighting/controls vendor/supplier shall contact the owner's representative in order to schedule a job site visit. The purpose of the visit shall be to confirm that all lighting control equipment that was initialized by lighting/control vendor/supplier is fully functioning. Any equipment not functioning as originally specified shall be repaired as required.

In addition if the end user has adjustments that need to be made to programming or to any of the control of the system these shall be made during the jobsite visit. If further training on the system is required this shall be provided at the time of the visit or scheduled at a time of mutual convenience.

A completed field service report shall be submitted to the electrical contractor, specifying engineer, and the owner's representative.

END OF SECTION

LUMINAIRES	26 51 00 - 13
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 26 74 00 TELEPHONE/DATA SYSTEMS (ROUGH-IN)

PART 1 – GENERAL

1.01 GENERAL

- A. Applicable provisions of the General Conditions, Supplemental General Conditions and Special Conditions govern work under this Section.

1.02 DESCRIPTION OF WORK

- A. This section includes work required to provide a system of raceways, outlet boxes with covers, terminal boards, and grounding to accommodate the installation of the telephone/data cabling system by Owner/Owner's vendor. Note that some indicated ceilings are inaccessible and extensions of raceways to accessible ceiling areas will be required.

1.03 RELATED SECTIONS

- A. Division 26 – ELECTRICAL

1.04 REFERENCES

- A. National Electrical Code (NEC)

1.05 SYSTEM DESCRIPTION

- A. It is the intent of this Specification to provide a system of raceways and outlets to accommodate the installation of telephone and data cabling by the Owner's vendor under a separate contract. The Contract Documents indicate the location and size of the main telephone service raceway and the location of telephone/data outlets and terminal boards. Routing of raceway system between outlets and terminal points shall be determined in the field by the contractor. Design of the system is based upon the premise that the telephone/data system installer will provide UL listed low smoke producing plenum cabling conforming to NEC requirements, permitting open wiring in plenum areas above accessible ceilings.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Raceways: All raceways shall be furnished and installed in accordance with the requirements of this Section and Section 26 13 60.
- B. Outlet Cover Plates: All outlet coverplates shall be in accordance with the requirements of Section 26 14 00. Provide for unused outlet boxes.
- C. Terminal Boards: Terminal boards shall be ¾-inch type Marine grade plywood having two coats of insulating oil base exterior enamel paint applied before installation on both sides and all edges. The quantity and dimensions shall be as indicated on the drawings.
- D. Cabling: By Owner's vendor under separate contract.

TELEPHONE/DATA SYSTEMS (ROUGH-IN)	26 74 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

E. Jacks: By Owner's vendor under separate contract.

PART 3 – EXECUTION

3.01 CONSTRUCTION

- A. Install terminal boards straight and level at locations indicated on drawings. Attach to masonry walls using expansion anchors, to CMU walls using toggle bolts, and to sheetrock and plaster walls using wood or sheet metal lag bolts fastened into the wall supporting the structure. The use of toggle bolts in sheetrock and plaster walls is not acceptable. Install anchors at a maximum of 24-inches on center at the perimeter of each board.
- B. At the main terminal board, stub-up the service entrance conduits at one end of the board within 3 inches of the supporting wall.
- C. Service entrance conduits shall be rigid galvanized steel or PVC encased in concrete with steel reinforced where it passes through the foundation and for at least 5' beyond the building line.
- D. Unless otherwise indicated, distribution raceways shall be electrical metallic tubing, except the PVC Schedule 40 may be used where raceway is buried in concrete slabs, columns, or beams. Provide insulating bushings at the ends of all raceways.
- E. The conduit size for each outlet shall be 1-1/4 inch minimum.
- F. Boxes shall be steel having the minimum dimensions of 4-11/16"x4-11/16"x2-1/8".
- G. Provide conduit from each outlet location to an accessible location above a lay-in type ceiling. Terminate conduit with bushing.
- H. Provide raceways sufficient to accommodate telephone cabling where passing through mechanical and electrical equipment rooms, pipe chases, mechanical chases, areas without ceilings (exposed structure), and nonaccessible areas such as ceiling plenums and crawl spaces.
- I. Provide 3/4-inch conduit with #6 AWG bare copper ground wire from main terminal location and bond to building grounding system as indicated on drawings.
- J. Contact local telephone company to coordinate the exact telephone service entrance location and requirements prior to installing the telephone service raceways.
- K. Refer to construction drawings for additional requirements.

END OF SECTION 26 74 00

TELEPHONE/DATA SYSTEMS (ROUGH-IN)	26 74 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

SECTION 26 75 00 CABLE TELEVISION SYSTEM (ROUGH-IN)

PART 1 – GENERAL

1.01 GENERAL

- A. Applicable provisions of the General Conditions, Supplemental General Conditions and Special Conditions govern work under this Section.

1.02 DESCRIPTION OF WORK

- A. This section includes work required to provide a system of raceways, outlet boxes and grounding of a cable TV system. Note that some indicated ceilings are inaccessible and extensions of raceways to accessible ceiling areas will be required.

1.03 RELATED SECTIONS

- A. Division 26 – ELECTRICAL

1.04 REFERENCES

- A. National Electrical Code (NEC)

1.05 SYSTEM DESCRIPTION

- A. It is the intent of this Specification to provide a system of raceways, outlet boxes and grounding to accommodate a CATV system by the Owner's vendor under a separate contract. The Contract Documents indicate the location and size of the main Cable service raceway and the location of TV outlets. Routing of raceway system between outlets and terminal points shall be determined in the field by the contractor. Design of the system is based upon the premise that the cable TV system installer will provide UL listed low smoke producing plenum cabling conforming to NEC requirements, permitting open wiring in plenum areas above accessible ceilings.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Raceways: All raceways shall be furnished and installed in accordance with the requirements of this Section and Section 261360.
- B. Outlet Cover Plates: Provide outlet cover plates in accordance with the requirements of Section 261400. Provide where outlet boxes are unused.
- C. Terminal Boards: Terminal boards shall be ¾-inch type Marine grade plywood having two coats of insulating oil base exterior enamel paint applied before installation on both sides and all edges. The quantity and dimensions shall be as indicated on the drawings. Label terminal board "CATV".

PART 3 – EXECUTION

CABLE TELEVISION SYSTEM (ROUGH-IN)	26 75 00 - 1
24214 - COPA New Lifeguard Facility	5-15-2025

3.01 CONSTRUCTION

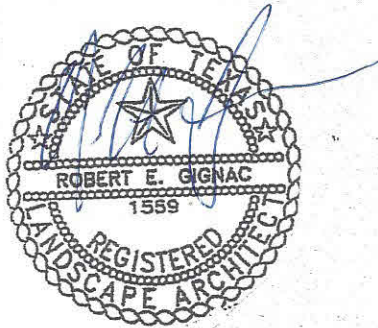
- A. Install terminal boards straight and level at locations indicated on drawings. Attach to masonry walls using expansion anchors, to CMU walls using toggle bolts, and to sheetrock and plaster walls using wood or sheet metal lag bolts fastened into the wall supporting the structure. The use of toggle bolts in sheetrock and plaster walls is not acceptable. Install anchors at a maximum of 24-inches on center at the perimeter of each board.
- B. At the main terminal board, stub-up the service entrance conduits at one end of the board within 3 inches of the supporting wall.
- C. Unless otherwise indicated, distribution raceways shall be electrical metallic tubing, except the PVC Schedule 40 may be used where raceway is buried in concrete slabs, columns, or beams. Provide insulating bushings at the ends of all raceways.
- D. The conduit size for each outlet shall be 3/4-inch minimum.
- E. Boxes shall be steel having the minimum dimensions of 4-11/16"x4-11/16"x2-1/8".
- F. Provide conduit from each outlet location to an accessible location above a lay-in type ceiling. Terminate conduit with bushing.
- G. Provide raceways sufficient to accommodate cabling where passing through mechanical and electrical equipment rooms, pipe chases, mechanical chases, areas without ceilings (exposed structure), and non-accessible areas such as ceiling plenums and crawl spaces.
- H. Provide 3/4-inch conduit with #6 AWG bare copper ground wire from main terminal location and bond to building grounding system as indicated on drawings.
- I. Provide pull wire or mylar cord in any empty conduit.
- J. Coordinate final termination with the Architect, Owner's representative and the Local Cable TV provider.

END OF SECTION 26 75 00

CABLE TELEVISION SYSTEM (ROUGH-IN)	26 75 00 - 2
24214 - COPA New Lifeguard Facility	5-15-2025

COPA LIFE GAURD HEADQUARTERS FACILITY
IRRIGATION AND LANDSCAPE INDEX

<u>Section</u>	<u>Title</u>
32 84 23	Underground Sprinklers
32 90 01	Common Planting Requirements
32 91 13	Soil Preparation
32 92 23	Sodding
32 90 00	Plants



5/15/25

SECTION 32 84 23 UNDERGROUND SPRINKLERS

PART.1 GENERAL

1.01 SUMMARY

A. Includes But Not Limited To:

1. Furnish and install planting irrigation system as described in Contract Documents complete with accessories necessary for proper function.

B. Related Requirements:

1. Section 32 91 13: Soil Preparation.
2. Section 32 90 01: Common Planting Requirements
3. Section 32 93 00: Plants.

1.02 REFERENCES

A. Definitions:

1. Automated Self Flushing Wye Strainer: A wye strainer located immediately downstream from the point of connection in-lieu of a backflow prevention device for irrigation systems that utilize non-potable, secondary and/or reclaimed water that is automatically self-flushing to control unwanted debris from infiltrating the remaining irrigation system.
2. Dielectric Fittings: Special type of fitting used between dissimilar metals to prevent galvanic action from causing corrosion failure.
3. Hydraulic Analysis: A required table that identifies all psi losses in irrigation equipment, psi losses due to elevation differentials and psi required at the spray head, rotor or emitter based on the peak flow requirements. This table shall be prepared and delivered to the Owner for evaluation prior to beginning irrigation design and construction documents.
4. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
5. Non-Pressure Lateral Line: Downstream from electric control valves to pop-up spray heads and drip valve assemblies to emitters. Piping or tubing is under pressure during flow. In areas where potable or secondary water are used, pressure supply line shall be white. In areas where non-potable or reclaimed water are used, pressure supply line shall be purple.
6. Peak Flow: The maximum required flow for a given month based on a 6 day a week, 9 hour a day watering window to be used for irrigation system design and to be used in the hydraulic analysis.
7. Point of Connection: The location where the meter for the irrigation system is located.
8. Pressure Supply Line: Downstream from point of connection to electric control valves. Piping is under water-distribution-system pressure when activated by master valve or hydrometer. In areas where potable or secondary water are used, pressure supply line shall be white. In areas where non-potable or reclaimed water are used, pressure supply line shall be purple.
9. Controllers: controllers are irrigation clocks.
10. Static Water Pressure: The pressure at the point of connection when the system is not operable.

11. Working Pressure: The pressure at the point of connection when the system is operable.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Provide Coordination for required tests and inspections.
 - a) Manufacturer's Field Service: Provide necessary manufacturer's field service.
 - b) Pressure Test: In the presence of Landscape Architect provide a pressure test.
 - c) Walk Through for Substantial Completion: In the presence of Landscape Architect, plan and provide walk through for Substantial Completion after Contractor has completed all Work.
 - d) Final Walk Through: In the presence of the Landscape Architect, plan and provide final walk through after Contractor has completed all work listed on substantial completion walk through punch list provided by Architect.

B. Pre-Installation Conference:

1. Schedule pre-installation conference before irrigation system installation begins.

C. Sequencing:

1. Install sleeves before paving or plan installation

1.04 SUBMITTALS

A. Action Submittals:

1. Product Data:
 - a) Manufacturer's cut sheets for each element of system.

B. Informational Submittals:

1. Certificates:
 - a) Acceptance certificate of irrigation system.
 - b) Upon acceptance of irrigation system, reviewer will provide signed acceptance certificate.
 - c) Certificate will include name and signature of reviewer, reviewer's company, date of review, and reviewer's telephone number.
2. Manufacturer Instructions:
 - a) Manufacturer's printed literature on operation and maintenance of operating elements of system.
 - b) Instruction Manual
 - c) Includes complete directions for system operation and maintenance, including winterizing, controller program worksheet and annual service and scheduling calendar based on local site specific conditions
 - d) Qualification Submittals
3. Irrigation Installer:
 - a) Provide documentation of the following:
 - 1) Firm experience in irrigation projects (minimum of five years)

- 2) Financial stability.
- 3) Comply with specifications and contract documents.

C. Closeout Submittals:

1. Include following in Operations And Maintenance Manual.
 - a) Operations and Maintenance Data:
 - b) Include one copy in Operations and Maintenance Manual
 - c) Instruction Manual.
 - d) Manufacturer's printed literature.
2. Record Documentation:
 - a) Record drawings: As installation occurs, prepare accurate record drawing to be submitted before final inspection, including
 - b) Detail and dimension changes made during construction.
 - c) Significant details and dimensions not shown in original Contract Documents.
 - d) Field dimensioned locations of valve boxes, quick-coupler valves, control wire runs not in mainline ditch, and both ends of sleeves.
 - e) Take dimensions from permanent constructed surfaces or edges located at or above finish grade.
 - f) Take and record dimensions at time of installation.

D. Maintenance Material Submittals:

1. Tools:
 - a) Furnish following items before Final Closeout Review:
 - b) One quick coupler keys with brass hose swivel. (if specified)

1.05 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Work and materials shall be in accordance with latest rules and regulations, and other applicable state or local laws.
2. Nothing in Contract Documents is to be construed to permit work not conforming to these codes.

B. Qualifications:

1. Requirements but not limited to the following:
 - a) Installer Qualifications:
1. General:
 - a) Perform installation under direction of foreman or supervisor with five (5) years minimum experience in sprinkling system installations.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements:

1. Storage and handling during installation: protect materials from damage and prolonged exposure to sunlight

1.07 WARRANTY

A. Manufacturer Warranty:

1. Standard one-year guarantee shall include:
 - a) Filling and repairing depressions and replacing plantings due to settlement of irrigation system trenches.
 - b) Adjusting system to supply proper coverage of areas to receive water.

PART.2 PRODUCTS

2.01 SYSTEM

A. Manufacturers:

1. Manufacturer Hunter
 - a) Hunter manufacturers equipment

B. Materials:

1. Rock-Free Soil:
 - a) Backfill soil around PVC pipe.
 - b) Soil having rocks no larger than 1/2 inch in any dimension.
2. Pea Gravel:
 - a) For use around drains, valves, and quick couplers.
 - b) 1/2-inch maximum dimension, washed rock.
 - c) Native Material: Soil native to project site free of wood and other deleterious materials and rocks over 1-1/2 inches
 - d) Topsoil: Remove rocks, roots, sticks, clods, debris, and other foreign matter over 1 inch's longest dimension encountered during trenching.
 - e) Pipe, Pipe Fittings, And Connections:
 - f) Pipe shall be continuously and permanently marked with Manufacturer's name, size, schedule, type, and working pressure.
 - g) Pipe sizes shown on Drawings are minimum. Larger sizes may be substituted if at no additional cost to Owner.
 - h) Fittings: Same material as pipe, except were detailed otherwise.
 - i) Sleeves:
 - 1) Under Parking Area, walks, planters and Driveway Paving: Schedule 40 PVC Pipe.
 - j) All Other: Class 200 PVC Pipe.
 - k) Sleeve diameter refer to irrigation plan.

C. Automatic irrigation Controllers:

1. Automatic Irrigation Control Wiring and Controller:
 - a) Waterproof Wire Connectors:
 - b) Control wire connections shall consist of a properly-sized wire nut inserted in a waterproof grease cap.
 - c) Automatic controller:
 - 1) Refer to Irrigation Legend:
 - d) Automatic Rain Sensors:
 - 1) Hunter wireless
2. Valves:
 - a) Hunter: ICV series.
 - 1) Isolation Valves line size:

- 2) PVC ball valves, size to match pipe size
- 3) Backflow Preventer: Make and Model shown on Drawings or as required by local code.
3. Lid Colors:
 - a) Brown/tan: Install in groups together.
4. Type Acceptable Products:
 - a) Hunter Industries: 10" & Jumbo. Equal as approved by Architect

PART 3 –EXECUTION

3.01 EXAMINATION

A. Verification Of Conditions:

1. Perform pressure test at stub-out on main water line provided for irrigation system, or at near-by fire hydrant.
2. Notify Architect if pressures are under 45 psi to determine if some re-design of system is necessary before beginning work on system

3.02 PREPARATION

A. Protection:

1. Protection Of In-Place Conditions:
2. Repair or replace work damaged during course of the Work at no additional cost to Owner. If damaged work is new, installer of original work shall perform repair or replacement.

B. Surface Preparation:

1. Layout of Irrigation Heads:
 - a) Location of drip runs and piping shown on Drawings is approximate. Actual placement may vary slightly as is required to achieve full, even coverage without spraying on to buildings, sidewalks, fences, etc.
 - b) During layout, consult with Landscape Architect to verify proper placement and make recommendations, where revisions are advisable.
 - c) Minor adjustments in system layout will be permitted to avoid existing fixed obstructions.
 - d) Make certain changes from Contract Documents are shown on record drawings.

3.03 INSTALLATION

A. Trenching And Backfilling:

1. Pulling of pipe is not permitted.
2. Excavate trenches to specified depth. Remove rocks larger than 1-1/2 inch in any direction from bottom of trench. Separate out rocks larger than 1-1/2 inch in any direction uncovered in trenching operation from excavated material and remove from areas to receive landscaping.
3. Cover pipe both top and sides with 12" for laterals for mainline & 15 inches of rock-free soil as specified.
4. Do not cover pressure main, irrigation pipe, or fittings until Architect has inspected and approved system.

B. Sleeving:

1. Sleeve water lines and control wires under walks and paving. Extend sleeves 18 -24 inches minimum beyond walk or pavement edge. Cover sleeve ends until pipes and wires are installed to keep sleeve clean and free of dirt and debris.
2. Position sleeves with respect to buildings and other obstructions so pipe can be easily removed.

C. Installation of Pipe:

1. Install pipe in manner to provide for expansion and contraction as recommended by Manufacturer.
2. Unless otherwise indicated on Drawings, install main lines and lateral lines connecting pop-up rotor and impact sprinklers with minimum cover of 15 inches based on finished grade. Install remaining lateral lines, including those connecting drip tubing, with minimum of 12 inches of cover based on finish grade.
3. Install pipe and wires under driveways or parking areas in specified sleeves 15 inches below finish grade or as shown on Drawings.
4. Locate no sprinkler head closer than 6" inches from building foundation. Heads immediately adjacent to mow strips, walks, or curbs shall be one inch below top of mow strip, walk, or curb and have one to 3 inches clearance between head and mow strip, walk, or curb.
5. Cut plastic pipe square. Remove burrs at cut ends before installation so unobstructed flow will result.
6. Make solvent weld joints as follows:
 - a) Do not make solvent weld joints if ambient temperature is below 35 deg F
 - b) Clean mating pipe and fitting with clean, dry cloth and apply one coat of P-70 primer to each.
7. Apply solvent to fitting in similar manner.
8. Give pipe or fitting a quarter turn to insure even distribution of solvent and make sure pipe is inserted to full depth of fitting socket.
9. Allow joints to set at least 24 hours before applying pressure to PVC pipe.
10. Tape threaded connections with Teflon tape.

D. Control Valves And Controller

1. Install valves in plastic boxes with reinforced heavy duty plastic covers. Locate valve boxes within 12 inches of sidewalks and shrub bed/planter edges with tops at finish grade. Do not install more than two valves in single box.
2. Place 3 inches minimum of pea gravel below bricks supporting valve boxes to drain box. Set valve boxes over valve so all parts of valve can be reached for service. Set cover of valve box even with finish grade. Valve box cavity shall be reasonably free from dirt and debris.
3. Wiring:
 - a) Tape control wire to side of main line every 10 feet. Where control wire leaves main or lateral line, enclose it in gray conduit.
 - b) Use waterproof wire connectors consisting of properly-sized wire nut and grease cap at splices and locate all splices within valve boxes.

- c) Use white or gray color for common wire and other colors for all other wire. Each common wire may serve only one controller.
 - d) Run one spare control wire from panel continuously from valve to valve throughout system similar to common wire for use as a replacement if a wire fails. Spare wire shall be different color than other wires, except use of green wire is not acceptable. Mark spare control wire in control box as an unconnected wire. Extend spare control wires 24 inches and leave coiled in each valve box.
 - E. Backflow Preventer:
 - 1. RPZ is 1 ". Contractor shall certify that it is properly working. Supply and install a 1" isolation valve for the irrigation connection.
 - F. Sprinkler Heads: Not used
 - 1. Set sprinkler heads and quick-coupling valves perpendicular to finish grade.
 - 2. Do not install sprinklers using side inlets. Install using base inlets only.
 - 3. Set sprinkler heads at a consistent distance from existing walks, curbs, and other paved areas.
 - 4. Before installation of sprinkler heads and drip line, open control valves and use full head of water to flush out system.
 - G. Arrange valve stations to operate in an easy-to-view progressive sequence around building.
- 3.04 ADJUSTING Refer to Drip notes.
- A. Adjust sprinkler heads to proper grade when turf is sufficiently established to allow walking on it without appreciable harm. Such lowering and raising of sprinkler heads shall be part of original contract with no additional cost to Owner.
 - B. Adjust sprinkler heads for proper distribution and trim so spray does not fall on building or walks.
 - C. Adjust watering time of valves to provide proper amounts of water to plants.
- 3.05 CLOSEOUT ACTIVITIES
- A. Training:
 - 1. After system is installed and approved, instruct Owner's designated personnel in complete operation and maintenance.

END OF SECTION 32 84 23

SECTION 32 90 01 COMMON PLANTING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Includes But Not Limited To:
 - 1. Common procedures and requirements for landscaping work.
 - 2. Provide maintenance for new landscaping as described in Contract Documents.
- B. Related Requirements:
 - 1. Section 32 93 00: Plants
 - 2. Section 32 91 13: Soil Preparation.
 - 3. Section 32 84 23: Underground Sprinklers.
 - 4. Section 32 90 01: Common Planting Requirements

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Conference:
 - 1. Schedule pre-installation conference.
 - 2. Schedule planting pre-installation conference after completion of fine grading.

1.3 SUBMITTALS

- A. Closeout Submittals:
 - 1. Include following in Operations and Maintenance Manual.
 - a. Operations And Maintenance Data:
 - 1) At completion of landscape work, submit two copies of typewritten instructions recommending procedures to be established by Owner for maintenance of landscape work for one full year after contract maintenance period ends.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Installer:
 - a. Use trained personnel familiar with required planting procedures and with Contract Documents.
 - b. Planting shall be performed under direction of foreman or supervisor with minimum five years' experience in landscape installations.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Storage And Handling Requirements:

1. Deliver packaged materials in containers showing weight, analysis, and name of Manufacturer.
 2. Deliver sod, plants, trees and shrubs in healthy and vigorous condition.
 3. Protect materials from deterioration during delivery.
- B. Storage And Handling Requirements:
1. Store in location on site where they will not be endangered and where they can be adequately watered and kept in healthy and vigorous condition.
 2. Protect materials from deterioration while stored at site.

PART 2 - PRODUCTS:

2.1 POST-EMERGENT WEED CONTROL:

- A. Type Two Acceptable Products: For all planting beds.
1. Treflan or Surflan by Dow Agrosiences.
 2. Eptan by Syngenta.
 3. Equal as approved by Landscape Architect.

PART 3 - EXECUTION

3.1 INSTALLERS

- A. Acceptable Installers:
1. Landscape contractors that have experience in successful landscape installation in this region.
 2. Equal approved by Landscape Architect.

3.2 EXAMINATION

- A. Verification Of Conditions:
1. Inspect site and Contract Documents to become thoroughly acquainted with locations of irrigation, ground lighting, and utilities.
 2. Repair damage to irrigation, ground lighting, and utilities and other items adjacent to landscaping caused by work of this Section or replace at no additional cost to Owner.

3.3 PREPARATION

- A. Before proceeding with work, verify dimensions and quantities. Report variations between Drawings and site to Landscape Architect before proceeding with landscape work.
1. Plant totals are for convenience of Contractor only and are not guaranteed. Verify amounts shown on Drawings.
 2. All planting indicated on Drawings is required unless indicated otherwise.

- B. Protection:
 - 1. Take care in performing landscaping work to avoid conditions that will create hazards. Post signs or barriers as required.
 - 2. Provide adequate means for protection from damage through excessive erosion, flooding, heavy rains, etc. Repair or replace damaged areas.
 - 3. Keep site well drained and landscape excavations dry.

3.4 INSTALLATION

- A. Interface With Other Work:
 - 1. Do not plant trees or and shrubs until major construction operations are completed.
- B. Coordinate installation of planting materials during normal planting for each type of plant material required.
- C. Hand excavate as required.
- D. Maintain grade stakes until parties concerned mutually agree upon removal.
- E. When conditions detrimental to plant growth are encountered, such as rubble fill, high water table or adverse drainage conditions, notify Landscape Architect before planting.

3.5 FIELD QUALITY CONTROL

- A. Field Inspection:
 - 1. Landscape Architect will inspect landscaping installation approximately two weeks before Substantial Completion.
 - 2. Replace landscaping that is dead or appears dead as directed by Architect within 10 days of notification and before Substantial Completion.

3.6 CLEANING

- A. Waste Management:
 - 1. Immediately clean up soil or debris spilled onto pavement and dispose of deleterious materials.

3.7 CLOSEOUT ACTIVITIES

- A. Instruction Of Owner:
 - 1. Replace damaged plantings at no additional cost to Owner.

3.8 PROTECTION

- A. Protect planted areas against traffic or other use immediately after planting is completed.

- B. Provide adequate protection of planted areas against trespassing, erosion, and damage of any kind. Remove this protection after Landscape Architect has accepted planted areas.

3.9 MAINTENANCE DURING CONSTRUCTION

A. General:

1. Plants shall be in at least as sound, healthy, vigorous, and in approved condition as when delivered to site, unless accepted by Architect in writing at final landscape inspection.
2. Maintain landscaping until Substantial Completion and accepted by owner.
3. Replace landscaping that is dead or appears unhealthy or non-vigorous as directed by Architect. Make replacements within 10 days of notification. Lawn that does not live and has to be replaced shall be guaranteed and maintained an additional 30 days from date of replacement.

B. Sodded Lawn: NOT USED

1. Maintain sodded lawn areas until lawn until acceptance including mowing and weed control.
2. Water sodded areas in sufficient quantities and at required frequency to maintain sub-soil immediately under sod continuously moist 3 to 4 inches deep.
3. Cut grass when it reaches 3 inches high. Continue to mow until acceptance.
4. Apply weed killer as necessary to maintain weed-free lawn. Apply weed killer in accordance with manufacturer's instructions during calm weather when air temperature is between 50 and 80 deg F

C. Trees, Shrubs and Plants:

1. Maintain by pruning, cultivating, trimming and weeding as required for healthy growth.
2. Restore planting basins.
3. Tighten and repair stake and guy support and reset trees and shrubs to proper grades or vertical positions as required.
4. Spray as required to keep trees and shrubs free of insects and disease.
5. Provide supplemental water by hand as needed in addition to water from sprinkling system.

END OF SECTION 32 90 01

SECTION 32 91 13 SOIL PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Includes But Not Limited To:
 - 1. Perform soil preparation work as described in Contract Documents.
 - 2. Furnish and apply soil amendments as described in Contract Documents.

1.2 REFERENCES

- A. Reference Standards:
 - 1. ASTM International:
 - a. ASTM D1557-09, 'Standard Test Methods for Laboratory Compaction Characteristics of Soil Using

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Conference:
 - 1. Schedule pre-installation conference.

1.4 SUBMITTALS

- A. Action Submittals:
 - 1. Product Data:
 - a. Product literature and chemical / nutrient analysis of soil amendments and fertilizers.
 - 2. Samples:
 - a. Sample of soil conditioner for approval before delivery to site. Include product analysis list.
- B. Informational Submittals:
 - 1. Field Quality Control Submittals:
 - a. Submit tests on imported and site topsoil by licensed laboratory.
 - 1) Before use, topsoil shall meet minimum specified requirements and be approved by Architect.
 - 2) If necessary, submit proposed amendments and application rates necessary to bring topsoil up to minimum specified requirements.
 - b. Submit report stating location of source of imported topsoil and account of recent use.

2. Installer Reports:
 - a. Delivery slips indicating amount of soil conditioner delivered to Project site.
- C. Closeout Submittals:
 1. Include following in Operations and Maintenance Manual.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil:
 1. Topsoil used in landscaped areas, imported, shall be fertile, brown in color, loose, friable soil meeting following criteria:
 - a. Chemical Characteristics:
 - 1) Acidity / alkalinity range: pH 6.5 to 7.5.
 - 2) Soluble Salts: less than 5.0 mmhos/cm.
 - 3) Sodium Absorption Ratio (SAR): less than 10.0.
 - 4) Organic Matter: greater than twenty percent.
 - b. Physical Characteristics:
 - 1) Gradation as defined by USDA triangle of physical characteristics as measured by hydrometer.
 - a) Compost: 15 to 60 percent.
 - b) Silt: 10 to 60 percent.
 - c) Top Soil: 15 to 60 percent
 - d) Bark mulch: 5 to 30 percent.
 - 2) Clean and free from toxic minerals and chemicals, noxious weeds, rocks larger than 1-1/2 inch in any dimension, and other objectionable materials.
 - 3) Soil shall not contain more than 2 percent by volume of rocks measuring over 3/32 inch in largest size.
- B. Soil Amendments:
 1. Incorporate following soil amendments into topsoil used for Project:
 - a. Acceptable Soil Amendments, Soil Conditioners, And Application Rates or approved planting mix:
 - 1) Soil mixture by ¼ sharp sand, ¼ compost, 1/4 bark mulch or peat moss and ¼ new top soil.
 - b. Acceptable Fertilizers and Application Rates:
 - 1) Apply a NP and iron fertilizer at label rate (ironite). Submit brand and analysis for approval.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Soil Amendments:

1. Add specified soil amendments at specified rates to the planting areas.
2. Roto-till or otherwise mix amendments evenly into top 4 inches of topsoil. Till to an 8" depth. Sub grade to be approved by LA prior to bed preparation
3. Incorporate and leach soil amendments, such as gypsum, within such time limits that soil is sufficiently dry to allow proper application of fertilizer and soil conditioners.

END OF SECTION 32 91 13

SECTION 32 92 23 SODDING

PART 1 - GENERAL

1.1 SUMMARY

- A. Includes But Not Limited To:
 - 1. Furnish and install sodded lawn as described in Contract Documents.
- B. Related Requirements:
 - 1. Section 32 84 23: Irrigation system.
 - 2. Section 32 90 01: Common Planting Requirements.

1.2 SUBMITTALS

- A. Informational Submittals:
 - 1. Source Quality Control Submittals:
 - a. Written certification confirming the type of grass.
- B. Closeout Submittals:
 - 1. Include following in Operations and Maintenance Manual for the care of the new lawn.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Delivery And Acceptance Requirements:
 - 1. Harvest, deliver, store, and handle sod in accordance with requirements of Turfgrass Producers International (TPI) (formally American Sod Producers Association) Specifications for Turfgrass Sod Materials and Transplanting / Installing.
 - 2. Schedule deliveries to coincide with topsoil operations and laying. Keep storage at job site to minimum without causing delays.
 - a. Deliver, unload, and store sod on pallets within 24 hours of being lifted.
 - b. Do not deliver small, irregular, or broken pieces of sod.
- B. Storage And Handling Requirements:
 - 1. Cut sod in pieces approximately 3/4 to one inch thick. Roll or fold sod so it may be lifted and handled without breaking or tearing and without loss of soil.
 - 2. During wet weather, allow sod to dry sufficiently to prevent tearing during lifting and handling.
 - 3. During dry weather, protect sod from drying before installation. Water as necessary to ensure vitality and to prevent excess loss of soil in handling. Sod that dries out before installation will be rejected.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Description:

1. Superior sod grown from certified, high quality, seed of known origin or from plantings of certified grass seedlings or stolon's:
 - a. Assure satisfactory genetic identity and purity.
 - b. Assure over-all high quality and freedom from noxious weeds or an excessive amount of other crop and weedy plants at time of harvest.
2. Sod shall be 100% 'Celebration' Bermuda Certified.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Interface With Other Work:

1. Do not commence work of this Section until work of Sections 32 9113 and 32 9300 has been completed and approved.

B. Tolerances:

1. Final grade of soil after sodding of lawn areas is complete shall be one inch (3/4" below top of adjacent pavement of any kind.)

C. Laying of Sod:

1. Lay sod during growing season and within 48 hours of being lifted.
2. Lay sod while top 6 inches of soil is damp, but not muddy. Lay sod in rows perpendicular to slope with joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with a sharp knife.
3. Lay sod flush with adjoining surfaces and flat work. Finished grade to be 3/4" below top of surface/flatwork prior to sodding.
4. Finished grade prior to sodding to be 1" below to of flatwork or concrete.

D. After Laying of Sod Is Complete:

1. Roll horizontal surface areas in two directions perpendicular to each other.
2. Repair and re-roll areas with depressions, lumps, or other irregularities. Heavy rolling to correct irregularities in grade will not be permitted.
3. Water sodded areas immediately after laying sod to obtain moisture penetration through sod into top 6 inches of topsoil.

3.2 FIELD QUALITY CONTROL

A. Field Inspection:

1. Sodded areas will be accepted at Project closeout if:
 - a. Sodded areas are properly established.
 - b. Sod is free of bare and dead spots and is without weeds.
 - c. No surface soil is visible when grass has been cut to height of 2 inches.
2. Sodded areas have been mowed a minimum of 2".

3.3 TOP SOIL

A. Quality:

1. All lawn area to have 3" of new top soil. Soil to be brown in color, friable and a Ph. of 6.5-7.5
Submit sample and source prior to any deliveries for approval.

END OF SECTION 32 92 23

SECTION 32 93 00 PLANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Includes But Not Limited To:
 - 1. Furnish and install landscaping plants as described in Contract Documents.
- B. Related Requirements:
 - 1. Section 32 84 23: Irrigation system.
 - 2. Section 32 90 01: Common Planting Requirements.
 - 3. Section 32 91 13: Soil Preparation.

1.2 REFERENCES

- A. Reference Standards:
 - 1. American Nursery & Landscape Association / American National Standards Institute:
 - a. ANLA / ANSI Z60.1-2004, 'American Standard for Nursery Stock.'

1.3 SUBMITTALS

- A. Action Submittals:
 - 1. Samples:
 - a. Top dressing mulch & granite for approval before delivery to site.
- B. Closeout Submittals:
 - 1. Include following in Operations and Maintenance Manual
 - a. Operations And Maintenance Data:
 - 1) Installer Instructions:
 - a) Provide written instructions covering maintenance requirements by Owner for one year beyond Contract maintenance period.
 - b. Warranty Documentation:
 - 1) Include final, executed copy of warranty.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Delivery And Acceptance Requirements:
 - 1. Deliver trees, shrubs, ground covers, and plants after preparations for planting have been completed and install immediately.
 - 2. Do not prune before delivery, except as approved by Landscape Architect.
 - 3. Protect bark, branches, and root systems from sun scald, drying, whipping, and other handling and tying damage.
 - 4. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape.
 - 5. Provide protective covering during delivery.

- B. Storage And Handling Requirements;
 - 1. Handle balled stock by root ball or container. Do not drop trees and shrubs during delivery.
 - 2. If planting is delayed more than six hours after delivery, set planting materials in shade and protect from weather and mechanical damage.
 - 3. Set all stock in the shade. .
 - 4. Do not remove container-grown stock from containers before time of planting.
 - 5. Water root systems of trees and shrubs stored on site with fine spray. Water as often as necessary to maintain root systems in moist condition. Do not allow plant foliage to dry out.

1.5 WARRANTY

- A. Special Warranty:
 - 1. Provide written warranties as follows:
 - a. Guarantee shrubs and ground covers to be alive and remain in strong, vigorous, and healthy condition for one year minimum from date landscape installation is accepted as complete.
 - b. Guarantee tree to live and remain in strong, vigorous, and healthy condition for one year from date landscape installation is accepted as complete.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Plants:
 - 1. Conform to requirements of Plant List and Key on Drawings and to ANLA / ANSI Z60.1.
 - 2. Nomenclature:
 - a. Plant names used in Plant List conform to 'Standardized Plant Names' by American Joint Committee on Horticultural Nomenclature except in cases not covered. In these instances, follow custom of nursery trade. Plants shall bear a tag showing the genus, species, and variety of at least 10 percent of each species delivered to site.
 - 3. Quality:
 - a. Plants shall be sound, healthy, vigorous, free from plant disease, insect pests or their eggs, noxious weeds, and have healthy, normal root systems. Container stock shall be well established and free of excessive root-bound conditions.
 - b. Do not prune plants or top trees prior to delivery.
 - c. Plant materials shall be subject to approval by Landscape Architect as to size, health, quality, and character.
 - d. Bare root trees are not acceptable.
 - e. Provide plant materials from licensed nursery or grower.
 - 4. Measurements:
 - a. Measure height and spread of specimen plant materials with branches in their normal position as indicated on Drawings or Plant List.
 - b. Measurement should be average of plant, not greatest diameter.

- c. Plants properly trimmed should be measured same in every direction.
- d. Four inches from top of root ball for caliper on trees.
- e. Where caliper or other dimensions of plant materials are omitted from Plant List, plant materials shall be normal stock for type listed.
- f. Plant materials larger than those specified may be supplied, with prior written approval of Landscape Architect,
- 5. Shape and Form:
 - a. Plant materials shall be symmetrical or typical for variety and species and conform to measurements specified in Plant List.
 - b. Well grown material will generally have height equal to or greater than spread. However, spread shall not be less than 2/3's of height.

2.2 ACCESSORIES

- A. Planting Mix:
 - 1. Mixture of three parts topsoil mixture as specified in Section 32 9113 and one part well-rotted composted manure, or approved commercial mix. 'Submit sample for approval..
- B. Planting Tablets:
 - 1. 21 gram Agriform 20-10-5.
- C. Tree Stakes and braces:
 - 1. Acceptable Products:
 - a. 8' 'T' post (new)
- D. Tree Guys:
 - 1. Acceptable Products:
 - a. 3/4" Arbor tie (green), 3/4" green hose for trees.
- E. Pre-Emergent Herbicide:
 - 1. Category Four Approved Products. See Section 01 6200 for definitions of Categories.
 - a. Chipco Dimension Granular by The Andersons Inc, Maumee, IL
 - b. Elanco XL2G granular by Crop Data Management Systems, Marysville, CA
 - c. Ronstar G granular by Bayer Crop Science, Monheim, Germany .
 - d. Surflan AS liquid by United Phosphorous Inc, Trenton, NJ
 - e. Oryzalin 4 A.S. liquid by Farm Saver, Seattle, WA
- F. Weed Barrier:
 - 1. Type Dewitt Product:
 - a. DeWitt 4.1 oz. Pro 5, 20 year woven polypropylene weed barrier.(white)
- G. Top Dressing Mulch:
 - 1. Acceptable Products:
 - a. White to cream round Medina River rock 1"-3" on a Dewitt Pro 5 landscape Fabric.

2.3 EXAMINATION

A. Evaluation And Assessment:

1. Before proceeding with work, check and verify dimensions and quantities. Report variations between Drawings and site to Architect before proceeding with work of this Section.
2. Plant totals are for convenience only and are not guaranteed. Verify amounts shown on Drawings. All planting indicated on Drawings is required unless indicated otherwise.

2.4 PREPARATION

- ### A. Layout individual tree and shrub locations and areas for multiple plantings. Stake locations and outline areas. Secure Architect's acceptance before planting. Make minor adjustments as may be requested.

2.5 INSTALLATION

A. Interface With Other Work:

1. Do not commence work of this Section until work of Section 32 9113 has been completed and approved.

B. Excavation:

1. If underground construction work or obstructions are encountered in excavation of planting holes, Landscape Architect will select alternate locations.
2. Plant Excavation Size:
 - a. Diameter: Twice diameter of root ball or container minimum.
 - b. Depth: Equal to container or root ball depth. See landscape details.
3. Unless excavated material meets topsoil requirements as specified in Section 32 9113, remove from landscape areas and do not use for landscaping purposes.
4. Roughen sides and bottoms of excavations.

C. Planting:

1. Removing Binders and Containers:
 - a. Remove top one / third of wire root ball and burlap binders' /A
 - b. Remove plastic and twine binders from around root ball and tree trunk/A
 - c. Remove wood boxes from around root ball. Remove box bottoms before positioning plant in hole. After plant is partially planted, remove remainder of box without injuring root ball.
2. Plant immediately after removing binding material and containers. Place tree and shrub root balls on undisturbed soil. After watering and settling, top of tree root balls shall be approximately one inches higher than finished grade and trunk flare is visible. Shrub root balls shall be approximately one inch higher than finished grade
3. Properly cut off broken or frayed roots.
4. Center plant in hole, remove remaining wire basket, and backfill with specified planting mix. Make ring of mounded soil around hole perimeter to form watering basin.
5. Add planting tablets in plant pit as follows. Place tablets in relation to root ball as recommended by Manufacturer.

- a. One Gallon Shrub: 1 tablet.
 - b. 3/5 Gallon Shrub: 3 tablets.
 - c. 15 Gallon Tree: 4 tablets.
 - d. 24 inches Box Tree or greater: 6 Tablets.
6. Fill landscape excavations tamped planting mix. Settle by firming and watering to ensure top of ball one inch higher than surrounding soil.
 7. Do not use muddy soil for backfilling.
 8. Make adjustments in positions of plants as directed by Landscape Architect.
 9. Thoroughly water trees and shrubs immediately after planting.
 10. At base of each tree, leave 36 – 48 inch diameter circle free of any grass.
- D. Supports for New Trees:
1. Provide new supports for trees noted on Drawings to be staked.
 - a. Remove nursery stakes delivered with and attached to trees.
 - b. Support shall consist of at least three tree stakes driven into hole base before backfill so roots are not damaged. Place stakes vertically and run parallel to tree trunk. Install stakes so three feet of stake length is below finish grade.
 - c. Place tree arbor tie 6 to 12 inches twist tied to trunk secure to eliminate slippage
 2. Provide 8' 'T' stakes for palm trees.
- E. Ground Covers:
1. Container-grown unless otherwise specified on Drawings. Space evenly to produce a uniform effect, staggered in rows and intervals shown.
- F. Post Planting Weed Control:
1. Apply specified pre-emergent herbicide to shrub and ground cover planting areas and grass-free areas at tree bases after completion of planting.
 2. Areas shall be free of existing weed growth before application of herbicide.
 3. Protect existing trees to remain.
- G. Weed Barrier Fabric:
1. After planting and application of herbicide in shrub beds, apply covering of Dewitt Pro 5 weed barrier fabric.
 2. Achieve 100 percent coverage over ground areas.
 3. Overlap seams 6 inches minimum.
 4. Staple at 5 feet on center each way and within 3 inches of edge of shrub bed, with two at each corner. Staples to be 6"-8" long.
- H. Topdressing
1. After application of herbicide, top dress all planting areas with 4 inches deep layer of River Rock.
 2. Place rock to uniform depth and rake to neat, finished appearance. Submit sample for approval.
 3. Top of rock to be ½" higher than any flat work, curb or planter wall.

END OF SECTION 32 93 00