



PROJECT MANUAL

DICKINSON MUSEUM CENTER BUILDING ADDITION DICKINSON, ND

FEBRUARY, 2026

Set No. _____

SECTION 00 01 01
PROJECT TITLE PAGE

DICKINSON MUSEUM CENTER EXPANSION

BUILDING REMODEL
DICKINSON, NORTH DAKOTA 58601

PROJECT NUMBER: 080523

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CONSTRUCTION MANAGER

I hereby certify that this specification was prepared by me or under my direct supervision, and that I am a duly Registered Architect under the laws of the State of North Dakota.



Brian Gregoire
Registered Architect #1883
Dated: 02-05-2026

END OF SECTION

TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS

Division 00 -- Procurement and Contracting Requirements

- 00 01 01 - Project Title Page
- 00 01 10 - Table of Contents
- 00 31 00 - Available Project Information
- 00 31 01 - Soil Report
- 00 43 25 - Substitution Request Form - During Procurement

SPECIFICATIONS

Division 01 -- General Requirements

- 01 10 00 - Summary
- 01 23 00 - Alternates
- 01 25 00 - Substitution Procedures
- 01 30 00 - Administrative Requirements
- 01 40 00 - Quality Requirements
- 01 57 13 - Temporary Erosion and Sediment Control
- 01 58 13 - Temporary Project Signage
- 01 60 00 - Product Requirements
- 01 70 00 - Execution and Closeout Requirements
- 01 78 00 - Closeout Submittals

Division 02 -- Existing Conditions

- For Site Preparation and Earthwork, see Division 31
- For Pavements and Site Improvements, see Division 32
- For Site Utilities, see Division 33
- 02 41 00 - Demolition

Division 03 -- Concrete

- 03 30 00 - Cast-in-Place Concrete
- 03 35 11 - Concrete Floor Finishes

Division 04 -- Masonry

- 04 05 11 - Masonry Mortaring and Grouting
- 04 20 00 - Unit Masonry

Division 05 -- Metals

- 05 12 00 - Structural Steel Framing
- 05 21 00 - Steel Joist Framing
- 05 31 00 - Steel Decking
- 05 40 00 - Cold-Formed Metal Framing
- 05 44 00 - Cold-Formed Metal Trusses
- 05 50 00 - Metal Fabrications

Division 06 -- Wood, Plastics, and Composites

06 10 00 - Rough Carpentry

06 20 00 - Finish Carpentry

Division 07 -- Thermal and Moisture Protection

07 14 00 - Fluid-Applied Waterproofing

07 21 00 - Thermal Insulation

07 21 01 - Thermal Insulation (Fluid Applied)

07 21 19 - Foamed-In-Place Insulation

07 22 10 - Nailbase Insulation

07 24 00 - Exterior Insulation and Finish Systems

07 26 00 - Vapor Retarders

07 27 00 - Air Barriers

07 31 13 - Asphalt Shingles

07 53 00 - Elastomeric Membrane Roofing

07 62 00 - Sheet Metal Flashing and Trim

07 71 23 - Manufactured Gutters and Downspouts

07 84 00 - Firestopping

07 92 00 - Joint Sealants

07 95 13 - Expansion Joint Cover Assemblies

Division 08 -- Openings

08 11 13 - Hollow Metal Doors and Frames

08 14 16 - Flush Wood Doors

08 33 23 - Overhead Coiling Doors

08 36 13 - Sectional Doors

08 51 13 - Aluminum Windows

08 71 00 - Door Hardware

08 80 00 - Glazing

Division 09 -- Finishes

09 21 16 - Gypsum Board Assemblies

09 22 16 - Non-Structural Metal Framing

09 30 00 - Tiling

09 51 00 - Acoustical Ceilings

09 65 00 - Resilient Flooring

09 68 13 - Tile Carpeting

09 91 13 - Exterior Painting

09 91 23 - Interior Painting

09 93 00 - Staining and Transparent Finishing

Division 10 -- Specialties

10 21 13.13 - Metal Toilet Compartments

10 26 00 - Wall and Door Protection

10 28 00 - Toilet, Bath, and Laundry Accessories

10 44 00 - Fire Protection Specialties

Division 11 -- Equipment

Division 12 -- Furnishings

12 34 00 - Laminate Clad Casework - Commercial

Division 13 -- Special Construction

Division 14 -- Conveying Equipment

Division 21 -- Fire Suppression

21 05 00 - Fire Protection General Provisions

21 05 10 - Common Work Results For Fire Protection

21 10 00 - Fire Sprinkler System

Division 22 -- Plumbing

22 05 00 - Plumbing General Conditions

22 05 10 - Common Work Results for Plumbing

22 05 20 - General Motor Requirements

22 07 00 - Plumbing Insulation

22 11 00 - Plumbing Piping

22 12 00 - Plumbing Specialties

22 13 00 - Sanitary Waste Specialties

22 14 00 - Storm Drainage Specialties

22 30 00 - Plumbing Equipment

22 40 00 - Plumbing Fixtures

Division 23 -- Heating, Ventilating, and Air-Conditioning (HVAC)

23 05 00 - HVAC General Provisions

23 05 10 - Common Work Results for HVAC

23 05 20 - General Motor Requirements

23 05 90 - Testing Adjusting and Balancing

23 07 00 - HVAC Insulation

23 20 00 - HVAC Piping

23 30 00 - Air Distribution

23 34 00 - Fans and Fan Systems

23 37 00 - Air Outlets and Inlets

23 54 00 - Furnaces

23 55 00 - Fuel-Fired Heaters

23 60 00 - Central Cooling Equipment

23 710 00 - Central HVAC Equipment

Division 26 -- Electrical

26 05 00 - Common Work Results for Electrical

26 05 05 - Temporary Facilities & Controls

26 05 10 - Remodeling Work

- 26 05 19 - Conductors
- 26 05 26 - Grounding & Bonding For Electrical Systems
- 26 05 33 - Raceways
- 26 05 34 - Outlet, Pull & Junction Boxes
- 26 05 40 - Floor Boxes
- 26 05 53 - Identifications
- 26 05 83 - Connections To Equipment
- 26 09 23 - Lighting Control System
- 26 24 16 - Panelboards
- 26 27 13 - Electrical Service
- 26 27 26 - Wiring Devices and Device Plates
- 26 28 13 - Fuses
- 26 28 16 - Enclosed Switches & Circuit Breakers
- 26 29 13 - Motor Starters
- 26 32 13 - Generator Set
- 26 36 00 - Transfer Switches
- 26 43 13 - Surge Protection Devices
- 26 51 00 - Luminaires
- 26 65 10 - Overhead Door Wiring
- 26 65 30 - Electric Heating Equipment

Division 27 -- Communications

- 27 05 00 - Division 27 General Provisions
- 27 05 28 - Network System Rough-In
- 27 15 13 - Network System Cabling

Division 28 -- Electronic Safety and Security

- 28 05 00 - Division 28 General Provisions
- 28 46 11 - Fire Alarm & Detection

Division 31 -- Earthwork

- 31 10 00 - Site Clearing
- 31 22 00 - Grading
- 31 23 33 - Trenching and Backfilling

Division 32 -- Exterior Improvements

- 32 11 23 - Aggregate Base Courses
- 32 12 16 - Asphalt Paving
- 32 13 13 - Concrete Paving
- 32 17 23 - Pavement Markings
- 32 31 13 - Staggered Aluminum Plank Screening
- 32 84 23 - Underground Sprinklers
- 32 92 19 - Seeding
- 32 94 88 - Trees, Plants, And Ground Cover

Division 33 -- Utilities

33 11 16 - Site Water Utility Distribution Piping

33 31 0 - Site Sanitary Utility Sewerage Piping

33 47 21 - Storm Sewage System

END OF SECTION

**SECTION 00 31 00
AVAILABLE PROJECT INFORMATION**

PART 1 GENERAL

1.01 EXISTING CONDITIONS

- A. A copy of the Report of Geotechnical Evaluation with respect to this building site is attached to the end of this Section.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

Geotechnical Evaluation Report

Dickinson Museum Expansion
200 Museum Drive East
Dickinson, North Dakota

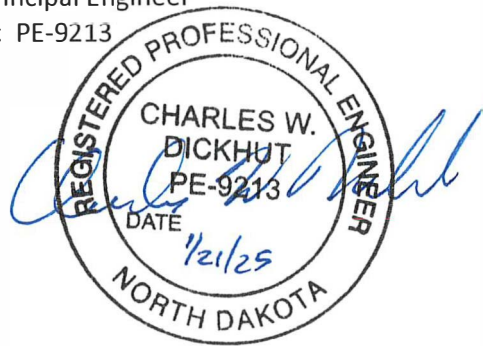
Prepared for

City of Dickinson

Professional Certification:

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly registered Professional Engineer under the laws of the State of North Dakota.

Charles (Wes) Dickhut
Associate Director, Principal Engineer
Registration Number: PE-9213
January 21, 2025



Project B2406649.06

Braun Intertec Corporation

January 21, 2025

Project B2406649.06

Kristopher Keller, PE
City of Dickinson
38 1st Street West
Dickinson, ND 58601

Re: Geotechnical Evaluation
Dickinson Museum Expansion
200 Museum Drive East
Dickinson, North Dakota

Dear Mr. Keller:

We are pleased to present this Geotechnical Evaluation Report for the Dickinson Museum Expansion. The following report contains the results of our evaluation and should be read in its entirety. Our borings encountered existing fill as deep as 5 feet below proposed floor level with high plasticity claystone bedrock that will require a mass excavation to remove and replace.

Thank you for making Braun Intertec your geotechnical consultant for this project. If you have questions about this report, or if there are other services that we can provide in support of our work to date, please contact Ian Becket at 612.750.2758 (ibecket@braunintertec.com) or Wes Dickhut at 701.934.1618 (wdickhut@braunintertec.com).

Sincerely,

BRAUN INTERTEC CORPORATION



Ian C. Becket, EIT
Staff Engineer



Charles (Wes) Dickhut, PE
Associate Director, Principal Engineer

c: Jared Twogood, AIA, GT Architecture
Andrew Schrank, Highlands Engineering & Surveying, PLLC
Tom Schanandore, PE

Table of Contents

Description	Page
A. Introduction.....	1
A.1. Project Description	1
A.2. Site Conditions and History	2
A.3. Purpose.....	4
A.4. Background Information and Reference Documents.....	4
A.5. Scope of Services	4
B. Results	5
B.1. Geologic Overview	5
B.2. Boring Results.....	6
B.3. Groundwater	7
B.4. Laboratory Test Results.....	7
C. Recommendations	8
C.1. Design and Construction Discussion	8
C.1.a. Building Subgrade Preparation	8
C.1.b. Reuse of On-Site Soils.....	9
C.1.c. Groundwater	9
C.1.d. Construction Disturbance.....	10
C.2. Site Grading and Subgrade Preparation	10
C.2.a. Building Subgrade Excavations.....	10
C.2.b. Excavation Oversizing.....	11
C.2.c. Excavated Slopes	12
C.2.d. Excavation Dewatering.....	13
C.2.e. Pavement and Exterior Slab Subgrade Preparation	13
C.2.f. Pavement Subgrade Proofroll	13
C.2.g. Engineered Fill Materials and Compaction	14
C.2.h. Special Inspections of Soils.....	15
C.3. Spread Footings.....	16
C.4. Construction Adjacent to Existing Structures.....	16
C.4.a. Excavations.....	16
C.4.b. Footing Depth.....	17
C.4.c. Settlement.....	17
C.5. Below-Grade Walls	17
C.5.a. Drainage Control	17
C.5.b. Configuring and Resisting Lateral Loads.....	18
C.6. Interior Slabs	19
C.6.a. Subgrade Modulus	19
C.6.b. Moisture Vapor Protection	20
C.7. Frost Protection.....	20
C.7.a. General.....	20
C.7.b. Frost Heave Mitigation	20
C.8. Pavements and Exterior Slabs	22
C.8.a. Design Sections	22
C.8.b. Concrete Pavements	22
C.8.c. Bituminous Pavement Materials	22
C.8.d. Subgrade Drainage	23

Table of Contents (continued)

Description	Page
C.8.e. Performance and Maintenance	23
C.9. Utilities	23
C.9.a. Subgrade Stabilization	23
C.9.b. Corrosion Potential	24
C.10. Equipment Support	24
D. Procedures.....	24
D.1. Penetration Test Borings	24
D.2. Exploration Logs	25
D.2.a. Log of Boring Sheets	25
D.2.b. Geologic Origins	25
D.3. Material Classification and Testing	25
D.3.a. Visual and Manual Classification	25
D.3.b. Laboratory Testing	25
D.4. Groundwater Measurements.....	26
E. Qualifications.....	26
E.1. Variations in Subsurface Conditions.....	26
E.1.a. Material Strata	26
E.1.b. Groundwater Levels	26
E.2. Continuity of Professional Responsibility	26
E.2.a. Plan Review	26
E.2.b. Construction Observations and Testing	27
E.3. Use of Report.....	27
E.4. Standard of Care.....	27

Appendix

Soil Boring Location Sketch

Fence Diagram

Log of Boring Sheets ST-1 through ST-5

Descriptive Terminology of Soil

Descriptive Terminology of Rock

Laboratory Tests

A. Introduction

A.1. Project Description

This Geotechnical Evaluation Report addresses the design and construction of the proposed Dickinson Museum Expansion, located to the north and west of the existing museum building at 200 Museum Drive East in Dickinson North Dakota. The project will include the construction of a building addition to the existing structure. Table 1 below provides project details.

Table 1. Building Description

Aspect	Description
Below grade levels	None
Above grade levels	1
Lowest level floor elevation (feet)	2450.67
Column loads (kips)	75
Wall loads (kips/linear foot)	3
Nature of construction	Steel framed
Cuts or fills for buildings	Cuts of up to 7 feet, fills of up to 1 foot
Tolerable building settlement	1 inch
Assumed traffic loads (ESALs*)	Light-duty bituminous: 20,000
	Medium-duty concrete: 100,000
Pavement Grade Changes:	Cuts and fills of less than 2 feet

*Equivalent 18,000-lb single axle loads based on 20-year design.

The figure below shows an illustration of the proposed site layout.

Figure 1. Site Layout

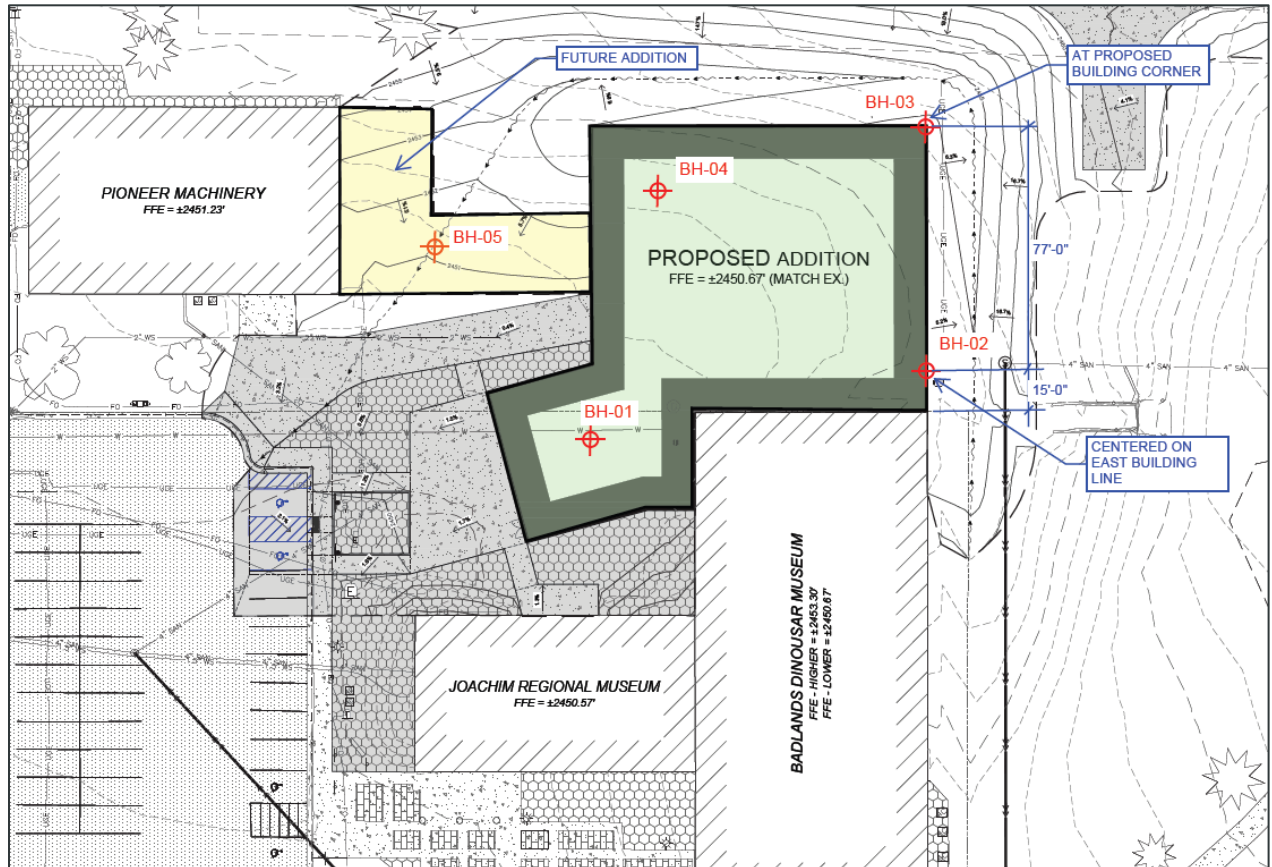


Figure provided by Highlands Engineering, dated November 20, 2024.

A.2. Site Conditions and History

Currently, the site exists as two museum buildings and a bituminous parking lot. The area where the building addition is proposed is currently a vacant grassy field. The site is surrounded by Interstate Highway 94 to the north, Sims Street to the West, Museum Drive East to the south, and a park to the east. Current grades range from about 2250 to 2260 feet. The site generally slopes down towards the south and west.

We reviewed historical aerial photographs dated back to 1957. As seen in Photograph 1 below, the area to the east of the site was disturbed in 1957, likely associated with landfill activities. Since these activities, the current site structures were constructed, as seen in Photograph 2.

We understand the museum was constructed around 1993 and that there are no obvious signs of distress or concerns with the existing building.

Photograph 1. Aerial Photograph of the Site in 1957



Photograph provided by ND Aerial Photography Dissemination Service. Approximate building addition extents in red.

Photograph 2. Aerial Photograph of the Site in 1995



Photograph provided by ND Aerial Photography Dissemination Service. Approximate building addition extents in red.

A.3. Purpose

The purpose of our geotechnical evaluation was to characterize subsurface geologic conditions at the selected boring locations, evaluate their impact on the project, and provide recommendations for the design and construction of the museum building expansion.

A.4. Background Information and Reference Documents

We reviewed the following information:

- Historical aerial photographs obtained from ND Aerial Photography Dissemination Service and Google Earth Pro.
- Preliminary site plan provided by Highlands Engineering, dated November 20, 2024.
- Building aspects and structure loading, provided by Tom Schanandore, PE, dated December 2, 2024.

We have described our understanding of the proposed construction and site to the extent others reported it to us. Depending on the extent of available information, we may have made assumptions based on our experience with similar projects. If we have not correctly recorded or interpreted the project details, the project team should notify us. New or changed information could require additional evaluation, analyses, and/or recommendations.

A.5. Scope of Services

We performed our scope of services for the project in accordance Task 9 of proposal QTB198010, dated June 14, 2023. The following list describes the geotechnical tasks completed in accordance with our authorized scope of services.

- Reviewing the background information and reference documents previously cited.
- Staking and clearing the exploration location of underground utilities. We staked the selected new exploration locations. We acquired the surface elevations and locations with GPS technology. The Soil Boring Location Sketch included in the Appendix shows the approximate locations of the borings.

- Performing 5 standard penetration test (SPT) borings, denoted as ST-1 through ST-5, to nominal depths of 25 feet below grade across the site. As landfill activities were suspected in the vicinity of the site, two borings were requested to extend to nominal depths of 40 feet if natural soils were not encountered.
- Performing laboratory testing on select samples to aid in soil classification and engineering analysis.
- Perform engineering analysis including settlement calculations, bearing capacity calculations, and calculating lateral earth pressures.
- Preparing this report containing a boring location sketch, logs of soil borings, a summary of the soils encountered, results of laboratory tests, and recommendations for structure and pavement subgrade preparation and the design of foundations, floor slabs, exterior slabs, and utilities.

Our scope of services did not include environmental services or testing and our geotechnical personnel performing this evaluation are not trained to provide environmental services or testing. We can provide environmental services or testing at your request.

B. Results

B.1. Geologic Overview

We reviewed the map Surface Geology, Dickinson North Quadrangle, North Dakota. The site is underlain by the Sentinel Butte Formation, which consists of gray to brown siltstone, mudstone, claystone, sandstone, and lignite. We note that the map indicates that a man-made landfill deposit resides very close-by to the east of the site. Our borings did not encounter this deposit.

We based the geologic origins used in this report on the soil types, in-situ and laboratory testing, and available common knowledge of the geological history of the site. Because of the complex depositional history, geologic origins can be difficult to ascertain. We did not perform a detailed investigation of the geologic history for the site.

B.2. Boring Results

Table 2 provides a summary of the soil boring results; in the general order we encountered the strata. Please refer to the Log of Boring sheets in the Appendix for additional details. The Descriptive Terminology sheets in the Appendix include definitions of abbreviations used in Table 2.

Table 2. Subsurface Profile Summary*

Strata	Soil Type - ASTM Classification	Range of Penetration Resistances	Commentary and Details
Pavement section	---	---	- Encountered in Boring ST-1 - Bituminous thickness is about 5 inches. - Apparent aggregate base is about 6 inches.
Topsoil fill	CL	N/A	- Dark brown. - Variable thickness, not present at all borings. - Thicknesses at boring locations varied from about 5 to 8 inches. - Moisture condition generally moist.
Fill	CL	6 to 13 Blows Per Foot (BPF)	- Moisture condition generally moist. - Thicknesses at boring locations varied from about 4 to 7 feet. - Fill consisted of predominantly clay soils. - Existing fill contained trace debris, including plastic fragments.
Alluvial	CL	9 BPF	- Alluvial soils encountered in a stiff condition - Moisture condition generally moist.
Sentinel Butte Formation	Claystone	7 to 23 BPF	- Claystone samples hand classified as lean clay (CL) and fat clay (CH). - Moisture condition generally moist, but locally wet. - Occasional lenses, seams, and layers of lignite.

*Abbreviations defined in the attached Descriptive Terminology sheets.

We did not perform gradation analysis on the apparent aggregate base material encountered as part of the pavement section, in accordance with our scope of work. Therefore, we cannot conclusively determine if the encountered material satisfies a particular specification, and it should not be assumed it is suitable for reuse.

For simplicity in this report, we define existing fill to mean existing, uncontrolled, or undocumented fill.

B.3. Groundwater

Groundwater was observed in Borings ST-03 and ST-05 at depths of 23 and 10 feet, respectively. Water observed in these borings is not indicative of a water table, as, where observed, water was noted to be associated with lignite and scoria layers, which can contain perched water. We note that, due to the clayey nature of the soil and bedrock profile, groundwater may take days or longer to stabilize. Based upon the scope of work, we do not anticipate that groundwater will be encountered during site grading and foundation construction.

If deep excavations are planned, such as for utility installation, we could install piezometers to monitor groundwater levels. Project planning should anticipate seasonal and annual fluctuations of groundwater.

B.4. Laboratory Test Results

The boring logs show the results of laboratory testing we performed, next to the tested sample depth. We also performed unconfined compression testing of soils obtained with thinwall tubes. The Appendix contains the results of these tests. Tables 2 and 3 below present a summary of laboratory testing performed on penetration test and thinwall tube samples.

Table 2. Laboratory Classification Test Results

Geologic Strata	Soil Type - ASTM Classification	Moisture Content, % (ASTM D2216)	Atterberg Limit, (ASTM D4318)	Commentary Based on Selected Sample Results
Existing Fill	CL, SC, OL	11 to 25	LL: 35 PL: 13 PI: 22	- Estimated to be below to above optimum moisture contents. - Atterberg Limit result indicates CL soils.
Alluvium	CL	29	---	Estimated to be above optimum moisture contents.
Sentinel Butte Formation	CL	22 to 41	LL: 34 to 60 PL: 12 to 23 PI: 14 to 40	- Estimated to be slightly to well above optimum moisture contents. - Atterberg Limit results indicate that the deformed claystone classifies as CL and CH soils.

Table 3. Unit Weight and Unconfined Compression Results

Location	Sample Depth (ft)	Classification	Wet Density (pcf)	Dry Density (pcf)	Moisture Content, %	Unconfined Compressive Strength, q_u (tsf)
ST-1	4 to 6	CL	127	104	22	0.46
ST-2	7 to 9	CL	125	97	28	0.35
	22 to 24	CH	123	96	28	1.04
ST-3	12 to 14	CL	124	99	25	2.18
ST-4	9 to 11	CH	125	99	25	1.40
ST-5	7 to 9	CL	124	97	28	0.95

C. Recommendations

C.1. Design and Construction Discussion

Based upon the results of the soil borings, it is our opinion that the site is well-suited to support the building addition on spread footings and ground supported slabs, following a mass excavation to remove existing fill and high plasticity claystone and replace with engineered fill.

C.1.a. Building Subgrade Preparation

For the museum addition, we recommend that soil corrections be performed prior to foundation and building construction. The soil correction will consist of a mass excavation to remove unsuitable soils from below the slab, foundations, and their oversize zones. We define unsuitable soils as topsoil, organic soils, existing structures, pavement, existing fill, and any soft or loose soils.

We also recommend removing high plasticity claystone below the proposed floor level to a depth of 4 feet to reduce the potential for volume changes (shrinking and swelling) with changing moisture content.

After the excavation is extended to 4 feet below floor and our representative confirms that existing fill has been removed, we recommend scarifying the subgrade, moisture conditioning it to near optimum, and re-compacting it in accordance with our recommendations. The subgrade should be protected from freezing, drying, or becoming wet prior to backfilling and floor construction.

Following the mass excavation and subgrade improvement, we recommend that low plasticity or cohesionless onsite or imported soils may be used to re-establish building grades.

To reduce the potential for precipitation to infiltrate through the backfill and saturate the subgrade soil, we recommend that backfill consist of lean clay, silty sand, or clayey sand (minimum 20 percent silt and clay sized particles). We note that “clear” sand or gravel may allow water to rapidly infiltrate.

After following the recommended building subgrade preparation, it is our opinion that the building addition may be supported on spread footing foundations and grade supported slabs. We recommend that a site preparation drawing be incorporated into the contract drawings so that contractors can estimate the cost of these corrections accurately. We would be pleased to assist the preparation of this drawing, and to review the associated plan notes or specifications associated with these improvements.

C.1.b. Reuse of On-Site Soils

The on-site, non-organic, debris free soils (excluding fat clay) may be reused to support foundations, slabs, and pavements, provided it can be adequately compacted to the project specifications. We caution that the onsite soils varied from below to above their probable moisture optimums and moisture conditioning (both wetting and drying) of onsite soils should be anticipated to facilitate compaction of onsite soils.

Fat clay (CH) soils should be segregated and not considered for re-use below the building slab due to the risk of volume change with moisture conditions. If encountered within excavations, we recommend that fat clay soils be relegated to backfilling outside the building footprint in landscaped areas.

C.1.c. Groundwater

Two borings encountered water while the auger was advanced. Where encountered, the water was noted to be in a perched condition, where more permeable lignite and scoria are confined within the claystone profile. If encountered during foundation or utility excavations, we anticipate that perched water may be removed by using conventional sump and pump methods.

We additionally note that, due to the moisture sensitivity of the underlying site soils, water should be expediently removed from site excavations to limit the volume change potential of the underlying soils. We recommend that sumps be excavated adjacent to site excavations to collect and remove water to reduce the potential of saturating the underlying expansive soils.

C.1.d. Construction Disturbance

The onsite clayey soils are highly susceptible to disturbance, especially when wet. Contractors should use caution when performing work, as the once stable subgrade soils may become unstable once disturbed. If subgrade soils become disturbed, we recommend that they be moisture conditioned and recompacted or excavated and replaced with suitable soils or aggregate.

C.2. Site Grading and Subgrade Preparation

C.2.a. Building Subgrade Excavations

As described in Section C.1.a, we recommend removing unsuitable materials from below the building addition foundation, interior slabs, and oversize areas. We define unsuitable materials as existing fill, frozen materials, organic soils, existing structures, existing utilities, vegetation, soft soils, and expansive clays. Table 4 shows the anticipated excavation depths and bottom elevations for each of the building borings.

Table 4. Building Excavation Depths

Location	Measured Surface Elevation (ft)	Anticipated Excavation Depth (ft)	Anticipated Bottom Elevation (ft)*	Anticipated Depth Below Floor Grade – 2250.7 (ft)*
ST-1	2450.6	4	2446 1/2	4
ST-2	2455.5	9	2446 1/2	4**
ST-3	2456.5	10	2446 1/2	4**
ST-4	2453.2	7	2446	4 1/2
ST-5	2451.8	4	2447 1/2	(Future Addition– Not Applicable)

*Excavation bottoms and depths rounded to the nearest 1/2 foot.

**Includes over-excavation of 4 feet below interior slab.

Excavation depths will vary between the borings. Portions of the excavations may also extend deeper than indicated by the borings. A geotechnical representative should observe the excavations to make the necessary field judgments regarding the suitability of the exposed soils.

The contractor should use equipment and techniques to minimize soil disturbance. If soils become disturbed or are wet, we recommend moisture conditioning and surface compaction, or excavating the disturbed soils and replacing them with suitable soils or imported aggregate.

In addition, we recommend the following steps be performed following the over-excavation to remove unsuitable soils from below the interior slab on grade:

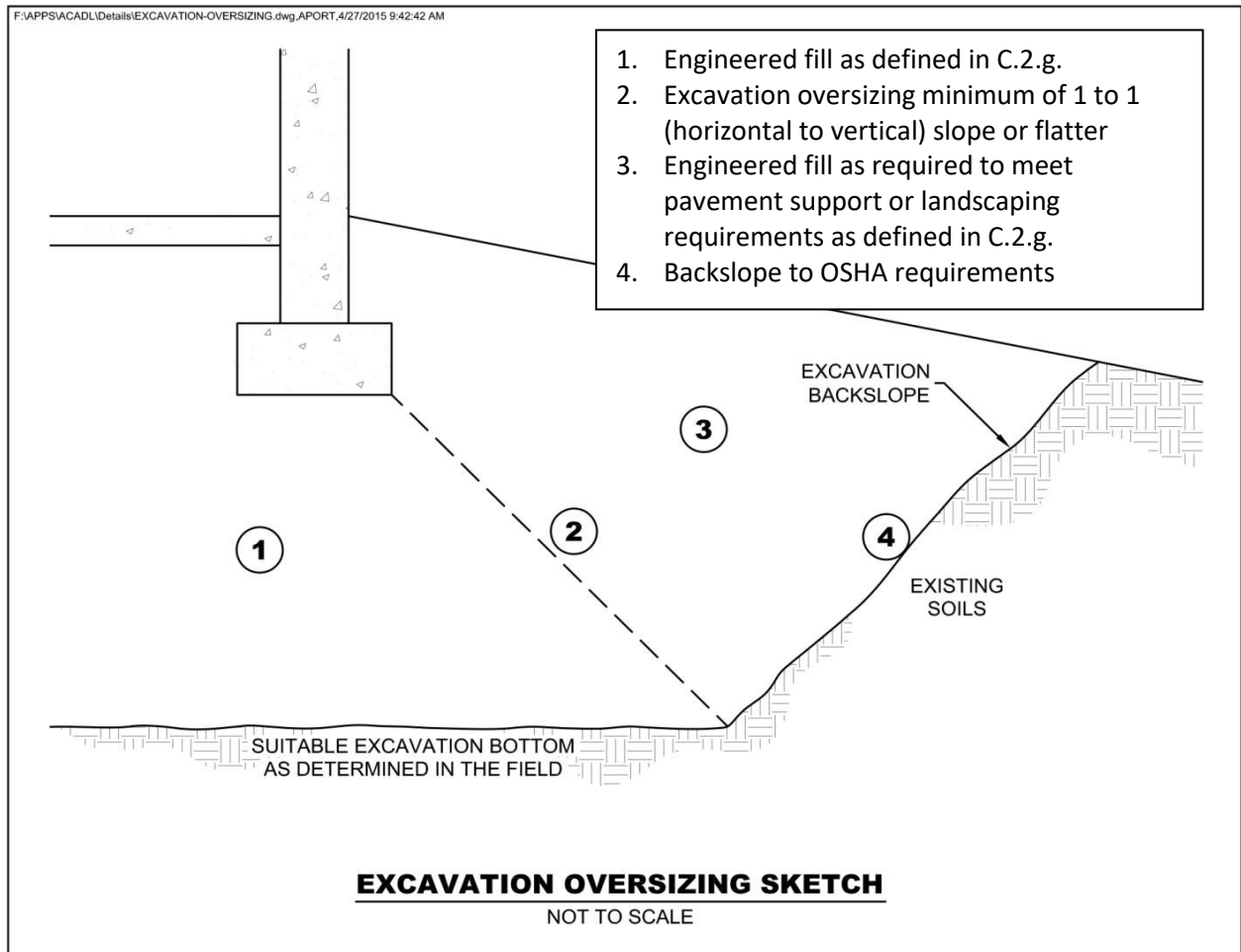
1. Scarify the building-pad-excavation-bottom to a depth of at least 6 inches.
2. Moisture condition the exposed subgrade soils to within 0 to 4 percentage points above the soils' optimum moisture content.
3. Compact the subgrade soils to a minimum of 95 percent of the material's Standard Proctor maximum dry density (determined in accordance with ASTM D698).

Note that following the excavation subgrade preparation, the prepared soils should be protected from changes in moisture condition. If the soils are allowed to dry out or become saturated, they should be re-conditioned and compacted per the above steps prior to placement of additional fill.

C.2.b. Excavation Oversizing

When removing unsuitable materials below structures or pavements, we recommend the excavation extend outward and downward at a slope of 1H:1V (horizontal: vertical) or flatter. See Figure 2 for an illustration of excavation oversizing.

Figure 2. Generalized Illustration of Oversizing



C.2.c. Excavated Slopes

Based on the borings, we anticipate on-site soils in excavations will consist of mixed native and fill clay soils. These soils are typically considered Type B Soil under OSHA (Occupational Safety and Health Administration) guidelines. OSHA guidelines indicate unsupported excavations in Type B soils should have a gradient no steeper than 1H:1V. Slopes constructed in this manner may still exhibit surface sloughing. OSHA requires an engineer to evaluate slopes or excavations over 20 feet in depth.

An OSHA-approved qualified person should review the soil classification in the field. Excavations must comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P, "Excavations and Trenches." This document states excavation safety is the responsibility of the contractor. The project specifications should reference these OSHA requirements.

C.2.d. Excavation Dewatering

We recommend removing any accumulated water from the excavations prior to placement of fill, foundations, or pavements. Project planning should include temporary sumps and pumps for excavations in the low-permeability onsite clay soils.

C.2.e. Pavement and Exterior Slab Subgrade Preparation

We recommend the following steps for pavement and exterior slab subgrade preparation, understanding the site will have a grade change of 2 feet or less. Note that project planning may need to require additional subcuts to limit frost heave.

1. Strip unsuitable soils consisting of topsoil, organic soils, vegetation, existing structures, and pavements from the area, within 2 feet of the surface of the proposed pavement grade.
2. Have a geotechnical representative observe the excavated subgrade to evaluate if additional subgrade improvements are necessary.
3. Slope subgrade soils to areas of sand or drain tile to allow the removal of accumulating water.
4. Place pavement engineered fill to grade and compact in accordance with Section C.2.g to bottom of pavement and exterior slab section. See Section C.7 for additional considerations related to frost heave.
5. Proofroll the pavement or exterior slab subgrade as described in Section C.2.h.

Note, we recommend sloping subgrade soils to promote drainage and removal of accumulated water.

C.2.f. Pavement Subgrade Proofroll

After preparing the subgrade as described above and prior to the placement of the aggregate base, we recommend proofrolling the subgrade soils with a fully loaded tandem-axle truck. We also recommend having a geotechnical representative observe the proofroll. Areas that fail the proofroll likely indicate soft or weak areas that will require additional soil correction work to support pavements.

The contractor should correct areas that display excessive yielding or rutting during the proofroll, as determined by the geotechnical representative. Possible options for subgrade correction include moisture conditioning and recompaction, subcutting and replacement with soil or crushed aggregate, chemical stabilization and/or geotextiles. We recommend performing a second proofroll after the aggregate base material is in place, and prior to placing bituminous or concrete pavement.

C.2.g. Engineered Fill Materials and Compaction

Table 5 below contains our recommendations for engineered fill materials.

Table 5. Engineered Fill Materials*

Locations To Be Used	Engineered Fill Classification	Possible Soil Type Descriptions	Gradation	Additional Requirements
- Below foundations - Below interior and exterior slabs and pavements	Structural fill, pavement fill	SM, SC, CL	100% passing 2-inch sieve >20% passing the #200 sieve	< 2% Organic Content (OC) Plasticity Index (PI) < 25%
- Drainage layer - Non-frost-susceptible	- Free-draining - Non-frost-susceptible fill	GP, SP	100% passing 1-inch sieve < 50% passing #40 sieve < 5% passing #200 sieve	< 2% OC
Behind below-grade walls, beyond drainage layer	Retained fill	SP, SP-SM, SM, SC	100% passing 3-inch sieve < 20% passing #200 sieve	< 2% OC Plasticity Index (PI) < 4%
Below landscaped surfaces, where subsidence is not a concern	Non-structural fill	Any	100% passing 6-inch sieve	< 10% OC

* More select soils comprised of coarse sands with < 5% passing #200 sieve may be needed to accommodate work occurring in periods of wet or freezing weather.

For large self-propelled compactors, we recommend spreading engineered fill in loose lifts of no more than 12 inches thick. For walk-behind compactors, we recommend spreading engineered fill in loose lifts of no more than 6 inches thick. We recommend compacting engineered fill in accordance with the criteria presented below in Table 6. The project documents should specify relative compaction of engineered fill, based on the structure located above the engineered fill, and vertical proximity to that structure.

Table 6. Compaction Recommendations Summary

Reference	Relative Compaction, percent (ASTM D698 – Standard Proctor)	Moisture Content Variance from Optimum, percentage points	
		< 12% Passing #200 Sieve (SP, SP-SM)	> 12% Passing #200 Sieve (CL, SC, SM)
Below foundations and oversizing zones	98	As needed to facilitate compaction	-1 to +3
Below interior and exterior slabs and pavements	95	As needed to facilitate compaction	-1 to +3
Below landscaped surfaces	90	As needed to facilitate compaction	-2 to +5
Adjacent to exterior walls	95	As needed to facilitate compaction	-1 to +3

The project documents should not allow the contractor to use frozen material as engineered fill or to place engineered fill on frozen material. Frost should not penetrate under foundations during construction.

We recommend performing density tests in engineered fill to evaluate if the contractors are effectively compacting the soil and meeting project requirements.

C.2.h. Special Inspections of Soils

We recommend including the site grading and placement of engineered fill within the building pad under the requirements of Special Inspections, as provided in Chapter 17 of the International Building Code. Special Inspection requires observation of soil conditions below engineered fill or footings, evaluations to determine if excavations extend to the anticipated soils, and if engineered fill materials meet requirements for type of engineered fill and compaction condition of engineered fill. A licensed geotechnical engineer should direct the Special Inspections of site grading and engineered fill placement. The purpose of these Special Inspections is to evaluate whether the work is in accordance with the approved Geotechnical Report for the project. Special Inspections should include evaluation of the subgrade, observing preparation of the subgrade (surface compaction or dewatering, excavation oversizing, placement procedures and materials used for engineered fill, etc.) and compaction testing of the engineered fill.

C.3. Spread Footings

Table 7 below contains our recommended parameters for foundation design. These recommendations are based on the complete removal of existing fill and replacement with engineered fill that conforms to our recommendations.

Table 7. Recommended Spread Footing Design Parameters

Item	Description
Maximum net allowable bearing pressure (psf)	3,000
Minimum factor of safety for bearing capacity failure	3.0
Minimum width (inches) Perimeter (Strip) Column (Spread)	18 30 by 30
Minimum embedment below final exterior grade for heated structures (inches)	60
Minimum embedment below final exterior grade for unheated structures or for footings not protected from freezing temperatures during construction (inches)	72
Total estimated settlement (inches)	Less than 1
Differential settlement	Typically about 1/2 of total settlement*

* Actual differential settlement amounts will depend on final loads and foundation layout. When tying into the existing buildings, the total settlement of this new building will be differential to the existing building.

C.4. Construction Adjacent to Existing Structures

C.4.a. Excavations

Excavations for the building addition may extend near or below existing footing grades of the existing museum building. To reduce the risk of undermining the existing foundations, we recommend excavations not extend within the influence zone of the area that extends 1 foot horizontally away from the footing then down and away at a 1H:1V inclination. After reaching the design depth, a geotechnical representative should observe the excavation bottom to evaluate the suitability of the soils near the existing foundation for support of the new floor slab and foundation. We recommend contacting us if excavations need to extend beyond the limits described above, as this may warrant additional construction such as ground improvement, retention, or underpinning.

During construction, the contractor should monitor the slope and structure for movement. We also recommend protecting the slope from disturbance, such as precipitation, runoff, or sloughing. The project team should establish threshold limits of movement and required action, if the movement exceeds the limits.

C.4.b. Footing Depth

New building foundations constructed adjacent to the foundations of the existing building may exert additional stresses on existing foundations. In general, we recommend constructing new foundations to bear at the same elevation as the existing foundations. We also recommend lowering or offsetting foundations so a foundation or its oversize zone does not exert a load on adjacent structures.

C.4.c. Settlement

Due to the existing building not likely settling with the proposed addition, we anticipate that up to approximately 1 inch of differential settlement could occur between the existing building and the addition. To accommodate this settlement, we recommend connecting the addition to the building later in the construction process after most of the dead load is in place on the addition. We also recommend installing expansion joints between the existing building and the addition or designing the structure to accommodate differential movement.

C.5. Below-Grade Walls

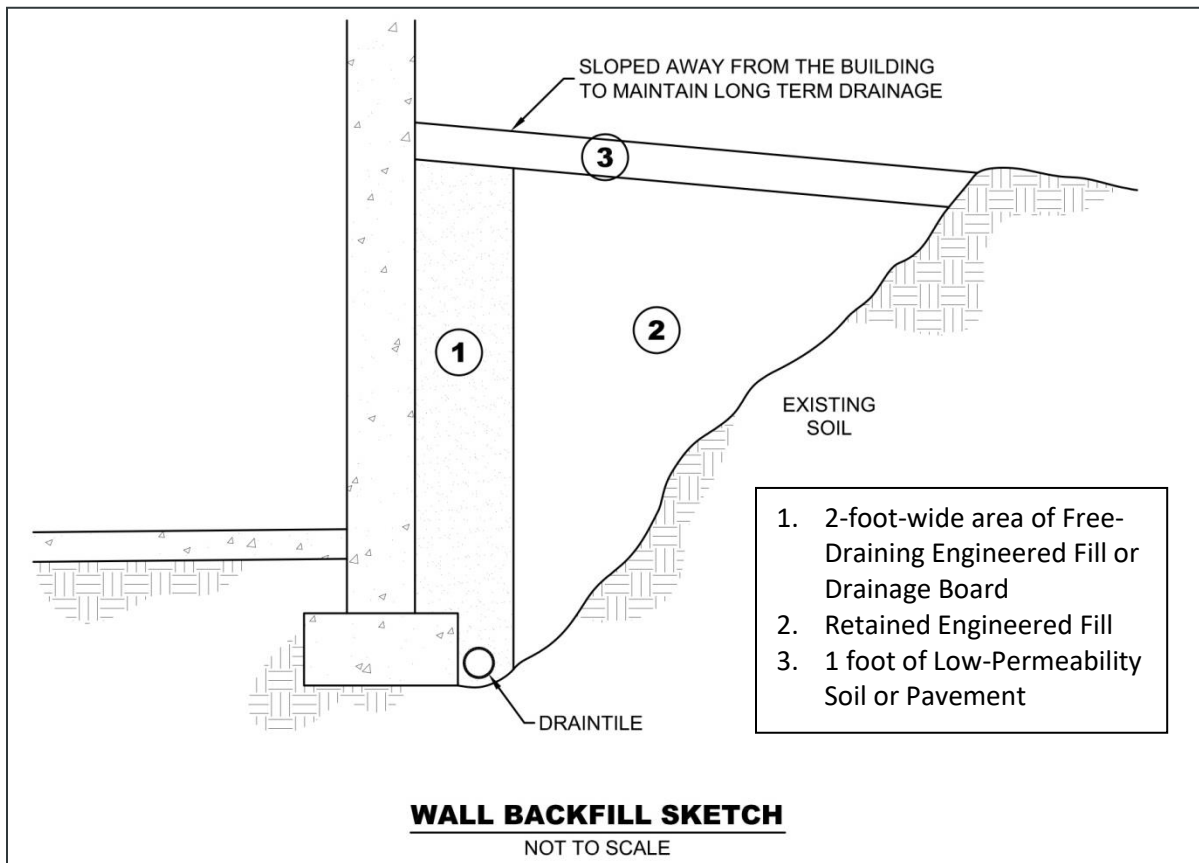
While this will be a slab-on-grade building, we understand some of the exterior walls along the north and east sides of the addition will act as small retaining walls, retaining up to about 4 feet of earth to accommodate site grades along the rear of the addition. For the design of these and other site walls retaining fill, we recommend the following sections be considered.

C.5.a. Drainage Control

We recommend installing drain tile to remove water behind the below-grade walls, at the location shown in Figure 3. The below-grade wall drainage system should also incorporate free-draining, engineered fill or a drainage board placed against the wall and connected to the drain tile.

Even with the use of free-draining, engineered fill, we recommend general waterproofing of below-grade walls that surround occupied or potentially occupied areas because of the potential cost impacts related to seepage after construction is complete.

Figure 3. Generalized Illustration of Wall Engineered Fill



The materials listed in the sketch should meet the definitions in Section C.2.g. Low-permeability material is capable of directing water away from the wall, like clay, topsoil or pavement. The project documents should indicate if the contractor should brace the walls prior to filling and allowable unbalanced fill heights.

As shown in Figure 3, we recommend Zone 2 consist of retained, engineered fill, and this material will control lateral pressures on the wall.

C.5.b. Configuring and Resisting Lateral Loads

We recommend that the wall designs use at-rest earth pressure conditions, as we anticipate that lateral movement and rotation is not acceptable. We have provided earth pressures for both onsite soils and imported granular fill for consideration.

Table 8 presents our recommended lateral coefficients and equivalent fluid pressures for wall design of active, at-rest and passive earth pressure conditions.

The table also provides recommended wet unit weights and internal friction angles. Designs should also consider the slope of any engineered fill, and dead or live loads placed behind the walls within a horizontal distance that is equal to the height of the walls. Our recommended values assume the wall design provides drainage so water cannot accumulate behind the walls. The construction documents should clearly identify what soils the contractor should use for engineered fill of walls.

Table 8. Recommended Below-Grade Wall Design Parameters – Drained Conditions

Retained Soil	Wet Unit Weight (pcf)	Friction Angle (degrees)	At-Rest Lateral Equivalent Fluid Pressure (pcf)	Passive Lateral Equivalent Fluid Pressure* (pcf)
Imported Retained Fill (SP, SP-SM, SM <20% fines)	120	32	55	390
Other fill (SM >20% fines, SC, CL)	125	28	65	350

* Based on Rankine model for soils in a region behind the wall extending at least 2 horizontal feet beyond the bottom outer edges of the wall footings and then rising up and away from the wall at an angle no steeper than 60 degrees from horizontal.

Sliding resistance between the bottom of the footing and the soil can also resist lateral pressures. We recommend assuming a sliding coefficient equal to 0.35 between the concrete and soil.

The values presented in this section are un-factored.

C.6. Interior Slabs

C.6.a. Subgrade Modulus

The anticipated floor subgrade is either sandy lean clay or silty sand that will be placed and compacted in accordance with our report. We recommend using a modulus of subgrade reaction, k, of 100 pounds per square inch per inch of deflection (pci) to design the slabs. If the slab design requires placing 6 inches of compacted crushed aggregate base immediately below the slab, the slab design may increase the k-value by 40 pci. We recommend that the aggregate base materials be free of bituminous. In addition to improving the modulus of subgrade reaction, an aggregate base facilitates construction activities and is less weather sensitive.

C.6.b. Moisture Vapor Protection

Excess transmission of water vapor could cause floor dampness, certain types of floor bonding agents to separate, or mold to form under floor coverings. If project planning includes using floor coverings or coatings, we recommend placing a vapor retarder or vapor barrier immediately beneath the slab. We also recommend consulting with floor covering manufacturers regarding the appropriate type, use and installation of the vapor retarder or barrier to preserve warranty assurances.

C.7. Frost Protection

C.7.a. General

We anticipate that clay soils will underlie exterior slabs. We consider these soils to be moderately to highly frost susceptible. Soils of this type can retain moisture and heave upon freezing. In general, this characteristic is not an issue unless these soils become saturated, due to surface runoff or infiltration, or are excessively wet in situ. Once frozen, unfavorable amounts of general and isolated heaving of the soils and the surface structures supported on them could develop. This type of heaving could affect design drainage patterns and the performance of exterior slabs and pavements, as well as any isolated exterior footings and piers.

Note that general runoff and infiltration from precipitation are not the only sources of water that can saturate subgrade soils and contribute to frost heave. Roof drainage and irrigation of landscaped areas in close proximity to exterior slabs, pavements, and isolated footings and piers, contribute as well.

C.7.b. Frost Heave Mitigation

To address most of the heave related issues, we recommend setting general site grades and grades for exterior surface features to direct surface drainage away from buildings, across large, paved areas and away from walkways. Such grading will limit the potential for saturation of the subgrade and subsequent heaving. General grades should also have enough “slope” to tolerate potential larger areas of heave, which may not fully settle after thawing.

Even small amounts of frost-related differential movement at walkway joints or cracks can create tripping hazards. Project planning can explore several subgrade improvement options to address this condition.

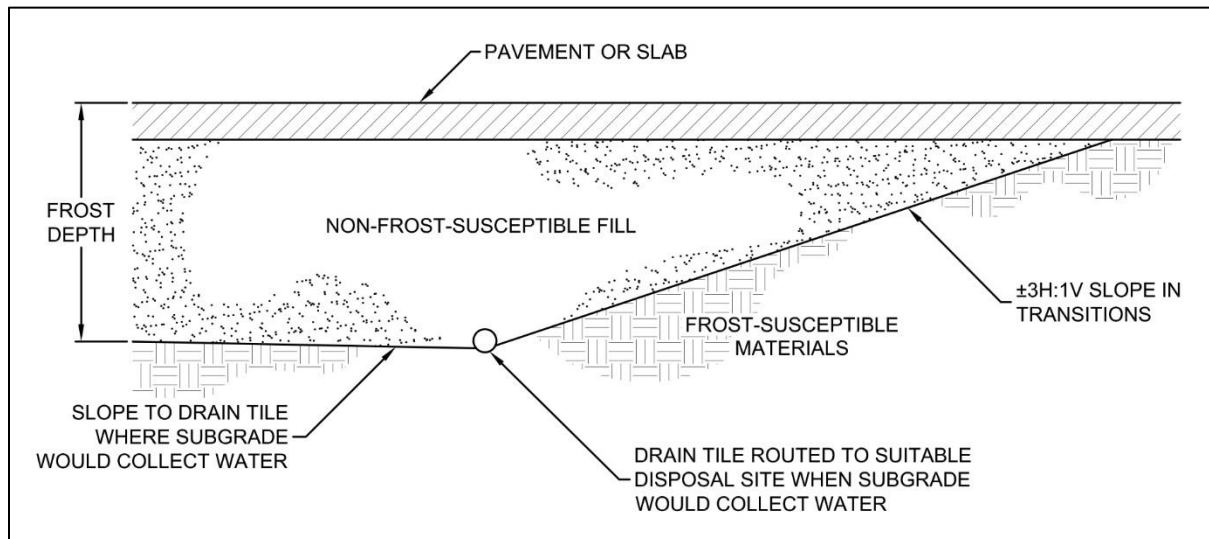
One of the more conservative subgrade improvement options to mitigate potential heave is removing any frost-susceptible soils present below the exterior slab areas down to a minimum depth of 4 feet below subgrade elevations. We recommend filling the resulting excavation with non-frost-susceptible fill.

We also recommend sloping the bottom of the excavation toward one or more collection points to remove any water entering the engineered fill. This approach will not be effective in controlling frost heave without removing the water.

An important geometric aspect of the excavation and replacement approach described above is sloping the banks of the excavations to create a more gradual transition between the unexcavated soils considered frost susceptible and the engineered fill in the excavated area, which is not frost susceptible. The slope allows attenuation of differential movement that may occur along the excavation boundary. We recommend slopes that are 3H:1V, or flatter, along transitions between frost-susceptible and non-frost-susceptible soils.

Figure 4 shows an illustration summarizing some of the recommendations.

Figure 4. Frost Protection Geometry Illustration



Another option is to limit frost heave in critical areas, such as doorways and entrances, via frost-depth footings or localized excavations with sloped transitions between frost-susceptible and non-frost-susceptible soils, as described above.

Over the life of slabs and pavements, cracks will develop, and joints will open up, which will expose the subgrade and allow water to enter from the surface and either saturate or perch atop the subgrade soils. This water intrusion increases the potential for frost heave or moisture-related distress near the crack or joint.

Therefore, we recommend implementing a detailed maintenance program to seal and/or fill any cracks and joints. The maintenance program should give special attention to areas where dissimilar materials abut one another, where construction joints occur and where shrinkage cracks develop.

C.8. Pavements and Exterior Slabs

C.8.a. Design Sections

Our scope of services for this project did not include laboratory tests on subgrade soils to determine a CBR-value for pavement design. Based on our experience with similar clayey soils anticipated at the pavement subgrade elevation, we recommend pavement design assume a CBR-value of 3. Note the contractor may need to perform limited removal of unsuitable or less suitable soils to achieve this value. Table 9 provides recommended pavement sections, based on the soils support and traffic loads.

We based the concrete pavement designs on a modulus of subgrade reaction (k) of 100 pci.

Table 9. Recommended Pavement Sections

Use	Light Duty Bituminous	Medium Duty Concrete
Minimum asphalt thickness (inches)	4	---
Minimum concrete thickness (inches)	---	5
Minimum aggregate base thickness (inches)	8	6

C.8.b. Concrete Pavements

We assumed the concrete pavement sections in Table 9 will have edge support. We recommend placing an aggregate base below the pavement to provide a suitable subgrade for concrete placement, reduce faulting and help dissipate loads. Appropriate mix designs, panel sizing, jointing, doweling and edge reinforcement are critical to performance of rigid pavements. We recommend you contact your civil engineer to determine the final design or consult with us for guidance on these items.

C.8.c. Bituminous Pavement Materials

Appropriate mix designs are critical to the performance of flexible pavements. We can provide recommendations for pavement material selection during final pavement design.

C.8.d. Subgrade Drainage

We recommend installing perforated drainpipes throughout pavement areas at low points, around catch basins, and behind curb in landscaped areas. We also recommend installing drainpipes along pavement and exterior slab edges where exterior grades promote drainage toward those edge areas.

The contractor should place drainpipes in small trenches, extended at least 8 inches below the granular subbase layer, or below the aggregate base material where no subbase is present.

C.8.e. Performance and Maintenance

We based the above pavement designs on a 20-year performance life. This is the amount of time before we anticipate the pavement will require reconstruction. This performance life assumes routine maintenance, such as seal coating and crack sealing. The actual pavement life will vary depending on variations in weather, traffic conditions and maintenance.

It is common to place the non-wear course of bituminous and then delay placement of wear course. For this situation, we recommend evaluating if the reduced pavement section will have sufficient structure to support construction traffic.

Many conditions affect the overall performance of the exterior slabs and pavements. Some of these conditions include the environment, loading conditions and the level of ongoing maintenance.

With regard to bituminous pavements in particular, it is common to have thermal cracking develop within the first few years of placement, and continue throughout the life of the pavement.

We recommend developing a regular maintenance plan for filling cracks in exterior slabs and pavements to lessen the potential impacts for cold weather distress due to frost heave or warm weather distress due to wetting and softening of the subgrade.

C.9. Utilities

C.9.a. Subgrade Stabilization

Earthwork activities associated with utility installations located inside the building area should adhere to the recommendations in Section C.2.g.

For exterior utilities, we anticipate the soils at typical invert elevations will be suitable for utility support. However, if construction encounters unfavorable conditions such as soft clay, organic soils or perched water at invert grades, the unsuitable soils may require some additional subcutting and replacement with sand or crushed rock to prepare a proper subgrade for pipe support. Project design and construction should not place utilities within the 1H:1V oversizing of foundations.

C.9.b. Corrosion Potential

Based on our experience, the soils encountered by the borings are moderately corrosive to metallic conduits, but only marginally corrosive to concrete. We recommend specifying non-corrosive materials or providing corrosion protection, unless project planning chooses to perform additional tests to demonstrate the soils are not corrosive.

C.10. Equipment Support

The recommendations included in the report may not be applicable to equipment used for the construction and maintenance of this project. We recommend evaluating subgrade conditions in areas of shoring, scaffolding, cranes, pumps, lifts, and other construction equipment prior to mobilization to determine if the exposed materials are suitable for equipment support, or require some form of subgrade improvement. We also recommend project planning consider the effect that loads applied by such equipment may have on structures they bear on or surcharge – including pavements, buried utilities, below-grade walls, etc. We can assist you in this evaluation.

D. Procedures

D.1. Penetration Test Borings

We drilled the penetration test borings with a CME 75 truck-mounted core and auger drill equipped with hollow-stem auger. We performed the borings in general accordance with ASTM D6151 taking penetration test samples at 2 1/2- or 5-foot intervals in general accordance with ASTM D1586. We collected thin-walled tube samples in general accordance with ASTM D1587 at selected depths. The boring logs show the actual sample intervals and corresponding depths.

We sealed penetration test boreholes meeting the Minnesota Department of Health (MDH) Environmental Borehole criteria with an MDH-approved grout. We will forward/forwarded a sealing record (or sealing records) for those boreholes to the Minnesota Department of Health Well Management Section. A copy of the sealing record follows (or copies of the sealing records follow) the Log of Boring sheets in the Appendix.

D.2. Exploration Logs

D.2.a. Log of Boring Sheets

The Appendix includes Log of Boring sheets for our penetration test borings. The logs identify and describe the penetrated geologic materials, and present the results of penetration resistance tests performed. The logs also present the results of laboratory tests performed on penetration test samples, and groundwater measurements. The Appendix also includes a Fence Diagram intended to provide a summarized cross-sectional view of the soil profile across the site.

We inferred strata boundaries from changes in the penetration test samples and the auger cuttings. Because we did not perform continuous sampling, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations, and the boundaries themselves may occur as gradual rather than abrupt transitions.

D.2.b. Geologic Origins

We assigned geologic origins to the materials shown on the logs and referenced within this report, based on: (1) a review of the background information and reference documents cited above, (2) visual classification of the various geologic material samples retrieved during the course of our subsurface exploration, (3) penetration resistance and other in-situ testing performed for the project, (4) laboratory test results, and (5) available common knowledge of the geologic processes and environments that have impacted the site and surrounding area in the past.

D.3. Material Classification and Testing

D.3.a. Visual and Manual Classification

We visually and manually classified the geologic materials encountered based on ASTM D2488. When we performed laboratory classification tests, we used the results to classify the geologic materials in accordance with ASTM D2487. The Appendix includes a chart explaining the classification system we used.

D.3.b. Laboratory Testing

The exploration logs in the Appendix note most of the results of the laboratory tests performed on geologic material samples. The remaining laboratory test results follow the exploration logs. We performed the tests in general accordance with ASTM procedures.

D.4. Groundwater Measurements

The drillers checked for groundwater while advancing the penetration test borings, and again after auger withdrawal. We then filled the boreholes as noted on the boring logs.

E. Qualifications

E.1. Variations in Subsurface Conditions

E.1.a. Material Strata

We developed our evaluation, analyses, and recommendations from a limited amount of site and subsurface information. It is not standard engineering practice to retrieve material samples from exploration locations continuously with depth. Therefore, we must infer strata boundaries and thicknesses to some extent. Strata boundaries may also be gradual transitions, and project planning should expect the strata to vary in depth, elevation, and thickness, away from the exploration locations.

Variations in subsurface conditions present between exploration locations may not be revealed until performing additional exploration work, or starting construction. If future activity for this project reveals any such variations, you should notify us so that we may reevaluate our recommendations.

Such variations could increase construction costs, and we recommend including a contingency to accommodate them.

E.1.b. Groundwater Levels

We made groundwater measurements under the conditions reported herein and shown on the exploration logs, and interpreted in the text of this report. Note that the observation periods were relatively short, and project planning can expect groundwater levels to fluctuate in response to rainfall, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

E.2. Continuity of Professional Responsibility

E.2.a. Plan Review

We based this report on a limited amount of information, and we made a number of assumptions to help us develop our recommendations. We should be retained to review the geotechnical aspects of the designs and specifications.

This review will allow us to evaluate whether we anticipated the design correctly, if any design changes affect the validity of our recommendations, and if the design and specifications correctly interpret and implement our recommendations.

E.2.b. Construction Observations and Testing

We recommend retaining Braun Intertec to perform the required observations and testing during construction as part of the ongoing geotechnical evaluation. This will allow us to correlate the subsurface conditions exposed during construction with those encountered by the borings and provide professional continuity from the design phase to the construction phase. If we do not perform observations and testing during construction, it becomes the responsibility of others to validate the assumption made during the preparation of this report and to accept the construction-related geotechnical engineer-of-record responsibilities.

E.3. Use of Report

This report is for the exclusive use of the addressed parties. Without written approval, we assume no responsibility to other parties regarding this report. Our evaluation, analyses and recommendations may not be appropriate for other parties or projects.

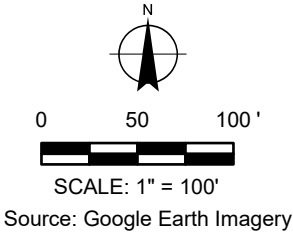
E.4. Standard of Care

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

Appendix



 Standard Penetration Test Boring



**BRAUN
INTERTEC**
The Science You Build On.
2908 Morrison Ave. Suite 3
Bismarck, ND 58504
701.204.8875
braunintertec.com

Project No: B2406649.06	
Drawing No: Boring Location Sketch	
Drawn By:	ZS
Date Drawn:	1/10/2025
Checked By:	IB
Last Modified:	1/10/2025

202320 - Dickinson Museum Expansion
Museum Drive E
Dickinson, North Dakota

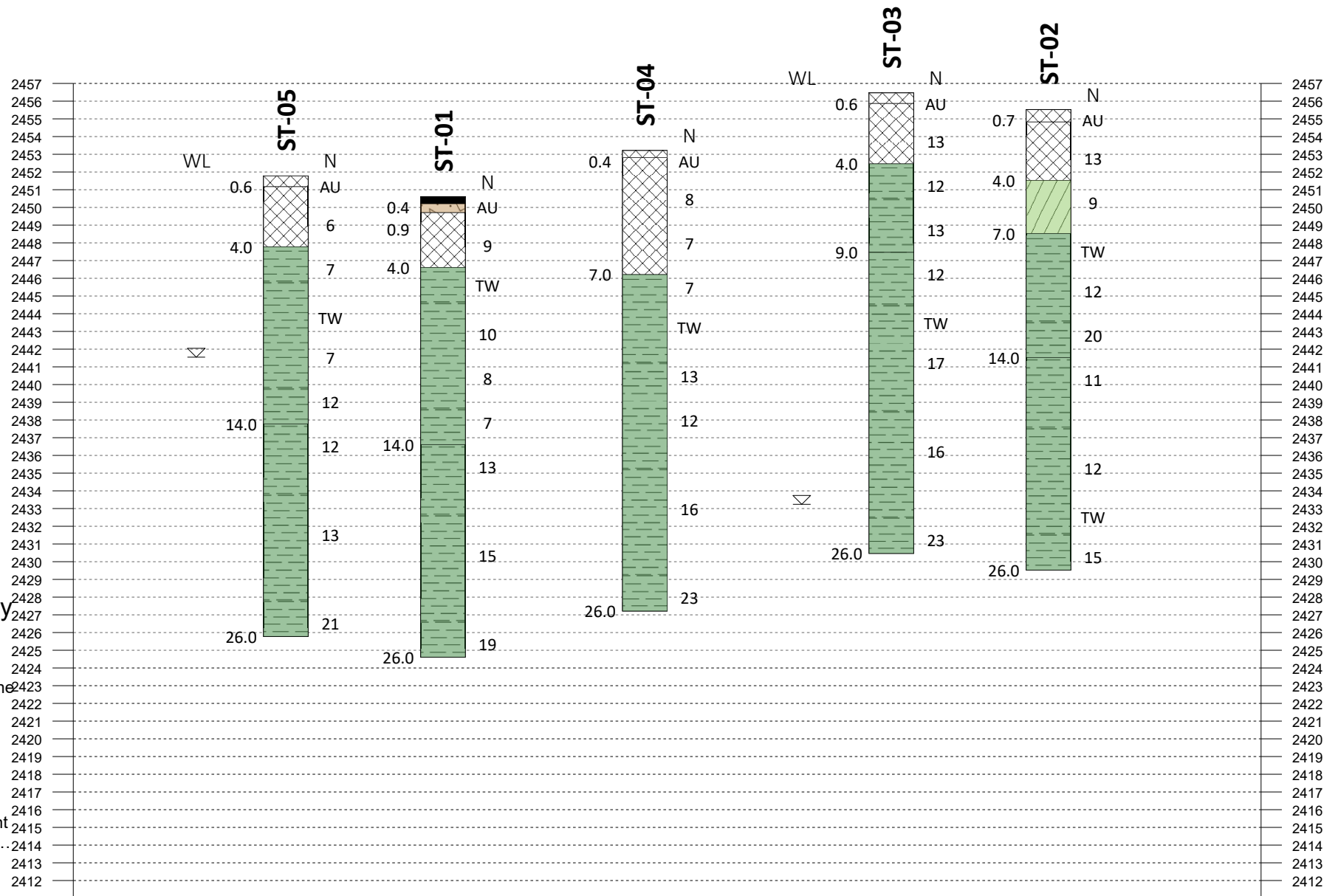
**Boring Location
Sketch**



Legend Key

-  Fill
-  Claystone
-  CL
-  Asphalt
-  Apparent Aggreg...

2411.00



SECTION LINE 1

Fence Diagram

Geotechnical Evaluation
Dickinson Museum Expansion

Dickinson, North Dakota

Project ID: B2406649.06
Vert. Scale: 1"= 8'
Hor. Scale: NTS
Date: 01/21/2025

Project Number B2406649.06 Geotechnical Evaluation Dickinson Museum Expansion Dickinson, North Dakota					BORING: ST-01		
					LOCATION: Captured with RTK GPS.		
					DATUM: WGS 84		
					LATITUDE: 46.895021	LONGITUDE: -102.783518	
DRILLER: B.Hattle	LOGGED BY: I.Becket		START DATE: 01/06/25	END DATE: 01/06/25			
SURFACE ELEVATION: 2450.6 ft	RIG: 7520	METHOD: 3 1/4" HSA	SURFACING: Bituminous	WEATHER: Clear			
Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
2450.2 0.4		BITUMINOUS, 5 inches		AU			
2449.7 0.9		APPARENT AGGREGATE BASE, 6 inches					
2446.6 4.0		FILL: SANDY LEAN CLAY (CL), trace roots, trace plastic, light gray, moist		8-6-3 (9) 10"		25	
		SENTINEL BUTTE FORMATION, CLAYSTONE, light gray to light brown, moist, decomposed, very soft, hand deformed sample classified as "Lean Clay (CL)"	5	TW 9"		22	LL=34, PL=12, PI=22 DD=104 pcf WD=127 pcf q _u =0.46 tsf
				4-5-5 (10) 13"		30	
			10	3-5-3 (8) 12"		36	
				4-3-4 (7) 13"		27	
2436.6 14.0		SENTINEL BUTTE FORMATION, CLAYSTONE, brown to light gray, moist, decomposed, very soft, hand deformed sample classified as "Fat Clay (CH)"	15	6-6-7 (13) 12"		30	
				6-7-8 (15) 16"		30	
			25	6-10-9 (19) 18"		30	
2424.6 26.0		END OF BORING					Water not observed while drilling.
		Boring then backfilled with auger cuttings					
			30				

Project Number B2406649.06 Geotechnical Evaluation Dickinson Museum Expansion Dickinson, North Dakota					BORING: ST-02		
					LOCATION: Captured with RTK GPS.		
					DATUM: WGS 84		
					LATITUDE: 46.895086	LONGITUDE: -102.783091	
DRILLER: B.Hattle		LOGGED BY: I.Becket		START DATE: 01/06/25		END DATE: 01/06/25	
SURFACE ELEVATION: 2455.5 ft		RIG: 7520	METHOD: 3 1/4" HSA		SURFACING: Grass		WEATHER: Clear
Elev./Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
2454.8 0.7		SANDY LEAN CLAY (CL), trace roots, dark brown, dry (TOPSOIL FILL) FILL: SANDY LEAN CLAY (CL), dark brown, moist		AU			
2451.5 4.0		LEAN CLAY with SAND (CL), light gray, moist, stiff (ALLUVIUM)	5	4-6-7 (13) 10"		14	
2448.5 7.0		SENTINEL BUTTE FORMATION, CLAYSTONE, light gray, moist, decomposed, very soft, with Silt lenses, hand deformed sample classified as "Lean Clay (CL)"	10	TW 23"		28	LL=37, PL=23, PI=14 DD=97 pcf WD=125 pcf q _u =0.35 tsf
2441.5 14.0		SENTINEL BUTTE FORMATION, CLAYSTONE, light gray, moist, decomposed, very soft, trace Lignite lenses, hand deformed sample classified as "Fat Clay (CH)"	15	4-5-6 (11) 18"		30	
			20	5-6-6 (12) 18"		30	
			25	TW 15"		28	DD=96 pcf WD=123 pcf q _u =1.04 tsf
2429.5 26.0				8-7-8 (15) 13"		27	
		END OF BORING					Water not observed while drilling.
		Boring then backfilled with auger cuttings					
			30				

Project Number B2406649.06 Geotechnical Evaluation Dickinson Museum Expansion Dickinson, North Dakota					BORING: ST-03		
					LOCATION: Captured with RTK GPS.		
					DATUM: WGS 84		
					LATITUDE: 46.895295	LONGITUDE: -102.783159	
DRILLER: B.Hattle		LOGGED BY: I.Becket		START DATE: 01/06/25	END DATE: 01/06/25		
SURFACE ELEVATION: 2456.5 ft		RIG: 7520	METHOD: 3 1/4" HSA	SURFACING: Grass		WEATHER: Clear	
Elev./Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
2455.9 0.6		SANDY LEAN CLAY (CL), with roots, dark brown, moist (TOPSOIL FILL) FILL: SANDY LEAN CLAY (CL), brown, moist		AU			
2452.5 4.0				11-7-6 (13) 12"		11	
2447.5 9.0		SENTINEL BUTTE FORMATION, CLAYSTONE, light brown, moist, decomposed, very soft, hand deformed sample classified as "Fat Clay (CH)"	5 	8-6-6 (12) 14"		33	LL=60, PL=20, PI=40
				5-6-7 (13) 16"		31	
			SENTINEL BUTTE FORMATION, CLAYSTONE, brown to gray, moist, decomposed, very soft, hand deformed sample classified as "Lean Clay (CL)"	10 	4-5-7 (12) 13"		27
				TW 24"		25	DD=99 pcf WD=124 pcf q _u =2.18 tsf
			15 	4-8-9 (17) 16"			
			20 	4-7-9 (16) 18"			
		Lignite lenses at 20 feet					
2430.5 26.0			25 	7-11-12 (23) 10"			
		END OF BORING					Water observed at 23.0 feet while drilling.
		Boring then backfilled with auger cuttings					
			30				

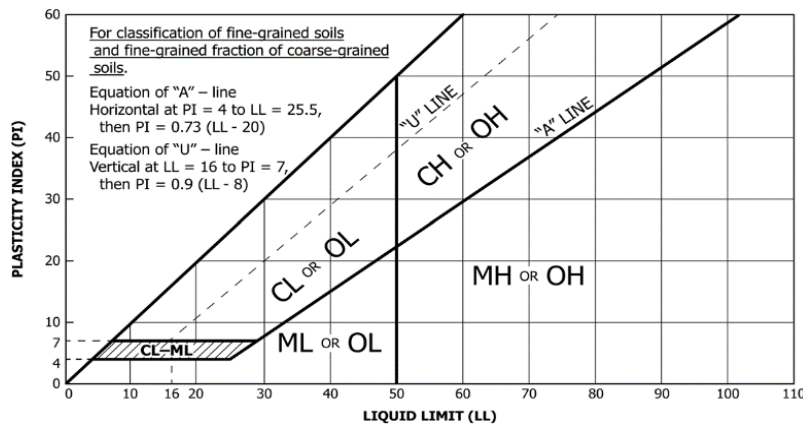
Project Number B2406649.06 Geotechnical Evaluation Dickinson Museum Expansion Dickinson, North Dakota					BORING: ST-04		
					LOCATION: Captured with RTK GPS.		
					DATUM: WGS 84		
					LATITUDE: 46.895246	LONGITUDE: -102.783433	
DRILLER: B.Hattle		LOGGED BY: I.Becket		START DATE: 01/06/25	END DATE: 01/06/25		
SURFACE ELEVATION: 2453.2 ft		RIG: 7520	METHOD: 3 1/4" HSA	SURFACING: Grass		WEATHER: Clear	
Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks
2452.8 0.4		SANDY LEAN CLAY with GRAVEL (CL), trace roots, dark brown, moist (TOPSOIL FILL) FILL: SANDY LEAN CLAY (CL), dark brown to brown, moist	AU	4-4-4 (8) 13"		18	LL=35, PL=13, PI=22
2446.2 7.0		SENTINEL BUTTE FORMATION, CLAYSTONE, brown to gray, moist, decomposed, very soft, hand deformed sample classified as "Fat Clay (CH)"		3-4-3 (7) 12"			
			5	4-4-3 (7) 13"		32	LL=50, PL=17, PI=33
			10	TW 23"		25	DD=99 pcf WD=125 pcf q _u =1.4 tsf
				6-6-7 (13) 14"			
		Lignite seams at 15 feet	15	4-6-6 (12) 18"		32	
			20	5-6-10 (16) 17"			
2427.2 26.0		END OF BORING	25	8-10-13 (23) 16"			Water not observed while drilling.
		Boring then backfilled with auger cuttings	30				

Project Number B2406649.06 Geotechnical Evaluation Dickinson Museum Expansion Dickinson, North Dakota					BORING: ST-05		
					LOCATION: Captured with RTK GPS.		
					DATUM: WGS 84		
					LATITUDE: 46.895195	LONGITUDE: -102.783715	
DRILLER: B.Hattle		LOGGED BY: I.Becket		START DATE: 01/06/25	END DATE: 01/06/25		
SURFACE ELEVATION: 2451.8 ft		RIG: 7520	METHOD: 3 1/4" HSA	SURFACING: Grass		WEATHER: Clear	

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q _p tsf	MC %	Tests or Remarks	
2451.2 0.6		SANDY LEAN CLAY (CL), trace roots, dark brown, moist (TOPSOIL FILL) FILL: LEAN CLAY with SAND (CL), brown, moist		AU				
2447.8 4.0				5-2-4 (6) 6"		21		
		SENTINEL BUTTE FORMATION, CLAYSTONE, gray to orange, moist, decomposed, very soft, hand deformed sample classified as "Lean Clay (CL)"	5		4-3-4 (7) 10"		25	LL=42, PL=17, PI=25
					TW 22"		28	DD=97 pcf WD=124 pcf q _u =0.95 tsf
		Wet, decomposed Scoria layer at 10 feet	10		2-3-4 (7) 14"		41	
					5-6-6 (12) 13"		32	
2437.8 14.0		SENTINEL BUTTE FORMATION, CLAYSTONE, light gray, moist, decomposed, very soft, hand deformed sample classified as "Fat Clay (CH)"	15		4-5-7 (12) 10"		31	
					6-6-7 (13) 18"		31	
		Lignite lenses at 20 feet	20					
					9-9-12 (21) 4"		30	
2425.8 26.0		END OF BORING					Water observed at 10.0 feet while drilling.	
		Boring then backfilled with auger cuttings						
			30					

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A					Soil Classification	
					Group Symbol	Group Name ^B
Coarse-grained Soils (more than 50% retained on No. 200 sieve)	Gravels (More than 50% of coarse fraction retained on No. 4 sieve)	Clean Gravels (Less than 5% fines ^C)	$C_u \geq 4$ and $1 \leq C_c \leq 3^D$	GW	Well-graded gravel ^E	
			$C_u < 4$ and/or ($C_c < 1$ or $C_c > 3$) ^D	GP	Poorly graded gravel ^E	
		Gravels with Fines (More than 12% fines ^C)	Fines classify as ML or MH	GM	Silty gravel ^{EFG}	
			Fines Classify as CL or CH	GC	Clayey gravel ^{EFG}	
	Sands (50% or more coarse fraction passes No. 4 sieve)	Clean Sands (Less than 5% fines ^H)	$C_u \geq 6$ and $1 \leq C_c \leq 3^D$	SW	Well-graded sand ^I	
			$C_u < 6$ and/or ($C_c < 1$ or $C_c > 3$) ^D	SP	Poorly graded sand ^I	
		Sands with Fines (More than 12% fines ^H)	Fines classify as ML or MH	SM	Silty sand ^{FGI}	
			Fines classify as CL or CH	SC	Clayey sand ^{FGI}	
Fine-grained Soils (50% or more passes the No. 200 sieve)	Silts and Clays (Liquid limit less than 50)	Inorganic	PI > 7 and plots on or above "A" line ^J	CL	Lean clay ^{KLM}	
			PI < 4 or plots below "A" line ^J	ML	Silt ^{KLM}	
		Organic	Liquid Limit – oven dried Liquid Limit – not dried <0.75	OL	Organic clay ^{KLMN} Organic silt ^{KLMQ}	
			PI plots on or above "A" line	CH	Fat clay ^{KLM}	
	Silts and Clays (Liquid limit 50 or more)	Inorganic	PI plots below "A" line	MH	Elastic silt ^{KLM}	
			Liquid Limit – oven dried Liquid Limit – not dried <0.75	OH	Organic clay ^{KLMP} Organic silt ^{KLMQ}	
		Organic	Liquid Limit – oven dried Liquid Limit – not dried <0.75	OH	Organic clay ^{KLMP} Organic silt ^{KLMQ}	
			Highly Organic Soils		Primarily organic matter, dark in color, and organic odor	

- A. Based on the material passing the 3-inch (75-mm) sieve.
B. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
C. Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay
D. $C_u = D_{60} / D_{10}$ $C_c = (D_{30})^2 / (D_{10} \times D_{60})$
E. If soil contains $\geq 15\%$ sand, add "with sand" to group name.
F. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
G. If fines are organic, add "with organic fines" to group name.
H. Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay
I. If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.
J. If Atterberg limits plot in hatched area, soil is CL-ML, silty clay.
K. If soil contains 15 to < 30% plus No. 200, add "with sand" or "with gravel", whichever is predominant.
L. If soil contains $\geq 30\%$ plus No. 200, predominantly sand, add "sandy" to group name.
M. If soil contains $\geq 30\%$ plus No. 200 predominantly gravel, add "gravelly" to group name.
N. PI ≥ 4 and plots on or above "A" line.
O. PI < 4 or plots below "A" line.
P. PI plots on or above "A" line.
Q. PI plots below "A" line.



DD Dry density, pcf
WD Wet density, pcf
P200 % Passing #200 sieve
MC Moisture content, %
OC Organic content, %

Laboratory Tests

q_p Pocket penetrometer strength, tsf
q_u Unconfined compression test, tsf
LL Liquid limit
PL Plastic limit
PI Plasticity index

Particle Size Identification

Boulders..... over 12"
Cobbles..... 3" to 12"
Gravel
Coarse..... 3/4" to 3" (19.00 mm to 75.00 mm)
Fine..... No. 4 to 3/4" (4.75 mm to 19.00 mm)
Sand
Coarse..... No. 10 to No. 4 (2.00 mm to 4.75 mm)
Medium..... No. 40 to No. 10 (0.425 mm to 2.00 mm)
Fine..... No. 200 to No. 40 (0.075 mm to 0.425 mm)
Silt..... No. 200 (0.075 mm) to .005 mm
Clay..... < .005 mm

Relative Proportions^{L M}

trace..... 0 to 5%
little..... 6 to 14%
with..... $\geq 15\%$

Inclusion Thicknesses

lens..... 0 to 1/8"
seam..... 1/8" to 1"
layer..... over 1"

Apparent Relative Density of Cohesionless Soils

Very loose 0 to 4 BPF
Loose 5 to 10 BPF
Medium dense..... 11 to 30 BPF
Dense..... 31 to 50 BPF
Very dense..... over 50 BPF

Consistency of Cohesive Soils Blows Per Foot Approximate Unconfined Compressive Strength

Very soft..... 0 to 1 BPF..... < 0.25 tsf
Soft..... 2 to 4 BPF..... 0.25 to 0.5 tsf
Medium..... 5 to 8 BPF..... 0.5 to 1 tsf
Stiff..... 9 to 15 BPF..... 1 to 2 tsf
Very Stiff..... 16 to 30 BPF..... 2 to 4 tsf
Hard..... over 30 BPF..... > 4 tsf

Moisture Content:

Dry: Absence of moisture, dusty, dry to the touch.
Moist: Damp but no visible water.
Wet: Visible free water, usually soil is below water table.

Drilling Notes:

Blows/N-value: Blows indicate the driving resistance recorded for each 6-inch interval. The reported N-value is the blows per foot recorded by summing the second and third interval in accordance with the Standard Penetration Test, ASTM D1586.

Partial Penetration: If the sampler could not be driven through a full 6-inch interval, the number of blows for that partial penetration is shown as #/x" (i.e. 50/2"). The N-value is reported as "REF" indicating refusal.

Recovery: Indicates the inches of sample recovered from the sampled interval. For a standard penetration test, full recovery is 18", and is 24" for a thinwall/shelby tube sample.

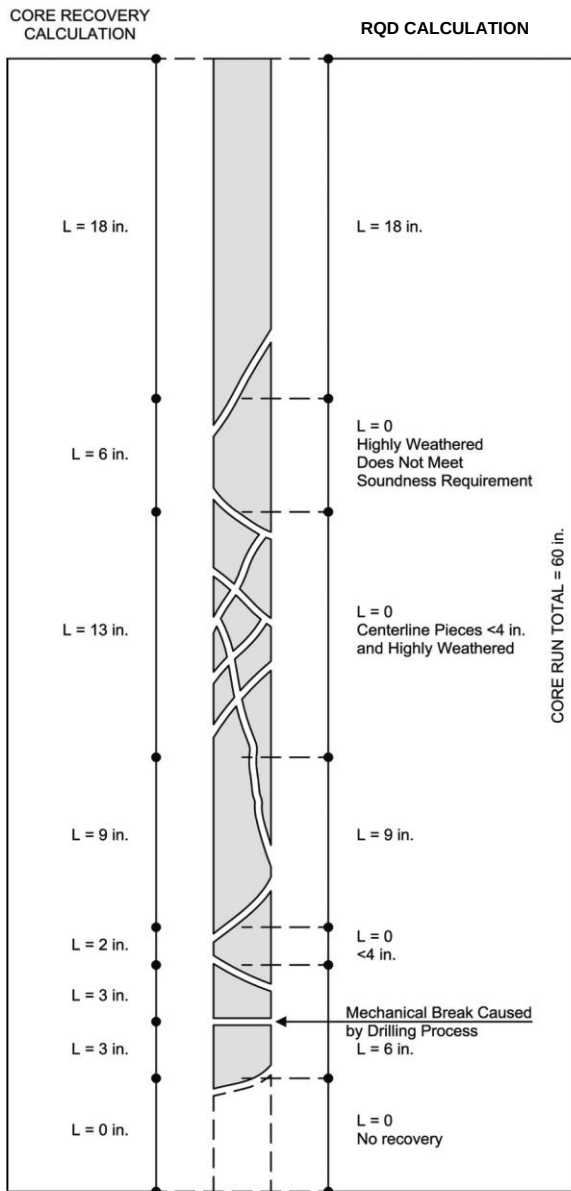
WOH: Indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

WOR: Indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

Water Level: Indicates the water level measured by the drillers either while drilling (, at the end of drilling (, or at some time after drilling ().

Sample Symbols

 Standard Penetration Test
 Modified California (MC)
 Auger
 Grab Sample
 Rock Core
 Thinwall (TW)/Shelby Tube (SH)
 Texas Cone Penetrometer
 Dynamic Cone Penetrometer



Example Calculations

Core Recovery, CR = $\frac{\text{Total length of rock recovered}}{\text{Total core run length}}$

Example: CR = $\frac{(18 + 6 + 13 + 9 + 2 + 3 + 3)}{(60)}$

CR = 90%

RQD = $\frac{\text{Sum of sound pieces 4 inches or larger}}{\text{Total core run length}}$

RQD Percent	Rock Quality
< 25	very poor
25 < 50	poor
50 < 75	fair
75 < 90	good
90 < 100	excellent

Example: RQD = $\frac{(18 + 9 + 6)}{(60)}$

RQD = 55%

Weathering

Unweathered: No evidence of chemical or mechanical alteration.

Slightly weathered: Slight discoloration on surface, slight alteration along discontinuities, less than 10% of rock volume altered.

Moderately Weathered: Discoloration evident, surface pitted and altered with alteration penetrating well below rock surfaces, weathering halos evident, 10% to 50% of the rock altered.

Highly Weathered: Entire mass discolored, alteration pervading nearly all of the rock, with some pockets of slightly weathered rock noticeable, some mineral leached away.

Decomposed: Rock reduced to a soil consistency with relict rock texture, generally molded and crumbled by hand.

Hardness

<i>Very soft:</i>	Can be deformed by hand
<i>Soft:</i>	Can be scratched with a fingernail
<i>Moderately hard:</i>	Can be scratched easily with a knife
<i>Hard:</i>	Can be scratched with difficulty with a knife
<i>Very hard:</i>	Cannot be scratched with a knife

Texture

Sedimentary Rocks:	Grain Size
Coarse grained	2 – 5 mm
Medium grained	0.4 – 2 mm
Fine grained	0.1 – 0.4 mm
Very fine grained	< 0.1 mm

Igneous and Metamorphic Rocks:

Coarse grained	5 mm
Medium grained	1 – 5 mm
Fine grained	0.1 – 1 mm
Aphanitic	< 0.1 mm

Thickness of Bedding

<i>Massive:</i>	3 ft. thick or greater
<i>Thick bedded:</i>	1 to 3 ft. thick
<i>Medium bedded:</i>	4 in. to 1 ft. thick
<i>Thin bedded:</i>	4 in. thick or less

Degree of Fracturing (Jointing)

<i>Unfractured:</i>	Fracture spacing 6 ft. or more
<i>Slightly fractured:</i>	Fracture spacing 2 to 6 ft.
<i>Moderately fractured:</i>	Fracture spacing 8 in. to 2 ft.
<i>Highly fractured:</i>	Fracture spacing 2 in. to 8 in.
<i>Intensely fractured:</i>	Fracture spacing 2 in. or less

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Phone: 701-255-7180

Client:
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38 1st St W
Dickinson, ND 58601

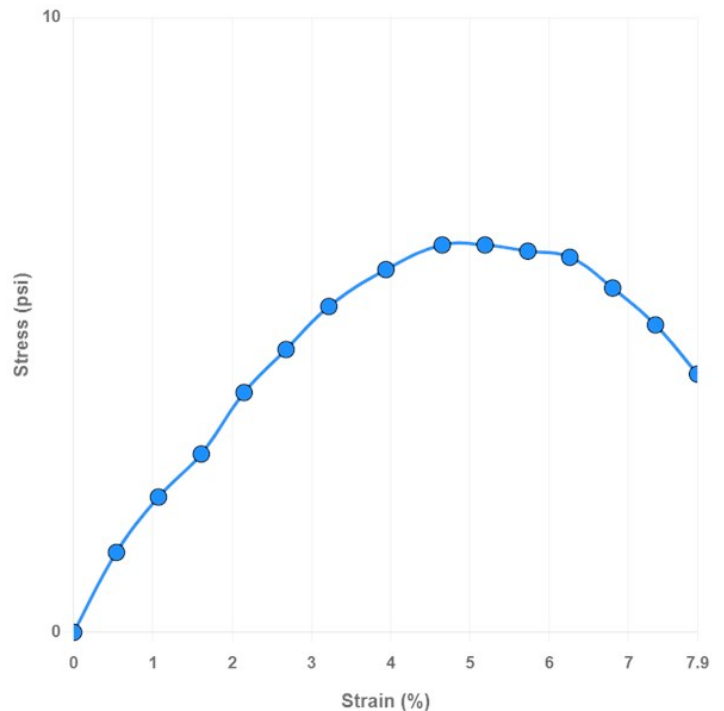
Project:
B2406649.06
202320 - Dickinson Museum Expansion
Dickinson, ND

Sample Information

Sample Number:	638960	Alternate ID:	39 TWT
Sampling Method:	Thinwall Tube ASTM D1587	Depth (ft):	5
Boring Number:	ST-01	Sampled By:	Drill Crew
Location:	Native Soil		
Location Details:	ST-01, 4-6'		
Sample Date:	01/06/2025		
Received Date:	01/13/2025	Lab:	2908 Morrison Ave. Suite 3, Bismarck, ND
Tested Date:	01/15/2025	Tested By:	Austin, Jon

Laboratory Data

Specimen Type:	Intact
Average Diameter (in):	2.841
Average Length (in):	5.589
Height to Diameter Ratio:	1.97
Wet Density (pcf):	127.1
Moisture Specimen:	Entire sample after shear
Moisture Content (%):	21.8
Dry Density (pcf):	104.4
Average Strain Rate (%/min):	1.25
Strain At Failure (%):	4.65
Unconfined Compressive Strength (psi):	6.4
Unconfined Compressive Strength (tsf):	0.46
Shear Strength (tsf):	0.23



Soil Classification: CL LEAN CLAY

General

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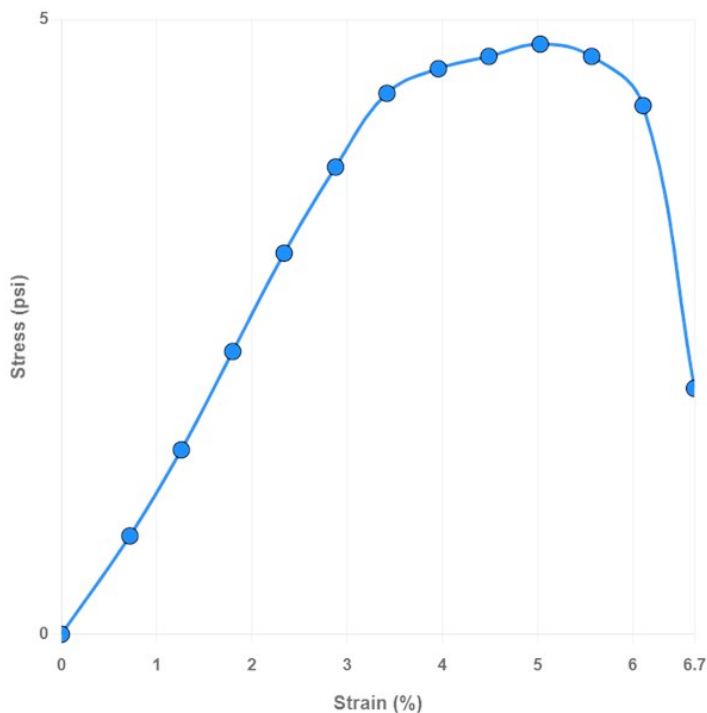
Project:
B2406649.06
202320 - Dickinson Museum Expansion
Dickinson, ND

Sample Information

Sample Number:	638961	Alternate ID:	31 TWT
Sampling Method:	Thinwall Tube ASTM D1587	Depth (ft):	8
Boring Number:	ST-02	Sampled By:	Drill Crew
Location:	Native Soil		
Location Details:	ST-02, 7-9'		
Sample Date:	01/06/2025		
Received Date:	01/13/2025	Lab:	2908 Morrison Ave. Suite 3, Bismarck, ND
Tested Date:	01/15/2025	Tested By:	Austin, Jon

Laboratory Data

Specimen Type:	Intact
Average Diameter (in):	2.783
Average Length (in):	5.562
Height to Diameter Ratio:	2.00
Wet Density (pcf):	124.8
Moisture Specimen:	Entire sample after shear
Moisture Content (%):	28.1
Dry Density (pcf):	97.4
Average Strain Rate (%/min):	1.26
Strain At Failure (%):	5.03
Unconfined Compressive Strength (psi):	4.9
Unconfined Compressive Strength (tsf):	0.35
Shear Strength (tsf):	0.18



Soil Classification: CL LEAN CLAY

General

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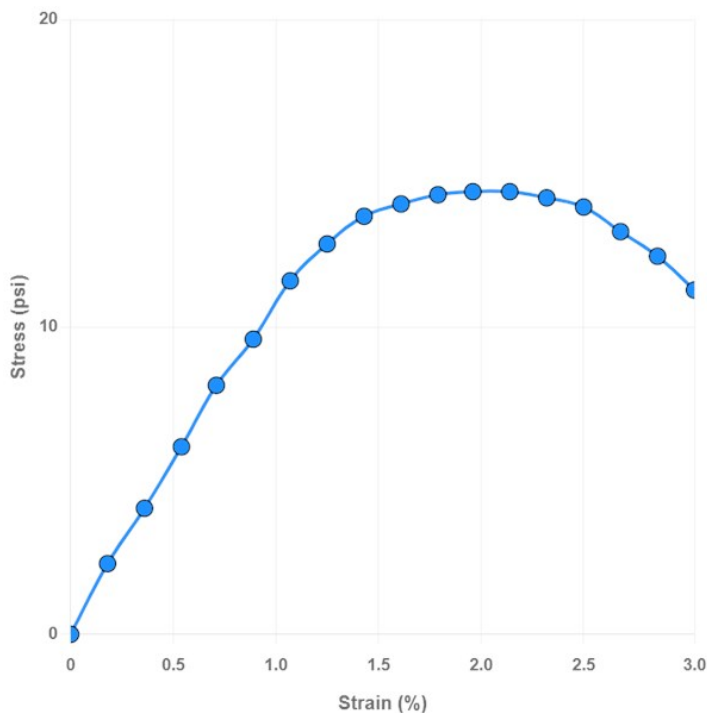
Project:
B2406649.06
202320 - Dickinson Museum Expansion
Dickinson, ND

Sample Information

Sample Number:	638962	Alternate ID:	36 TWT
Sampling Method:	Thinwall Tube ASTM D1587	Depth (ft):	23
Boring Number:	ST-02	Sampled By:	Drill Crew
Location:	Native Soil		
Location Details:	ST-02, 22-24'		
Sample Date:	01/06/2025		
Received Date:	01/13/2025	Lab:	2908 Morrison Ave. Suite 3, Bismarck, ND
Tested Date:	01/15/2025	Tested By:	Austin, Jon

Laboratory Data

Specimen Type:	Intact
Average Diameter (in):	2.851
Average Length (in):	5.598
Height to Diameter Ratio:	1.96
Wet Density (pcf):	123.0
Moisture Specimen:	Entire sample after shear
Moisture Content (%):	27.7
Dry Density (pcf):	96.3
Average Strain Rate (%/min):	1.25
Strain At Failure (%):	1.96
Unconfined Compressive Strength (psi):	14.4
Unconfined Compressive Strength (tsf):	1.04
Shear Strength (tsf):	0.52



Soil Classification: CH FAT CLAY

General

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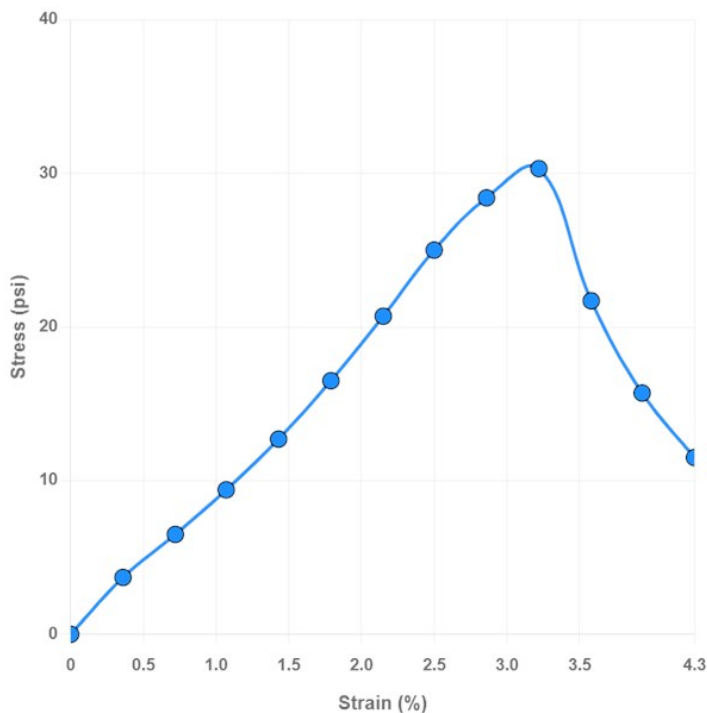
Project:
B2406649.06
202320 - Dickinson Museum Expansion
Dickinson, ND

Sample Information

Sample Number:	638963	Alternate ID:	6 TWT
Sampling Method:	Thinwall Tube ASTM D1587	Depth (ft):	13
Boring Number:	ST-03	Sampled By:	Drill Crew
Location:	Native Soil		
Location Details:	ST-03, 12-14'		
Sample Date:	01/06/2025		
Received Date:	01/13/2025	Lab:	2908 Morrison Ave. Suite 3, Bismarck, ND
Tested Date:	01/15/2025	Tested By:	Austin, Jon

Laboratory Data

Specimen Type:	Intact
Average Diameter (in):	2.861
Average Length (in):	5.594
Height to Diameter Ratio:	1.96
Wet Density (pcf):	124.3
Moisture Specimen:	Entire sample after shear
Moisture Content (%):	25.1
Dry Density (pcf):	99.4
Average Strain Rate (%/min):	1.25
Strain At Failure (%):	3.22
Unconfined Compressive Strength (psi):	30.3
Unconfined Compressive Strength (tsf):	2.18
Shear Strength (tsf):	1.09



Soil Classification: CL LEAN CLAY

General

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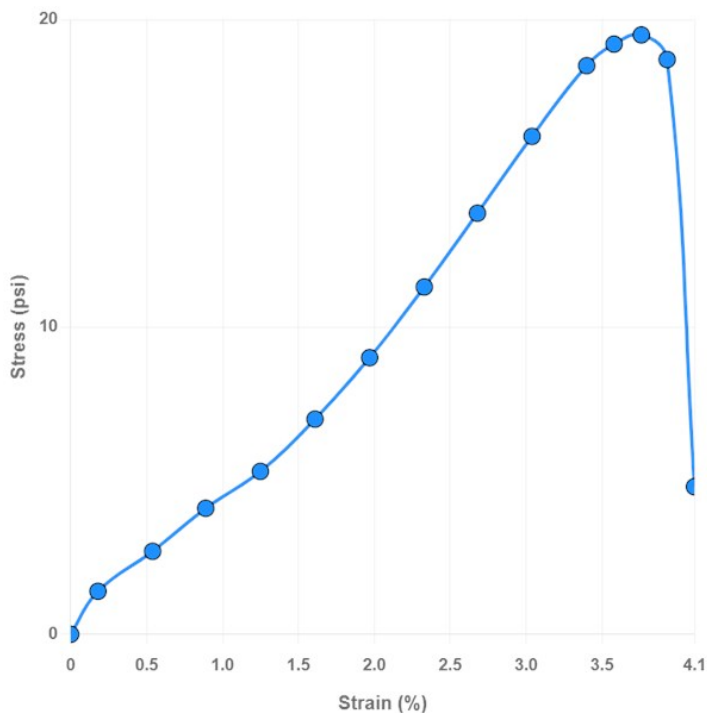
Project:
B2406649.06
202320 - Dickinson Museum Expansion
Dickinson, ND

Sample Information

Sample Number:	638964	Alternate ID:	14 TWT
Sampling Method:	Thinwall Tube ASTM D1587	Depth (ft):	10
Boring Number:	ST-04	Sampled By:	Drill Crew
Location:	Native Soil		
Location Details:	ST-04, 9-11'		
Sample Date:	01/06/2025		
Received Date:	01/13/2025	Lab:	2908 Morrison Ave. Suite 3, Bismarck, ND
Tested Date:	01/15/2025	Tested By:	Austin, Jon

Laboratory Data

Specimen Type:	Intact
Average Diameter (in):	2.839
Average Length (in):	5.591
Height to Diameter Ratio:	1.97
Wet Density (pcf):	124.5
Moisture Specimen:	Entire sample after shear
Moisture Content (%):	25.2
Dry Density (pcf):	99.4
Average Strain Rate (%/min):	1.25
Strain At Failure (%):	3.76
Unconfined Compressive Strength (psi):	19.4
Unconfined Compressive Strength (tsf):	1.40
Shear Strength (tsf):	0.70



Soil Classification: CH FAT CLAY

General

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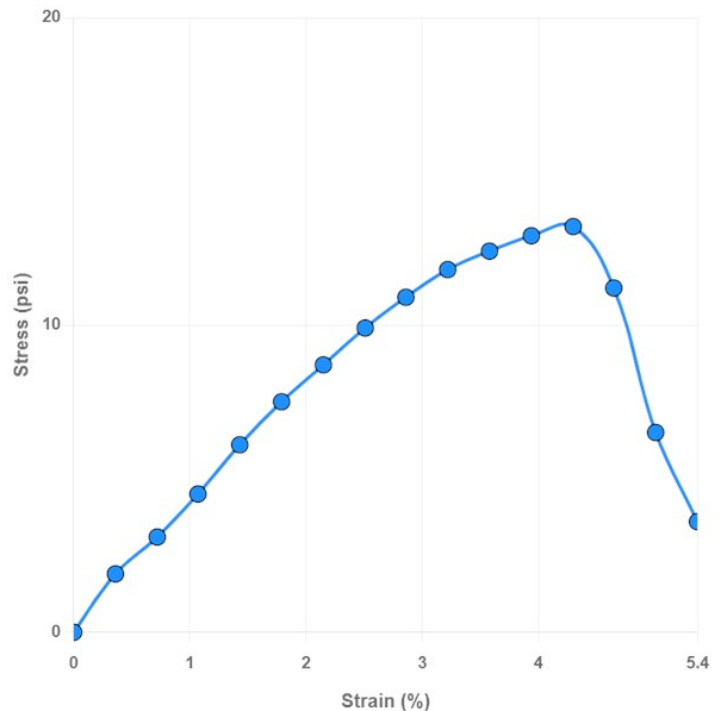
Project:
B2406649.06
202320 - Dickinson Museum Expansion
Dickinson, ND

Sample Information

Sample Number:	638965	Alternate ID:	22 TWT
Sampling Method:	Thinwall Tube ASTM D1587	Depth (ft):	8
Boring Number:	ST-05	Sampled By:	Drill Crew
Location:	Native Soil		
Location Details:	ST-05, 7-9'		
Sample Date:	01/06/2025		
Received Date:	01/13/2025	Lab:	2908 Morrison Ave. Suite 3, Bismarck, ND
Tested Date:	01/15/2025	Tested By:	Austin, Jon

Laboratory Data

Specimen Type:	Intact
Average Diameter (in):	2.835
Average Length (in):	5.586
Height to Diameter Ratio:	1.97
Wet Density (pcf):	123.5
Moisture Specimen:	Entire sample after shear
Moisture Content (%):	28.0
Dry Density (pcf):	96.5
Average Strain Rate (%/min):	1.25
Strain At Failure (%):	4.30
Unconfined Compressive Strength (psi):	13.2
Unconfined Compressive Strength (tsf):	0.95
Shear Strength (tsf):	0.48



Soil Classification: CL LEAN CLAY

General

**SECTION 00 43 25
SUBSTITUTION REQUEST FORM - DURING PROCUREMENT**

PROJECT: DICKINSON MUSEUM CENTER EXPANSION

1.01 SECTION NUMBER:_____ **TITLE:**_____

A. Specified Product:_____

B. Proposed Substitution:_____

1.02 ALL OF THE FOLLOWING QUESTIONS MUST BE ANSWERED. INCOMPLETE FORMS WILL BE NOT BE REVIEWED.

A. The following supporting data is attached:

1. Drawings - Product Data - Samples - Tests - Reports

B. Does the proposed substitution affect dimensions shown on Drawings, or functional clearances?

1. YES or NO

C. Does the proposed substitution change the design or details shown on the Drawings?

1. YES or NO

D. Does the proposed substitution affect other trades?

1. YES or NO

E. Does the proposed substitution affect maintenance service, or source of replacement parts, if applicable?

1. YES or NO

F. Does the proposed guarantee or warranty differ from that specified?

1. YES or NO

G. If you indicated "YES" to Items B, C, D, E or F above, attach a thorough explanation on your company letterhead.

H. If there are other major differences between proposed substitution and specified product, attach a thorough explanation on your company letterhead.

I. The proposed substitution was used within the last 24 months on the following project:

1. Project Name:_____

2. Location:_____

3. Architect:_____ Telephone:_____

J. Has the proposed substitution been used on a GT Architecture project within the last 12 months?

1. YES or NO

2. If yes, which project? _____

K. The undersigned states that the function, appearance and quality of the substitution item are equivalent or superior to the specified item.

1.03 SUBMITTED BY:

A. Signature:_____ Firm:_____

B. Address:_____

C. Telephone:_____ Fax:_____

D. Date:_____ E-Mail:_____

1.04 FOR USE BY DESIGN CONSULTANT:

A. Accepted - Accepted As Noted - Not Accepted - Received Too Late

B. Name:_____ Signature:_____

C. Date:_____ Remarks:_____

END OF SECTION

SECTION 01 10 00 SUMMARY

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: Dickinson Museum Center Expansion

1.02 WORK BY OWNER

- A. Items noted NIC (Not in Contract) will be supplied and installed by Owner before Date of Substantial Completion.

1.03 OWNER OCCUPANCY

- A. Owner intends to occupy the Project upon Substantial Completion.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- C. Schedule the Work to accommodate Owner occupancy.

1.04 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings.
 - 1. Locate and conduct construction activities in ways that will limit disturbance to site.
- B. Arrange use of site and premises to allow:
 - 1. Owner occupancy.
 - 2. Work by Others.
 - 3. Work by Owner.
- C. Provide access to and from site as required by law and by Owner:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- D. Utility Outages and Shutdown:
 - 1. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
 - 2. Limit shutdown of utility services to 3 hours at a time, arranged at least 24 hours in advance with Owner.
 - 3. Prevent accidental disruption of utility services to other facilities.

1.05 WORK SEQUENCE

- A. Coordinate construction schedule and operations with Owner.
- B. Coordinate construction schedule and operations with Architect.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 23 00
ALTERNATES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Description of Alternates.

1.02 RELATED REQUIREMENTS

- A. JE Dunn Front End Documents.

1.03 ACCEPTANCE OF ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.04 SCHEDULE OF ALTERNATES

- A. Alternate No. 1 (Add) - The Contractor shall state the amount to Add to the Base Bid for the work related to creating the Family Restroom 127:as shown on the drawings.
- B. Alternate No. 2 (Add) - The Contractor shall state the amount to Add to the Base Bid for the work related to remodeling restrooms Women's 110 and Men's 111:as shown on the drawings.
- C. Alternate No. 3 (Add) - The Contractor shall state the amount to Add to the Base Bid for concrete paving in lieu of asphalt paving:as shown on the drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**SECTION 01 25 00
SUBSTITUTION PROCEDURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

- A. Section 00 43 25 - Substitution Request Form - During Procurement: Required form for substitution requests made prior to award of contract (During procurement).
- B. Section 01 23 00 - Alternates, for product alternatives affecting this section.
- C. Section 01 30 00 - Administrative Requirements: Submittal procedures, coordination.
- D. Section 01 60 00 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.03 DEFINITIONS

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

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

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

1. Forms indicated in the Project Manual are adequate for this purpose, and must be used.
- E. Limit each request to a single proposed substitution item.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

- A. Submittal Time Restrictions:
1. Instructions to Bidders specifies time restrictions and the documents required for submitting substitution requests during the bidding period.
- B. Submittal Form (before award of contract):
1. Submit substitution requests by completing the form in Section 00 43 25; see this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.
- C. The Architect will issue an addendum with the decision to accept or reject the request.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Submittal Form (after award of contract):
- B. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
- C. Submit request for Substitution for Convenience within 14 days of discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
 2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
 3. Bear the costs engendered by proposed substitution of:
 - a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.
- D. Substitutions will not be considered under one or more of the following circumstances:
1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
 2. Without a separate written request.
 3. When acceptance will require revisions to Contract Documents.

3.04 RESOLUTION

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

3.05 ACCEPTANCE

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

3.06 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

END OF SECTION

**SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Submittals for review, information, and project closeout.
- C. Number of copies of submittals.
- D. Requests for Interpretation (RFI) procedures.
- E. Submittal procedures.
- F. Discrepancies or omissions from drawings or documents.

1.02 RELATED REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: General product requirements.
- B. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.
- C. Section 01 78 00 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect:
 - 1. Requests for Interpretation (RFI).
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. Applications for payment and change order requests.
 - 8. Progress schedules.
 - 9. Coordination drawings.
 - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
 - 11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 REQUESTS FOR INTERPRETATION (RFI)

- A. Definition: A request seeking one of the following:
 - 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
 - 2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
 - 1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.
 - 2. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
 - 1. Unacceptable Uses for RFIs: Do not use RFIs to request the following:
 - a. Approval of submittals (use procedures specified elsewhere in this section).
 - b. Approval of substitutions (see Section - 01 60 00 - Product Requirements)
 - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
 - 2. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
 - a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.
- E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
 - 1. Discrete and consecutive RFI number, and descriptive subject/title.
 - 2. Issue date, and requested reply date.
 - 3. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
 - 4. Annotations: Field dimensions and/or description of conditions which have engendered the request.
 - 5. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 - 1. Indicate current status of every RFI. Update log promptly and on a regular basis.
 - 2. Note dates of when each request is made, and when a response is received.
- H. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
 - 1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.

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

3.02 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.03 SUBMITTALS FOR INFORMATION

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

3.04 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:
 1. Project record documents.
 2. Operation and maintenance data.
 3. Warranties.
 4. Bonds.
 5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

3.05 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Documents for Review:
 1. Small Size Sheets, Not Larger Than 8-1/2 by 11 inches: Submit the number of copies that Contractor requires, plus two copies that will be retained by Architect.

- C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
 - 1. After review, produce duplicates.
 - 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.06 SUBMITTAL PROCEDURES

- A. General Requirements:
 - 1. Use a single transmittal for related items.
 - 2. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
 - 3. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 - 4. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
 - 5. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
 - a. Deliver submittals to Architect at business address.
 - 6. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
 - b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
 - 7. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
 - 8. Provide space for Contractor and Architect review stamps.
 - 9. When revised for resubmission, identify all changes made since previous submission.
 - 10. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
 - 11. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
 - 12. Submittals not requested will be recognized, and will be returned "Not Reviewed",
- B. Product Data Procedures:
 - 1. Submit only information required by individual specification sections.
 - 2. Collect required information into a single submittal.
 - 3. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
 - 1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
 - 2. Do not reproduce Contract Documents to create shop drawings.
 - 3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
 - 1. Transmit related items together as single package.
 - 2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
- E. Approval Stamp: This review is to verify general conformance with the design concept of the Project and substantial compliance with the information provided in the Contract Documents. This review does not in any way relieve the Contractor or their suppliers of their responsibility to

provide all materials and equipment as specified, in quantities, quality and dimensions required. Submittals will be reviewed with the following actions:

1. "Approved" indicates that the Submittal appears to conform to the design concept of the Work and that the Contractor, at his discretion, may with fabrication and/or procurement and installation.
 2. "Approved as Noted" indicates that the Submittal, after noted corrections are made, appears to conform to the design concept of the Work and that the Contractor, at his discretion, may proceed with fabrication and/or procurement and installation, if the corrections are accepted by the Contractor without an increase in Contract Sum or Time.
 3. "Revise and Resubmit" indicates that the noted revisions are such that a corrected copy of the Submittal is required for review to confirm that the noted revisions have been understood and made. The Contractor, at his discretion, may proceed with fabrication and/or procurement and installation after submitting a corrected copy and verifying with the reviewer that the corrected copy is acceptable, if the corrections are accepted by the Contractor without an increase in the Contract Sum or Time.
 4. "Not Approved" indicates that the Submittal does not appear to conform to the specifications, a resubmission is required and fabrication or procurement is not authorized.
- F. If the Architect rejects (Revise and Resubmit or Not Approved) the same section two times the Architect shall be compensated for additional reviews. Compensation will be incorporated by Change Order and will be deducted from the Contractor's application for payment. Contractor is responsible for all delays caused by the resubmittal process.

3.07 SUBMITTAL REVIEW

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
- D. Architect's and consultants' actions on items submitted for review:
 1. Authorizing purchasing, fabrication, delivery, and installation:
 - a. "Approved", or language with same legal meaning.
 - b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
 - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
 - c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
 - 1) Resubmit corrected item, with review notations acknowledged and incorporated. Resubmit separately, or as part of project record documents.
 2. Not Authorizing fabrication, delivery, and installation:
 - a. "Revise and Resubmit".
 - 1) Resubmit revised item, with review notations acknowledged and incorporated.
 - b. "Rejected".
 - 1) Submit item complying with requirements of Contract Documents.
- E. Architect's and consultants' actions on items submitted for information:
 1. Items for which no action was taken:
 - a. "Received" - to notify the Contractor that the submittal has been received for record only.
 2. Items for which action was taken:
 - a. "Reviewed" - no further action is required from Contractor.

3.08 DISCREPANCIES OR OMISSIONS FROM DRAWINGS OR DOCUMENTS

- A. Notify the Architect of any discrepancies in, or omissions from the drawings or documents. Neither the Owner nor the Architect will be responsible for any oral instructions or modifications of the specifications or drawings. Written interpretations will be made only by Addenda.
- B. If discrepancies are not reported, the contractor shall bid the greater quantity or better quality (highest dollar value), and appropriate adjustment will be made after contract award.
- C. Discrepancies discovered during construction shall immediately be called to the attention of the Architect/Engineer for clarification.
- D. All minor items necessary for the completion and successful operation of the system, whether or not herein definitely specified or indicated on the drawings, shall be furnished and installed.
- E. Omission of/or express reference to any material necessary for/or reasonably incidental to complete installation shall not release Contractor from providing such material. Where material is shown on drawings but is not specified or is specified but not shown, such material shall be considered both shown and specified.
- F. Any work not clear to Contractor shall be referred to Architect for clarification before bid is submitted. If no question is raised prior to opening of bid, Contractor shall be required to provide work in question as directed by Architect, whose decision is final, without additional charges.
- G. By virtue of submitting a bid, Contractor agrees that he is skilled and experienced in use of and in interpretation of drawings and specifications. Contractor further agrees that he has carefully reviewed all drawings, all specifications and all addenda, which constitute bid documents for this contract, and finds them free of ambiguities and good and sufficient for bidding and construction purposes.

END OF SECTION

**SECTION 01 40 00
QUALITY REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 01 30 00 - Administrative Requirements: Submittal procedures.
- B. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

- A. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2025a.
- B. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2021.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- C. Test Reports: After each test/inspection, promptly submit a copy of report to Architect, Engineer and the Contractor.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Compliance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.
 - 2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.

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

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.06 REFERENCES AND STANDARDS

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

1.07 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. As indicated in individual specification sections, Owner or Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- C. Contractor Employed Agency:
1. Laboratory: Authorized to operate in the State in which the Project is located.
 2. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
 3. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

- A. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- B. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- C. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- D. Architect will use accepted mock-ups as a comparison standard for the remaining Work.
- E. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.03 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

- A. See individual specification sections for testing and inspection required.
- B. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with Architect, Engineer and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify Architect, Engineer and Contractor of observed irregularities or non-compliance of Work or products.
 - 5. Perform additional tests and inspections required by Architect and Engineer.
 - 6. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.

3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
4. Notify Architect, Engineer and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 5713

TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Prevention of erosion due to construction activities.
 - 2. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
 - 3. Restoration of areas eroded due to insufficient preventive measures.
 - 4. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

- B. Reference Standards: (The current standard as of the date noted on the plans shall be utilized, unless noted otherwise)
 - 1. ASTM D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
 - 2. ASTM D1388 - Standard Test Method for Stiffness of Fabrics.
 - 3. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus.
 - 4. ASTM D4533/D4533M - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 - 5. ASTM D4595 - Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
 - 6. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
 - 7. ASTM D4873/D4873M - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.
 - 8. ASTM D6460 - Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Performance in Protecting Earthen Channels from Stormwater-Induced Erosion.
 - 9. ASTM D6524 - Standard Test Method for Measuring the Resiliency of Turf Reinforcement Mats (TRMs).
 - 10. ASTM D6525/D6525M - Standard Test Method for Measuring Nominal Thickness of Rolled Erosion Control Products.
 - 11. ASTM D6566 - Standard Test Method for Measuring Mass per Unit Area of Turf Reinforcement Mats.
 - 12. ASTM D6567 - Standard Test Method for Measuring the Light Penetration of a Turf Reinforcement Mat (TRM).
 - 13. ASTM D6575 - Standard Test Method for Determining Stiffness of Geosynthetics Used as Turf Reinforcement Mats (TRMs).
 - 14. ASTM D6818 - Standard Test Method for Ultimate Tensile Properties of Rolled Erosion Control Products.
 - 15. ASTM D7322 - Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Ability to Encourage Seed Germination and Plant Growth Under Bench-Scale Conditions.
 - 16. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit.
 - 17. FHWA FLP-94-005 - Best Management Practices for Erosion and Sediment Control.

1.02 SUBMITTALS

- A. Provide Manufacturer's data for erosion control materials indicating product specifications. Certify that products supplied meet or exceed specified requirements.
- B. Storm Water Pollution Prevention Plan (SWPPP) meeting NDDEQ requirements:
 - 1. Submit not less than 30 days prior to anticipated start of clearing, grading, or other work involving disturbance of ground surface cover.
 - 2. Obtain the approval of the Plan by authorities having jurisdiction.
 - 3. Obtain the approval of the Plan by Owner.
- C. Inspection Reports: Submit report of each inspection required by the SWPPP. Identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 PRODUCTS

2.01 GRASS SEED FOR TEMPORARY COVER

- A. Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.

2.02 SILT FENCE WITH WIRE BACKING

- A. Silt fence fabric shall conform to ASTM D4439.
- B. Filter fabric shall be composed of fibers consisting of long chain synthetic polymers composed of at least 95% by weight of polyolefins, polyesters, or polyamides. The fibers shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other. The filter fabric shall be free of any treatment or coating which might adversely alter its physical properties after installation. The fabric shall be free of defects or flaws that affect its physical and/or filtering properties. The fabric shall have a minimum width of 36 inches. The filter fabric shall be furnished with suitable wrapping for protection against moisture and extended ultraviolet exposure prior to placement.
- C. Backing for a filter fabric silt fence shall consist of steel wire fence fabric. A woven wire fence shall conform to ASTM A116 Class 1 zinc coating for wire. The woven wire support fence shall be at least 32-inches high with a maximum opening size of 6-inches by 6-inches. The wire shall be a minimum of 14-gauge grade 60.
- D. Either wood or steel posts shall be used.
 - 1. Wood posts shall be treated (penta or green treated) and shall be a minimum of five feet long with minimum dimensions of 2 inches in diameter for round posts or 1½ by 1½ inches for rectangular posts
 - 2. Steel posts shall be a minimum of 5 feet long, weigh a minimum of 1.3 pounds per square foot, and have projections to aid in fastening the wire or fabric. Steel posts shall also have a metal plate welded near the bottom such that when the post is driven to the proper depth, the plate will be below the ground level for added stability.

2.03 STRAW WATTLES

- A. Wattles shall consist of rice or wheat straw fibers as filler within a containment netting. Filler shall be certified as weed-free. Fibers must have an average length greater than 3 inches and shall contain ultraviolet inhibitors. The strand thickness shall be no less than 0.035 inches, the

knot thickness no less than 0.0555 inches, and the netting weight no less than 0.35 ounces per foot.

- B. The entire wattle unit shall be sufficiently durable to withstand weather, construction, and installation conditions for at least three months, including multiple movements and reinstallations.
- C. Wattles shall have a 12-inch diameter (1-inch tolerance) with a life expectancy of 6-to-24-months.
- D. Wood posts of sufficient strength to withstand installation and weather shall be used for anchoring. Stakes shall be wooden, 1½ inches thick by 30 inches long.

2.04 WEIGHTED FIBER ROLLS

- A. Weighted fiber roll shall be a photodegradable, extruded netting tube filled with wood curled excelsior and a weighted inner core. The weight shall be a minimum of 8½ pounds per foot.
- B. The roll diameter shall be 6-inches and the lengths shall be as required.
- C. An adequate number of weighted fiber rolls shall be placed around an inlet to provide complete protection.

2.05 DRAINAGE STRUCTURE INLET FILTER

- A. Drainage structure inlet filters shall be as shown by the Plans and shall be installed immediately after installation of the storm inlet.
- B. The inlet filters shall include an overflow feature designed to allow full flow of water into the structure if the filter is filled with sediment.
- C. Inlet filters shall have a minimum flow rate of 130 gallons per minute per square foot.
- D. Inlet filters shall remain in-place until final stabilization of site soils.

2.06 EROSION CONTROL BLANKET

- A. Shall meet the requirements of NDDOT Standard Specification Section 856 for the type of blanket specified by the Plans.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

- A. Prepare Storm Water Pollution Prevention Plan (SWPPP) meeting current NDDEQ requirements. Submit the plan to the Architect for approval no less than 30 days prior to anticipated start of clearing, grading, or other work involving disturbance of ground surface cover.
- B. Upon completion and approval of the SWPPP and a minimum of seven (7) days prior to starting any construction activity on-site, submit a "Notice of Intent to Obtain Coverage under NDPDES

General Permit for Stormwater Discharges Associated with Construction Activity" (SFN 19145) to the North Dakota Department of Environmental Quality (NDDEQ). Obtain Owner's approval and signature for this notice of intent. The provisions of the permit shall be followed by the contractor and any subcontractors on-site, and the SWPPP plan shall be updated by the contractor with any necessary changes throughout the duration of construction. Actual erosion and sediment control items required may vary from the plan shown herein due to the contractor's method of operations. Contractor shall provide necessary erosion and sediment control items and methods to comply with the NDPDES permit at all times until the "Notice of Termination to Cancel Coverage under NDPDES General Permit for Storm Water Discharges Associated with Construction Activity" (SFN 19146) is submitted by the contractor to the NDDEQ. The Notice of Termination shall not be submitted until final stabilization as defined within the NDPDES permit has been achieved.

- C. Schedule work so that soil surfaces are left exposed for the minimum amount of time necessary to complete the work.

3.03 SCOPE OF PREVENTIVE MEASURES

- A. In all cases, if permanent erosion resistant measures have been installed, temporary preventive measures are not required.
- B. If temporary erosion control measures need to be removed to accommodate construction operations, the measures must be replaced by the end of the workday or prior to a rain event, whichever occurs sooner.
- C. Construction Entrances: Traffic-bearing aggregate surface.
 - 1. Provide at each construction entrance from public right-of-way or where equipment will enter on-site paved areas.
 - 2. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.
- D. Linear Sediment Barriers: Made of silt fences or fiber rolls.
 - 1. Provide linear sediment barriers:
 - a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
 - b. Along the toe of cut slopes and fill slopes.
 - 2. Space sediment barriers with the following maximum slope length upslope from barrier:
 - a. Slope of Less Than 2 Percent: 100 feet.
 - a. Slope Between 2 and 5 Percent: 75 feet.
 - b. Slope Between 5 and 10 Percent: 50 feet.
 - c. Slope Between 10 and 20 Percent: 25 feet.
 - d. Slope Over 20 Percent: 15 feet.
- E. Inlet Protection: Provide for all inlets that may collect sediment from disturbed areas.
- F. Soil Stockpiles: Protect using perimeter straw wattles or silt fence.
- G. Temporary Seeding: Place immediately in areas with no construction activity where permanent stabilization cannot be installed, or where no construction activity is planned for more than 14 days or 7 days for slopes 3:1 or greater.
- H. All waste materials (including garbage, debris, cleaning wastes, wastewater, toxic materials, or hazardous materials) shall be properly disposed of off-site and not allowed to be carried by runoff or wind. The site shall be watered if necessary to prevent dust from blowing onto adjacent properties.

- I. At the end of each workday any material placed on a public or private road shall be removed (not by flushing) to prevent sediment tracking.
- J. The construction contractor shall be required to control oil and fuel spills, and the discharge of any chemicals to prevent such spills or discharges from entering any water course, sump, sewer system, water body, or wetland.
- K. Any onsite concrete cleanout and wash areas must not impact public property. A concrete washout area shall be designated on-site by the contractor and included in the contractor's SWPPP. The concrete washout area shall be located away from surface waters and areas where water will drain.

3.04 INSTALLATION

- A. Construction Entrance
 - 1. Width: As required; 20 feet, minimum.
 - 2. Length: 50 feet, minimum.
 - 3. Excavate minimum of 6-inches.
 - 4. Place geotextile fabric full width and length, with minimum 12-inch overlap at joints.
 - 5. Place and compact at least 6-inches of 2-to-4-inch diameter washed stone.
- B. Silt Fence with Wire Backing
 - 1. Store and handle fabric in accordance with ASTM D4873/D4873M.
 - 2. Silt fence shall either be installed in a 4-inch deep by 6-inch-wide trench on the upslope side of the fence, or be machine sliced in with a 4-inch fabric embedment. If utilizing trench method, trench shall be backfilled and compacted. Top of fabric shall be at a minimum 32-inch nominal height.
 - 3. Steel posts shall be installed at a maximum 4-foot spacing. Wood posts shall be installed at a maximum of 4-foot spacing. All posts shall be installed with a minimum embedment of 24-inches.
 - 4. Do not splice fabric along its width and minimize splices in fabric along its length. Splice at posts only with a minimum overlap length of 18-inches and place an extra post at splices.
- C. Fiber Rolls
 - 1. Install with a minimum overlap of 1 foot at ends of rolls.
 - 2. Embed the bottom of the wattle at least 3 inches in the ground. Place soil excavated for trench against bales on the upslope side of the row and compact.
 - 3. Install stakes at least every 4 feet. Stakes shall not extend more than two inches above straw wattle.
- D. Weighted Fiber Roll
 - 1. Provide fiber rolls meeting the following requirements:
 - a. Non-degradable, extruded netting tube filled with wood curled excelsior and weighted inner core
 - b. 8-inch roll diameter
 - c. 6-foot roll length
 - d. 8.33 lb/ft roll weigh
 - 2. Approximately 3 to 6 inches shall be left between the weighted fiber rolls and the inlets they are protecting. The fiber roll ends shall overlap 12 inches.
 - 3. When silt reaches one-third the height of the roll, remove and dispose of the silt and debris to allow the device to function properly.
- E. Erosion Control Blanket

1. All rocks or clods over 1½ inches in diameter and all sticks and other foreign material shall be removed prior to placement of blankets. Seed the disturbed area prior to placing blankets.
 2. Blankets shall be rolled out in the direction of the flow. Blanket ends shall be overlapped by a minimum of one foot where additional rolls are needed. When implementing multiple blankets, upstream/upslope blankets shall overlap downstream/downslope blankets.
 3. Wire staples and metal pins shall be driven flush to the soil surface.
 4. Allow erosion control blankets to degrade naturally, unless otherwise specified.
- F. Drainage Structure Inlet Filter
1. Install according to the manufacturer's recommendations.

3.05 MAINTENANCE

- A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.25 inches or more rainfall at the project site, and daily during prolonged rainfall.
- B. Repair deficiencies immediately or as soon as conditions allow.
- C. Silt Fences:
 1. Promptly replace fabric that deteriorates unless the need for fence has passed.
 2. Remove silt deposits that exceed one-third of the height of the fence.
 3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- D. Fiber Rolls:
 1. Promptly replace rolls that fall apart or otherwise deteriorate unless need has passed.
 2. Remove silt deposits that exceed one-half of the height of the rolls.
 3. Repair rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- E. Clean out temporary sediment control structures once sediment accumulation reaches a depth of 2-feet maximum and relocate soil on site.
- F. Place sediment in appropriate locations on site; do not remove from site.
- G. When Architect, Owner, or Owner's Representative notifies the Contractor that the erosion control measures (BMP's) are not in compliance with the SWPPP, the Contractor shall have 4 hours to begin addressing the situation and shall work diligently to resolve the issue as quickly as reasonably possible. Architect or Owner may apply a contract price reduction of \$1,000 per day until the issue is resolved.
- H. Contractor is responsible for payment of any fines, fees, or other financial penalties imposed by any governmental agency for Contractor's failure to comply with the terms of the SWPPP.

3.06 CLEAN UP

- A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Owner.
- B. Clean out temporary sediment control structures that are to remain as permanent measures.

- C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.
- D. Comply with all SWPPP and NDDEQ Permit requirements relative to protection removal.

END OF SECTION

**SECTION 01 58 13
TEMPORARY PROJECT SIGNAGE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project identification sign.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Responsibility to provide signs.

1.03 QUALITY ASSURANCE

- A. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

- A. Structure and Framing: New, metal, structurally adequate.

2.02 PROJECT IDENTIFICATION SIGN

- A. One painted sign of construction, design, and content indicated on drawings, location designated.
- B. Graphic Design, Colors, Style of Lettering: Designated by Architect.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install project identification sign within 30 days after date fixed by Notice to Proceed.
- B. Erect at location of high public visibility adjacent to main entrance to site.
- C. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
- D. Install sign surface plumb and level, with butt joints. Anchor securely.

3.02 MAINTENANCE

- A. Maintain signs and supports clean, repair deterioration and damage.

3.03 REMOVAL

- A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

END OF SECTION

**SECTION 01 60 00
PRODUCT REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations.
- F. Procedures for Owner-supplied products.
- G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Lists of products to be removed from existing building.
- B. Section 01 25 00 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- C. Section 01 40 00 - Quality Requirements: Product quality monitoring.

1.03 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

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

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

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

2.02 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Use of products having any of the following characteristics is not permitted:
 - 1. Containing lead, cadmium, or asbestos.

- C. Where other criteria are met, Contractor shall give preference to products that:
 - 1. If used on interior, have lower emissions, as defined in Section 01 61 16.
 - 2. If wet-applied, have lower VOC content, as defined in Section 01 61 16.

2.03 PRODUCT OPTIONS

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

2.04 MAINTENANCE MATERIALS

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

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

- A. See Section 01 25 00 - Substitution Procedures.
- B. The Architect will issue an addendum with the decision to accept or reject the request.

3.02 OWNER-SUPPLIED PRODUCTS

- A. Owner's Responsibilities:
 - 1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
 - 2. Arrange and pay for product delivery to site.
 - 3. On delivery, inspect products jointly with Contractor.
 - 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
 - 5. Arrange for manufacturers' warranties, inspections, and service.
- B. Contractor's Responsibilities:
 - 1. Review Owner reviewed shop drawings, product data, and samples.
 - 2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
 - 3. Handle, store, install and finish products.
 - 4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

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

- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

- A. Provide protection of stored materials and products against theft, casualty, or deterioration.
- B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.
 - 1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.
- C. Store and protect products in accordance with manufacturers' instructions.
- D. Store with seals and labels intact and legible.
- E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.
- F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- G. For exterior storage of fabricated products, place on sloped supports above ground.
- H. Provide off-site storage and protection when site does not permit on-site storage or protection.
 - 1. Execute a formal supplemental agreement between Owner and Contractor allowing off-site storage, for each occurrence.
- I. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- J. Comply with manufacturer's warranty conditions, if any.
- K. Do not store products directly on the ground.
- L. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- M. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- N. Prevent contact with material that may cause corrosion, discoloration, or staining.
- O. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- P. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Surveying for laying out the work.
- F. Cleaning and protection.
- G. Starting of systems and equipment.
- H. Demonstration and instruction of Owner personnel.
- I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- J. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 01 30 00 - Administrative Requirements: Submittals procedures.
- C. Section 01 40 00 - Quality Requirements: Testing and inspection procedures.
- D. Section 01 57 13 - Temporary Erosion and Sediment Control: Additional erosion and sedimentation control requirements.
- E. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.
- F. Section 02 41 00 - Demolition: Demolition of whole structures and parts thereof; site utility demolition.
- G. Section 07 84 00 - Firestopping.

1.03 QUALIFICATIONS

- A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,
- B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.

1.04 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

- C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- D. Perform dewatering activities, as required, for the duration of the project.
- E. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- F. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
 - 1. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.
- G. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
 - 1. Minimize amount of bare soil exposed at one time.
 - 2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
 - 3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
 - 4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- H. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
- I. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
- J. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.
- K. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.05 COORDINATION

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

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

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

3.03 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Contractor shall locate and protect survey control and reference points.
- D. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

- E. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- F. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- G. Utilize recognized engineering survey practices.
- H. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.
- I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations.
- J. Periodically verify layouts by same means.
- K. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

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

3.06 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
 - 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
 - 2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
- D. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
 - 2. Remove items indicated on drawings.
 - 3. Relocate items indicated on drawings.
 - 4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.

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

3.07 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
 1. Complete the work.

2. Fit products together to integrate with other work.
 3. Provide openings for penetration of mechanical, electrical, and other services.
 4. Match work that has been cut to adjacent work.
 5. Repair areas adjacent to cuts to required condition.
 6. Repair new work damaged by subsequent work.
 7. Remove samples of installed work for testing when requested.
 8. Remove and replace defective and non-complying work.
- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- G. Restore work with new products in accordance with requirements of Contract Documents.
- H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.
- J. Patching:
1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 2. Match color, texture, and appearance.
 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

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

3.09 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.

- G. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- H. Prohibit traffic from landscaped areas.
- I. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

- A. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- C. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.
- D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
- F. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

3.12 ADJUSTING

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

3.13 FINAL CLEANING

- A. Execute final cleaning prior to Substantial Completion.
- B. Use cleaning materials that are nonhazardous.
- C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- F. Clean filters of operating equipment.

- G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
- H. Clean site; sweep paved areas, rake clean landscaped surfaces.
- I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

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

3.15 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

**SECTION 01 78 00
CLOSEOUT SUBMITTALS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project record documents.
- B. Operation and maintenance data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 00 72 00 - General Conditions and 00 73 00 - Supplementary Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.
- B. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- C. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.
- D. Individual Product Sections: Specific requirements for operation and maintenance data.
- E. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
 - 2. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.

- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Field changes of dimension and detail.
 - 2. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Additional information as specified in individual product specification sections.
- D. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- E. Provide servicing and lubrication schedule, and list of lubricants required.
- F. Include manufacturer's printed operation and maintenance instructions.
- G. Include sequence of operation by controls manufacturer.

- H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- I. Include test and balancing reports.
- J. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. Arrangement of Contents: Organize each volume in parts as follows:
 - 1. Project Directory.
 - 2. Table of Contents, of all volumes, and of this volume.
 - 3. Operation and Maintenance Data: Arranged by system, then by product category.
 - a. Source data.
 - b. Product data, shop drawings, and other submittals.
 - c. Operation and maintenance data.
 - d. Field quality control data.
 - e. Photocopies of warranties and bonds.
 - 4. Design Data: To allow for addition of design data furnished by Architect or others, provide a tab labeled "Design Data" and provide a binder large enough to allow for insertion of at least 20 pages of typed text.

3.06 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

- F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

SECTION 02 41 00 DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Building demolition as required for the building addition.
- B. Selective demolition of built site elements.
- C. Selective demolition of building elements for alteration purposes.
- D. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 10 00 - Summary: Description of items to be salvaged or removed for re-use by Contractor.
- C. Section 01 57 13 - Temporary Erosion and Sediment Control.
- D. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- E. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- F. Section 31 10 00 - Site Clearing: Vegetation and existing debris removal; earth stripping and stockpiling.
- G. Section 31 22 00 - Grading: Rough and fine grading. Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.03 DEFINITIONS

- A. Demolish: Dismantle, raze, destroy, or wreck any building or structure or any part thereof.
- B. Remove: Detach or dismantle items from existing construction and dispose of them off site, unless items are indicated to be salvaged or reinstalled.
- C. Remove and Salvage: Detach or dismantle items from existing construction in a manner to prevent damage. Clean, package, label and deliver salvaged items to Owner in ready-for-reuse condition.
- D. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall where indicated.
- E. Existing to Remain: Designation for existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.04 REFERENCE STANDARDS

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

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Site Plan: Indicate:
 - 1. Areas for temporary construction and field offices.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Fill Material: See Section 31 22 00.

PART 3 EXECUTION

3.01 DEMOLITION

- A. Remove paving and curbs required to accomplish new work.
- B. Remove concrete slabs on grade as indicated on drawings.
- C. Remove manholes and manhole covers, curb inlets and catch basins.
- D. Remove fences and gates.
- E. Remove other items indicated, for salvage, relocation, and recycling.
- F. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 22 00.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

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

- H. Perform demolition in a manner that maximizes salvage and recycling of materials.
 - 1. Dismantle existing construction and separate materials.
 - 2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.
- I. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.03 EXISTING UTILITIES

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

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
 - 1. Verify construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Separate areas in which demolition is being conducted from areas that remain occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.
- D. Remove existing work as indicated and required to accomplish new work.
 - 1. Remove items indicated on drawings.
- E. Services including, but not limited to, HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications: Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
 - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - 3. Verify that abandoned services serve only abandoned facilities before removal.
 - 4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.
- F. Protect existing work to remain.

1. Prevent movement of structure. Provide shoring and bracing as required.
2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.
4. Patch to match new work.

3.05 DEBRIS AND WASTE REMOVAL

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

END OF SECTION

**SECTION 03 30 00
CAST-IN-PLACE CONCRETE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete formwork.
- B. Floors and slabs on grade.
- C. Concrete reinforcement.
- D. Joint devices associated with concrete work.
- E. Miscellaneous concrete elements, including equipment pads, equipment pits, light pole bases, flagpole bases, thrust blocks, and manholes.
- F. Concrete curing.

1.02 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.03 REFERENCE STANDARDS

- A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
- B. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.
- C. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- D. ACI PRC-305 - Guide to Hot Weather Concreting; 2020.
- E. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.
- F. ACI PRC-308 - Guide to External Curing of Concrete; 2016.
- G. ACI PRC-347 - Guide to Formwork for Concrete; 2014 (Reapproved 2021).
- H. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- I. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- J. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2024.
- K. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.
- L. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.
- M. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2024.
- N. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2025.
- O. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
- P. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.
- Q. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2020.
- R. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2024a.
- S. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2024.

- T. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2024.
- U. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2025a.
- V. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2020a.
- W. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2024.
- X. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2020.
- Y. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.
- Z. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types); 2023.
- AA. ASTM E1155/E1155M - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers; 2023.
- BB. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2024.
- CC. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
- C. Mix Design: Submit proposed concrete mix design.
- D. Samples: Submit samples of underslab vapor retarder to be used.
- E. Test Reports: Submit report for each test or series of tests specified.

1.05 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.
- B. Follow recommendations of ACI PRC-305 when concreting during hot weather.
- C. Follow recommendations of ACI PRC-306 when concreting during cold weather.

PART 2 PRODUCTS

2.01 FORMWORK

- A. Formwork Design and Construction: Comply with guidelines of ACI PRC-347 to provide formwork that will produce concrete complying with tolerances of ACI SPEC-117.
- B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
 - 1. Earth Cuts: Do not use earth cuts as forms for vertical surfaces. Natural rock formations that maintain a stable vertical edge may be used as side forms.
 - 2. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
 - 3. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

2.02 REINFORCEMENT MATERIALS

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
 - 1. Type: Deformed billet-steel bars.

- B. Reinforcement Accessories:
 - 1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
 - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type I/II - Normal Portland type - see Structural Drawings.
- B. Fine and Coarse Aggregates: ASTM C33/C33M - see Structural Drawings.
 - 1. Acquire aggregates for entire project from same source.
- C. Fly Ash: ASTM C618, Class C or F- see Structural Drawings.
- D. Calcined Pozzolan: ASTM C618, Class N.
- E. Silica Fume: ASTM C1240, proportioned in accordance with ACI PRC-211.1.
- F. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Air Entrainment Admixture: ASTM C260/C260M.
 - 1. See Structural Drawings.
- C. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.
- D. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
- E. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.
 - 1.
- F. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.
- G. Accelerating Admixture: ASTM C494/C494M Type C.
- H. Retarding Admixture: ASTM C494/C494M Type B.
- I. Water Reducing Admixture: ASTM C494/C494M Type A.

2.05 ACCESSORY MATERIALS

- A. Underslab Vapor Retarder:
 - 1. Sheet Material: ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single-ply polyethylene is prohibited.
 - 2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
 - 3. Products:
 - a. ISI Building Products; Viper VaporCheck II 15-mil (Class A): www.isibp.com/#sle.
 - b. Stego Industries, LLC; 15-mil Class A: www.stegoindustries.com/#sle.
 - c. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils (0.38 mm): www.wrmeadows.com/#sle.
 - d. Substitutions: Approved equal.

2.06 BONDING AND JOINTING PRODUCTS

- A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
 - 1. Products:
 - a. W. R. Meadows, Inc; ACRY-LOK: www.wrmeadows.com/#sle.
 - b. Substitutions: Approved equal.
- B. Epoxy Bonding System:

1. Complying with ASTM C881/C881M and of Type required for specific application.
2. Products:
 - a. Hilti HIT HY200.
 - b. Substitutions: Approved equal.
- C. Slab Isolation Joint Filler: 1/2-inch thick, height equal to slab thickness, with removable top section forming 1/2-inch deep sealant pocket after removal.
 1. Material: ASTM D1751, cellulose fiber.
 2. Products:
 - a. W. R. Meadows, Inc; Fibre Expansion Joint: www.wrmeadows.com/#sle.
 - b. Substitutions: Approved equal.
- D. Slab Contraction Joint Device: Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.
 1. Products:
 - a. W. R. Meadows, Inc; Speed-E-Joint: www.wrmeadows.com/#sle.
 - b. Substitutions: Approved equal.
- E. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form at 6 inches on center; ribbed steel stakes for setting.

2.07 CURING MATERIALS

- A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.
- B. Moisture-Retaining Sheet: ASTM C171.
 1. Curing paper, regular.
- C. Water: Potable, not detrimental to concrete.

2.08 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI PRC-211.1 recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI SPEC-301.
 1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
- C. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended or required by manufacturer.
- D. Normal Weight Concrete:
 1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: per Structural Drawings..
 2. Fly Ash Content: Maximum percentage of cementitious materials by weight per Structural Drawings.
 3. Calcined Pozzolan Content: Maximum 10 percent of cementitious materials by weight.
 4. Silica Fume Content: Maximum 5 percent of cementitious materials by weight.
 5. Cement Content: Minimum per Structural Drawings.
 6. Water-Cement Ratio: Maximum per Structural Drawings.
 7. Total Air Content: 4 percent, determined in accordance with ASTM C173/C173M.
 8. Maximum Slump: Maximum per Structural Drawings.
 9. Maximum Aggregate Size: Maximum per Structural Drawings.

2.09 MIXING

- A. Transit Mixers: Comply with ASTM C94/C94M.

- B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

- A. Formwork: Comply with requirements of ACI SPEC-301. Design and fabricate forms to support all applied loads until concrete is cured and for easy removal without damage to concrete.
- B. Verify that forms are clean and free of rust before applying release agent.
- C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
 - 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
 - 2. Use latex bonding agent only for non-load-bearing applications.
- E. In locations where new concrete is doweled to existing work, provide drilling depth and epoxy-setting per structural drawings.
- F. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.
 - 1. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on drawings. Do not use sand.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

- A. Comply with requirements of ACI SPEC-301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
- B. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

3.04 PLACING CONCRETE

- A. Place concrete in accordance with ACI PRC-304.
- B. Notify Architect not less than 24 hours prior to commencement of placement operations.
- C. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- D. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.
- E. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 SLAB JOINTING

- A. Locate joints as indicated on drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.
- D. Load Transfer Construction and Contraction Joints: Install load transfer devices as indicated; saw cut joint at surface as indicated for contraction joints.
- E. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than 1/3 the depth of the slab.
- F. Construction Joints: Where not otherwise indicated, use metal combination screed and key form, with removable top section for joint sealant.

3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. Maximum Variation of Surface Flatness:
 1. Exposed Concrete Floors: 1/8 inch in 10 feet.
 2. Under Seamless Resilient Flooring: 1/8 inch in 10 feet.
 3. Under Carpeting: 1/8 inch in 10 feet.
- B. Correct the slab surface if tolerances are less than specified.
- C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.07 CONCRETE FINISHING

- A. Repair surface defects, including tie holes, immediately after removing formwork.
- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
- C. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains as indicated on drawings.

3.08 CURING AND PROTECTION

- A. Comply with requirements of ACI PRC-308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
 1. Normal concrete: Not less than seven days.
- C. Surfaces Not in Contact with Forms:
 1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
 2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
 3. Final Curing: Begin after initial curing but before surface is dry.
 - a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.
 - b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3.09 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.

- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Test the concrete at the start of every pour and every subsequent 50 cubic yards maximum.
- E. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
- F. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.
- G. Compression Test Specimens: ASTM C 31/C 31M.
 - 1. Cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
- H. Compressive-Strength Tests: ASTM C 39/C 39M for standard cylinders; test one laboratory-cured specimens at 7 days, one at 14 days and one specimens at 28 days. Hold one cylinder.
 - 1. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
- I. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 Mpa).

3.10 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to Architect, Structural Engineer and Contractor within 24 hours of test.
 - 1. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7-day and 28-day tests.
- B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
- D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.11 PROTECTION

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

SECTION 03 35 11
CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface treatments.
- B. Polished concrete.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.
- B. Section 03 30 00 - Cast-in-Place Concrete: Curing compounds that also function as sealers.

1.03 ADMINISTRATIVE REQUIREMENTS

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

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.
- C. Specimen warranty.
- D. Executed warranty.

1.05 MOCK-UPS

- A. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.
- B. Construct mock-ups of each exposed concrete floor finish, 10 feet square.
- C. Locate where directed.
- D. Mock-up may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

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

1.07 FIELD CONDITIONS

- A. Maintain ambient temperature of 50 degrees F minimum.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide two-year manufacturer warranty for work commencing on the Date of Substantial Completion.
- C. Finish Warranty: Provide five-year manufacturer warranty against excessive degradation of finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Unless otherwise indicated on drawings, finish concrete floors using troweling aid, densifier, and curing agent.
- B. Polished Concrete System:
 - 1. Use at the following locations: As indicated on the Drawings.

2.02 SURFACE TREATMENTS

- A. Troweling Aid, Densifier and Curing Agent: Liquid reactive colloidal silica-based topical treatment, spray-applied to wet concrete and floated or troweled into the surface.

2.03 POLISHED CONCRETE SYSTEM

- A. Description: Materials, equipment, and procedures designed and furnished by single manufacturer to produce densely polished concrete of specified sheen.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 GENERAL

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

3.03 COATING APPLICATION

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

3.04 CONCRETE POLISHING

- A. Execute using materials, equipment, and procedures specified by manufacturer, using manufacturer approved installer.
- B. Protect finished surface as required and as recommended by manufacturer of polishing system.

END OF SECTION

SECTION 04 05 11
MASONRY MORTARING AND GROUTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Mortar for masonry.
- B. Grout for masonry.

1.02 RELATED REQUIREMENTS

- A. Section 04 20 00 - Unit Masonry: Installation of mortar and grout.
- B. Section 08 11 13 - Hollow Metal Doors and Frames: Products and execution for grouting steel door frames installed in masonry.

1.03 REFERENCE STANDARDS

- A. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2025.
- B. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2024.
- C. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.
- D. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2024.
- E. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2025.
- F. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2024.
- G. ASTM C476 - Standard Specification for Grout for Masonry; 2023.
- H. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2024.
- I. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.
- C. Samples: Submit two samples of mortar, illustrating mortar color and color range.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.07 FIELD CONDITIONS

- A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

- A. At Contractor's option, mortar and grout may be field-mixed from packaged dry materials, made from factory premixed dry materials with addition of water only, or ready-mixed.

- B. Mortar Mix Designs: ASTM C270, Property Specification.
 - 1. Masonry below grade and in contact with earth: Type S.
 - 2. Exterior, Loadbearing Masonry: Type S.
 - 3. Exterior, Non-loadbearing Masonry: Type O.
 - 4. Interior, Loadbearing Masonry: Type N.
 - 5. Interior, Non-loadbearing Masonry: Type O.
- C. Grout Mix Designs:
 - 1. Bond Beams and Lintels: 3,000 psi strength at 28 days; 8-10 inches slump; mix in accordance with ASTM C476.
 - 2. Engineered Masonry: 3,000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M.

2.02 MATERIALS

- A. Portland Cement: ASTM C150/C150M.
 - 1. Type: Type I - Normal; ASTM C150/C150M.
 - 2. Color: Color as required to produce approved color sample.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Mortar Aggregate: ASTM C144.
- D. Grout Aggregate: ASTM C404.
- E. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
 - 1. Color(s): As selected by Architect from manufacturer's full range.
- F. Water: Clean and potable.
- G. Accelerating Admixture: Nonchloride type for use in cold weather.
- H. Moisture-Resistant Admixture: Water repellent compound designed to reduce capillarity.
- I. Bonding Agent: Latex type.

2.03 MORTAR MIXING

- A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.
- B. Maintain sand uniformly damp immediately before the mixing process.
- C. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio; mix in accordance with manufacturer's instructions, uniform in coloration.
- D. Do not use anti-freeze compounds to lower the freezing point of mortar.
- E. If water is lost by evaporation, re-temper only within two hours of mixing.

2.04 GROUT MIXING

- A. Mix grout in accordance with ASTM C94/C94M.
- B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.

PART 3 EXECUTION

3.01 PREPARATION

- A. Apply bonding agent to existing concrete surfaces.
- B. Plug clean-out holes for grouted masonry with brick masonry units. Brace masonry to resist wet grout pressure.

3.02 INSTALLATION

- A. Install mortar and grout to requirements of section(s) in which masonry is specified.
- B. Do not displace reinforcement while placing grout.
- C. Remove excess mortar from grout spaces.

END OF SECTION

**SECTION 04 20 00
UNIT MASONRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete block.
- B. Clay facing brick.
- C. Flashings.
- D. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Loose steel lintels.
- B. Section 06 10 00 - Rough Carpentry: Nailing strips built into masonry.
- C. Section 07 21 00 - Thermal Insulation: Insulation for cavity spaces.
- D. Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2024.
- C. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019 (Reapproved 2025).
- D. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.
- F. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2023.
- G. ASTM C91/C91M - Standard Specification for Masonry Cement; 2025.
- H. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.
- I. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2024.
- J. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2025.
- K. ASTM C476 - Standard Specification for Grout for Masonry; 2023.
- L. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale); 2022.
- M. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2025.
- N. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2024.
- O. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017 (Reapproved 2023).
- P. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.
- Q. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.
- R. BIA Technical Notes No. 28B - Brick Veneer/Cold-Formed Steel Framed Walls; 2025.

- S. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.
- T. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).
- U. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Samples: Submit two samples of decorative block and facing brick units to illustrate color, texture, and extremes of color range.
- D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

1.06 MOCK-UPS

- A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar, accessories, structural backup, and flashings (with lap joint, corner, and end dam) in mock-up.
- B. Locate where directed.
- C. Mock-up may remain as part of work.

1.07 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.

2.02 BRICK UNITS

- A. Manufacturers:
 - 1. Match existing brick.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

- A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.
- B. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
- C. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

3.04 COURSING

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

3.05 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar and mortar smears as work progresses.
- E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.
- F. Interlock intersections and external corners, except for units laid in stack bond.
- G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- I. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.
- J. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
- K. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.06 WEEPS/CAVITY VENTS

- A. Install weeps in veneer and cavity walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

3.07 CAVITY MORTAR CONTROL

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.
- C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.08 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHE MASONRY, AND CAVITY WALL MASONRY

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.
- E. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches on center.

3.09 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

- A. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 36 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.
- B. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.
- C. Seismic Reinforcement: Connect veneer anchors with continuous horizontal wire reinforcement before embedding anchors in mortar.

3.10 REINFORCEMENT AND ANCHORAGES - MULTIPLE WYTHE UNIT MASONRY

- A. Use individual metal ties installed in horizontal joints to bond wythes together. Provide ties spaced as indicated on drawings.
- B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

3.11 MASONRY FLASHINGS

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
 - 1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up flashing ends at least 1 inch, minimum, to form watertight pan at nonmasonry construction.
 - 2. Remove or cover protrusions or sharp edges that could puncture flashings.
 - 3. Seal lapped ends and penetrations of flashing before covering with mortar.
- B. Terminate flashing up 8 inches minimum on vertical surface of backing:
 - 1. Install vertical leg of flashing behind water-resistive barrier sheet over backing.
 - 2. Install vertical leg of flashing over fluid-applied or self-adhered air/vapor barriers over backing or per manufacturer's directions.
 - 3. Terminate vertical leg of flashing into bed joint in masonry or reglet in concrete.
 - 4. Anchor vertical leg of flashing into backing with a termination bar and sealant.
- C. Extend metal flashings to within 1/2 inch of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.
- D. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.12 LINTELS

- A. Install loose steel lintels over openings.

3.13 GROUTED COMPONENTS

- A. Reinforce bond beams with 2, No. 5 bars, 1 inch from bottom web.
- B. Reinforce columns as detailed.
- C. Lap splices minimum 40 bar diameters.
- D. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- E. Place and consolidate grout fill without displacing reinforcing.
- F. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

3.14 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Size control joints as indicated on drawings; if not indicated, 3/4 inch wide and deep.
- C. Form expansion joint as detailed on drawings.

3.15 BUILT-IN WORK

- A. As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
 - 1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

3.16 TOLERANCES

- A. Maximum Variation from Alignment of Columns: 1/4 inch.
- B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.
- F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.17 CUTTING AND FITTING

- A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.18 PARGING

3.19 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

3.20 PROTECTION

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

END OF SECTION

**SECTION 05 12 00
STRUCTURAL STEEL FRAMING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Structural steel framing members.
- B. Structural steel support members and struts.
- C. Base plates, shear stud connectors and expansion joint plates.
- D. Grouting under base plates.

1.02 RELATED REQUIREMENTS

- A. Section 05 21 00 - Steel Joist Framing.
- B. Section 05 31 00 - Steel Decking: Support framing for small openings in deck.
- C. Section 05 50 00 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.03 REFERENCE STANDARDS

- A. AISC (MAN) - Steel Construction Manual; 2023, with Errata (2025).
- B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2022, with Errata (2025).
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.
- E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
- G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
- H. ASTM A514/A514M - Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding; 2022.
- I. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.
- J. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2022.
- K. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2024.
- L. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi, 144 ksi, and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2025.
- M. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
- N. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).
- O. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.
- P. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
 - 2. Connections not detailed.
 - 3. Indicate cambers and loads.
 - 4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
 - 5. Indicate ne weld lengths.
- C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.05 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."
- B. Structural steel members designated as architecturally-exposed structural steel (AESS) to also comply with Section 05 12 13.
- C. Maintain one copy of each document on site.
- D. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
- E. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Steel Angles and Plates: ASTM A36/A36M.
- B. Steel W Shapes and Tees: ASTM A992/A992M.
- C. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.
- D. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.
- E. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- F. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 - 1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
 - 2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.
- G. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.
- H. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Shop fabricate to greatest extent possible.
- B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- C. Fabricate connections for bolt, nut, and washer connectors.

- D. Develop required camber for members.

2.03 FINISH

- A. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

- A. Erect structural steel in compliance with AISC 303.
- B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C. Field weld components and shear studs indicated on shop drawings.
- D. Do not field cut or alter structural members without approval of Architect.
- E. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- F. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.03 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION

**SECTION 05 21 00
STEEL JOIST FRAMING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Open web steel joists, with bridging, attached seats and anchors.
- B. Loose bearing members, such as plates or angles, and anchor bolts for site placement.
- C. Supplementary framing for floor and roof openings greater than 18 inches.

1.02 RELATED REQUIREMENTS

- A. Section 05 12 00 - Structural Steel Framing: Grouting base plates and bearing plates. Superstructure framing.
- B. Section 05 31 00 - Steel Decking: Bearing plates and angles.
- C. Section 05 50 00 - Metal Fabrications: Non-framing steel fabrications attached to joists.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- B. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).
- C. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.
- D. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.
- E. SJI 100 - Standard Specifications for K-Series, LH-Series, and DLH-Series Open Web Steel Joists, and for Joist Girders; 2020.
- F. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders; 2008.
- G. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
- H. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.
- C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- D. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.
- B. Perform Work, including that for headers and other supplementary framing, in accordance with SJI 100 Standard Specifications Load Tables and SJI Technical Digest No. 9.
- C. Manufacturer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Transport, handle, store, and protect products to SJI requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Steel Joists:
 - 1. Canam Group Inc: www.canam-steeljoists.ws
 - 2. New Millennium Building Systems: www.newmill.com/#sle.
 - 3. Nucor-Vulcraft Group: www.vulcraft.com/#sle.
 - 4. Substitutions: Approved equal.

2.02 MATERIALS

- A. Open Web Joists: SJI Type K Joists:
 - 1. Provide bottom and top chord extensions as indicated.
 - 2. Minimum End Bearing on Steel Supports: As shown on the drawings.
 - 3. Finish: Shop primed.
- B. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36/A36M.
- C. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 FINISH

- A. Shop prime joists as specified.
- B. Prepare surfaces to be finished in accordance with SSPC-SP 2.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions prior to beginning work.

3.02 ERECTION

- A. Erect joists with correct bearing on supports.
- B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.
- C. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.
- D. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.
- E. Position and field weld joist chord extensions and wall attachments as detailed.
- F. Install supplementary framing for floor and roof openings greater than 18 inches.
- G. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.
- H. Do not field cut or alter structural members without approval of joist manufacturer.
- I. After erection, prime welds, damaged shop primer, damaged galvanizing, and surfaces not shop primed , except surfaces specified not to be primed.

3.03 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch.
- B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION

SECTION 05 31 00 STEEL DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof deck.
- B. Supplementary framing for openings up to and including 18 inches.
- C. Bearing plates and angles.

1.02 RELATED REQUIREMENTS

- A. Section 05 12 00 - Structural Steel Framing: Support framing for openings larger than 18 inches and shear stud connectors.
- B. Section 05 12 00 - Structural Steel Framing: Placement of embedded steel anchors for bearing plates in cast-in-place concrete.
- C. Section 05 21 00 - Steel Joist Framing: Placement of embedded steel anchors for bearing plates and joist seats in cast-in-place concrete.
- D. Section 05 50 00 - Metal Fabrications: Steel angle concrete stops at deck edges.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).
- D. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.
- E. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).
- F. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.
- G. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.
- H. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
- I. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.
- B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
- C. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.
- D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- E. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.05 QUALITY ASSURANCE

- A. Design deck layout, spans, fastening, and joints under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Cut plastic wrap to encourage ventilation.
- B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Steel Deck:
 - 1. Canam Steel Corporation: www.canam-steeljoists.ws.
 - 2. Cordeck, Inc: www.cordeck.com/#sle.
 - 3. New Millennium Building Systems: www.newmill.com/#sle.
 - 4. Nucor-Vulcraft Group: www.vulcraft.com/#sle.
 - 5. Substitutions: Approved equal.

2.02 STEEL DECK

- A. Roof Deck: Non-composite type, fluted steel sheet:
 - 1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
 - 2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
 - 3. Minimum Base Metal Thickness: 19 gauge, ____ inch.
 - 4. Nominal Height: 1-1/2 inch.
 - 5. Profile: Fluted; SDI WR.
 - 6. Formed Sheet Width: 36 inch.
 - 7. Side Joints: Lock seam.
 - 8. End Joints: Lapped, welded.

2.03 ACCESSORY MATERIALS

- A. Bearing Plates and Angles: ASTM A36/A36M steel, galvanized per ASTM A123/A123M.
- B. Welding Materials: AWS D1.1/D1.1M.
- C. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- D. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions prior to beginning work.

3.02 INSTALLATION

- A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.
- B. On steel supports provide minimum 1-1/2 inch bearing.
- C. Fasten deck to steel support members at ends and intermediate supports at 12 inches on center maximum, parallel with the deck flute and at each transverse flute using methods specified.
 - 1. Welding: Use fusion welds through weld washers.
- D. Clinch lock seam side laps.
- E. Weld deck in accordance with AWS D1.3/D1.3M.
- F. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.

- G. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

END OF SECTION

SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formed steel stud exterior wall and interior wall framing.

1.02 RELATED REQUIREMENTS

- A. Section 05 31 00 - Steel Decking.
- B. Section 07 21 00 - Thermal Insulation: Insulation within framing members.
- C. Section 09 51 00 - Acoustical Ceilings: Ceiling suspension system.

1.03 REFERENCE STANDARDS

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).
- B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.
- F. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).
- G. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

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

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on cold-formed steel structural members; include material descriptions and base steel thickness.
- C. Product Data: Provide manufacturer's data on factory-made connectors and mechanical fasteners, showing compliance with requirements.
- D. Product Data: For lateral-force resisting systems, provide product data sheets on hold-down, showing compliance with requirements.
- E. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
- F. Manufacturer's Qualification statement.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Company specializing in manufacturing the types of products specified in this section, and with minimum 3 years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Structural Framing:
 - 1. ClarkDietrich: www.clarkdietrich.com/#sle.
 - 2. SCAFCO Corporation: www.scafco.com/#sle.
- B. Connectors:
 - 1. Same manufacturer as metal framing.
 - 2. Simpson Strong-Tie: www.strongtie.com/#sle.
 - 3. Substitutions: Approved equal.

2.02 PERFORMANCE REQUIREMENTS

- A. Design Requirements: Design cold-formed framing systems, components and connectors to withstand specified design loads in compliance with ICC (IBC), ASCE 7, AISI S100, and AISI S240.

2.03 MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

2.04 STRUCTURAL FRAMING COMPONENTS

- A. Wall Studs and Track Sections: AISI S240; c-shaped studs and u-shaped track sections in stud-matching nominal width and compatible height.

2.05 MISCELLANEOUS CONNECTIONS

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot-dip galvanized per ASTM A153/A153M.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Structural Wall Foundations: For gaps between wall bottom track and top of foundation 1/4 inch or greater, level substrate with loadbearing shims or grout between track and foundation.

3.03 INSTALLATION - GENERAL

- A. Install structural members and connections in compliance with ASTM C1007.

3.04 INSTALLATION OF STUDS

- A. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.
- B. Install load-bearing studs full length in one piece. Splicing of studs is not permitted.
- C. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
- D. Install intermediate studs above and below openings to align with wall stud spacing.
- E. Provide deflection allowance in stud track, directly below horizontal building framing at non-loadbearing framing.
- F. Attach cross studs to studs for attachment of fixtures anchored to walls.
- G. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

3.05 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.

3.06 TOLERANCES

- A. Studs - Vertical Alignment (Plumbness): $1/960$ of span or $1/8$ inch in 10 ft, in accordance with ASTM C1007.

END OF SECTION

**SECTION 05 44 00
COLD-FORMED METAL TRUSSES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Light gauge cold-formed steel roof trusses.
- B. Anchorages, bracing, and bridging.

1.02 RELATED REQUIREMENTS

- A. Section 05 21 00 - Steel Joist Framing: Structural steel open-web joists and joist girders.
- B. Section 05 40 00 - Cold-Formed Metal Framing: Light gauge structural metal studs, joists, and rafters.

1.03 REFERENCE STANDARDS

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.
- D. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.
- E. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).
- F. CFSEI 5000 - Field Installation Guide for Cold-Formed Steel Roof Trusses; May 2000.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Span charts.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings:
 - 1. Include detailed roof truss layout.
 - 2. Show member type, location, spacing, size and gauge, methods of attachment, and erection details. Indicate supplemental bracing, strapping, splices, bridging, and accessories.
 - 3. For trusses with clear-span of 60 feet or greater, provide all inclusive bracing erection plan showing all temporary and permanent bracing, as well as sequencing of bracing during truss erection. Bracing erection plan shall be submitted as part of shop drawing review.

1.05 QUALITY ASSURANCE

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

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver trusses and other materials in manufacturer's unopened bundles or containers, each marked with manufacturer's name, brand, type, and grade. Exercise care to avoid damage during unloading, storing, and erection.

- B. Store trusses on blocking, pallets, platforms, or other supports, off the ground and in an upright position, sufficiently braced to avoid damage from excessive bending. Gently slope stored trusses to avoid accumulation of water on interior of truss chord members.
- C. Protect trusses and accessories from contact with earth, corrosion, deformation, mechanical damage, or other deterioration when stored at project site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cold-Formed Steel Trusses:
 - 1. Aegis Metal Framing, a Division of MiTek Industries: www.aegismetalframing.com/#sle.
 - 2. Alpine TrusSteel, an ITW Company Inc: www.trussteel.com/#sle.
 - 3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 TRUSS DESIGN REQUIREMENTS

- A. Design: Calculate structural characteristics of cold-formed steel truss members according to AISI S100.
- B. Structural Performance: Design, engineer, fabricate, and erect trusses to withstand specified design loads for project conditions within required limits.
 - 1. Design Loads: In accordance with applicable codes.
 - 2. Deflections: Live load deflection meeting requirements indicated in the structural drawings.
 - 3. Design trusses to accommodate movement attributable to temperature changes within a range of 120 degrees F without damage or overstressing, sheathing failure, undue strain on fasteners and anchors, or other deleterious effects.

2.03 COMPONENTS

- A. Trusses: Light gauge steel assemblies providing a complete horizontal framing system for locations indicated, ready for deck installation.
 - 1. Truss Type, Span, and Height: As indicated on drawings.
 - 2. Chord and Web Members: Fabricate required shapes from commercial quality galvanized steel sheet complying with ASTM A653/A653M, with minimum yield strength of 40,000 psi; minimum G60/Z180 coating; gauges as required for load conditions; all edges rolled or closed.
- B. Fasteners: Self-drilling, self-tapping screw fasteners with corrosion-resistant plated finish, as recommended by steel truss manufacturer and marked for easy identification.
 - 1. Welding: Comply with applicable provisions of AWS D1.1/D1.1M and AWS D1.3/D1.3M.
- C. Bracing, Bridging, and Blocking Members: Fabricate required shapes from commercial quality galvanized steel sheet complying with ASTM A653/A653M, with minimum yield strength of 33,000 psi; minimum G60/Z180 coating; gauges as required for load conditions.

2.04 FABRICATION

- A. Factory fabricate cold-formed steel trusses plumb, square, true to line, and with secure connections, complying with manufacturer's recommendations and project requirements.
 - 1. Fabricate trusses using jig templates.
 - 2. Cut truss members by sawing, shearing, or plasma cutting.
 - 3. Fasten members in full compliance with instructions of manufacturer. Wire tying of framing members is not permitted.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine structure, substrates, and installation conditions. Notify Architect of unsatisfactory preparation. Do not begin installation until substrates have been properly prepared and unsatisfactory conditions have been corrected.

- B. Proceeding with installation indicates installer's acceptance of substrate conditions.

3.02 INSTALLATION

- A. Install cold-formed steel trusses in strict accordance with manufacturer's instructions and approved shop drawings, using approved fastening methods.
- B. Install temporary erection bracing and permanent bracing and bridging before application of any loads. Erect trusses with plane of truss webs vertical and parallel to each other, accurately located at spacing indicated. Anchor trusses securely at bearing points. For trusses with clear-span of 60 feet or greater, following all inclusive bracing erection plan provided and designed by the truss supplier.
- C. Adequately distribute applied loads to avoid exceeding the carrying capacity of any one joint, truss, or other component.
- D. Exercise care to avoid damaging truss members during lifting and erection and to minimize horizontal bending of trusses.
- E. Removal, cutting, or alteration of any truss chord, web, or bracing member in the field is prohibited, unless approved in advance by Architect or the engineer of record and the truss manufacturer.
- F. Repair or replace damaged members and complete trusses as directed and approved in writing by Architect or the engineer of record and the truss manufacturer.
- G. Galvanizing Repair: Touch up bare steel with zinc-rich paint in compliance with ASTM A780/A780M.
- H. Roof Trusses:
 - 1. Comply with recommendations of CFSEI 5000.
 - 2. Align truss bottom chords with load-bearing studs or continuously reinforce track as required to transfer loads to structure.
 - 3. Install continuous bridging and permanent truss bracing as indicated.
 - 4. Install roof cross bracing and diagonal bracing as indicated.

3.03 TOLERANCES

- A. Install trusses to maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet.
- B. Space individual trusses not more than plus or minus 1/8 inch from plan location. Cumulative error in placement may not exceed minimum fastening requirements of sheathing or other material fastened to trusses.

3.04 FIELD QUALITY CONTROL

- A. Owner will provide inspection service for inspection of field connections, in accordance with requirements of Section 01 40 00 - Quality Requirements.

3.05 PROTECTION

- A. Protect trusses from damage by subsequent construction activities.
- B. Repair or replace damaged trusses, truss members, and bracing members; obtain approval in advance by Architect or the engineer of record and the truss manufacturer for all cutting, repairs, and replacements.

END OF SECTION

**SECTION 05 50 00
METAL FABRICATIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel items.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 04 20 00 - Unit Masonry: Placement of metal fabrications in masonry.
- C. Section 05 12 00 - Structural Steel Framing: Structural steel column anchor bolts.
- D. Section 05 21 00 - Steel Joist Framing: Structural joist bearing plates, including anchorage.

1.03 REFERENCE STANDARDS

- A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2024.
- B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.
- E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.
- G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
- H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- J. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi, 144 ksi, and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2025.
- K. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
- L. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).
- M. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.
- N. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata (2020).
- O. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.
- P. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
- Q. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.05 QUALITY ASSURANCE

- A. Design the work as shown on the drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A500/A500M Grade B cold-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, galvanized to ASTM A153/A153M where connecting galvanized components.
- F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- G. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

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

2.03 FABRICATED ITEMS

- A. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; galvanized finish.
- B. Lintels: As detailed; prime paint finish.

2.04 FINISHES - STEEL

- A. Prime paint steel items.
 - 1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
- B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- C. Prime Painting: One coat.

2.05 FINISHES - ALUMINUM

- A. Interior Aluminum Surfaces: Class I natural anodized.

- B. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

2.06 FABRICATION TOLERANCES

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

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components as indicated on drawings.
- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

3.04 TOLERANCES

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

END OF SECTION

**SECTION 06 10 00
ROUGH CARPENTRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonstructural dimension lumber framing.
- B. Rough opening framing for doors, windows, and roof openings.
- C. Miscellaneous framing and sheathing.
- D. Concealed wood blocking, nailers, and supports.
- E. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

- A. Section 07 62 00 - Sheet Metal Flashing and Trim: Sill flashings.
- B. Section 09 21 16 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).
- D. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing; 2019a.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- F. AWPA U1 - Use Category System: User Specification for Treated Wood; 2025.
- G. PS 1 - Structural Plywood; 2023.
- H. PS 2 - Performance Standard for Wood Structural Panels; 2018.
- I. PS 20 - American Softwood Lumber Standard; 2025.

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.

1.05 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
 - 2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 DIMENSION LUMBER

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: _____.
- C. Stud Framing (2 by 2 through 2 by 10):
 - 1. Grade: Standard.

2.03 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
 - 2. Gypsum Board Screws: ASTM C1002; Type W, bugle head, self-piercing, tapping screws; length to penetrate wood members 5/8 inch minimum.
 - 3. Anchors: Toggle bolt type for anchorage to hollow masonry.
- B. Sill Gasket on Top of Foundation Wall: 1/4 inch thick, plate width, glass fiber strip.
- C. Sill Flashing: See Section 07 62 00.
- D. General Purpose Construction Adhesives: Comply with ASTM C557.

2.04 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWWA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
 - 2. 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 AWWA standards.

PART 3 EXECUTION

3.01 PREPARATION

- A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches and seal.
- B. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

3.02 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.

3.03 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 nonstructural 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.

3.04 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 each roof opening except where prefabricated curbs are specified and where specifically indicated otherwise; form corners by alternating lapping side members.

3.05 TOLERANCES

- A. Framing Members: 1/4 inch from true position, maximum.
- B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.06 CLEANING

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

END OF SECTION

SECTION 06 20 00 FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wood casings and moldings.
- B. Hardware and attachment accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- B. AWI (QCP) - Quality Certification Program; Current Edition.
- C. NHLA G-101 - Rules for the Measurement and Inspection of Hardwood and Cypress; 2023.

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 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Provide manufacturer's product data, storage and handling instructions for factory-fabricated units.
 - 2. Provide instructions for attachment hardware and finish hardware.
- C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
- D. Samples: Submit two samples of wood trim 12 inch long.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-fabricated units to project site in original packages, containers or bundles bearing brand name and identification.
- B. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.
- C. Protect from moisture damage.
- D. Handle materials and products to prevent damage to edges, ends, or surfaces.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

- A. Interior Woodwork Items:
 - 1. Moldings, Bases, Casings, and Miscellaneous Trim: Oak to match existing; prepare for stain finish to match existing.

2.02 LUMBER MATERIALS

- A. Hardwood Lumber: oak species, _____ sawn, maximum moisture content of 6 percent ; with vertical grain , of quality suitable for transparent finish.
 - 1. Grading: In accordance with NHLA G-101 Grading Rules; www.nhla.com.

2.03 ACCESSORIES

- A. Primer: Alkyd primer sealer.
- B. Wood Filler: Solvent base, tinted to match surface finish color.

2.04 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.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

- A. Set and secure materials and components in place, plumb and level.
- B. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.03 PREPARATION FOR SITE FINISHING

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.
- B. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

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 14 00
FLUID-APPLIED WATERPROOFING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water-based asphalt emulsion waterproofing.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete substrate.

1.03 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 E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.
- C. NRCA (WM) - The NRCA Waterproofing Manual; 2021.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for membrane, surface conditioner, flexible flashings, joint cover sheet, and joint and crack sealants.
- C. Warranty Documentation:
 - 1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
 - 2. Submit installer's documentation that installation complies with warranty conditions for the field-applied waterproofing.

1.05 QUALITY ASSURANCE

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

1.06 MOCK-UPS

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Construct mock-up consisting of 100 sq ft of horizontal and vertical fluid-applied waterproofing; to represent finished work including internal and external corners, drainage panel, base flashings, control joints, expansion joints, counterflashings, and protective cover.
- C. Locate where directed.
- D. Mock-up may remain as part of work.

1.07 FIELD CONDITIONS

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

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Installer Warranty: Provide 5-year warranty for waterproofing failing to resist penetration of water commencing on Date of Substantial Completion. Complete forms in Owner's name and register with installer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Water-Based Asphalt Emulsion Waterproofing:
 - 1. Carlisle Coatings & Waterproofing, Inc: www.carlisleccw.com/#sle.
 - 2. Mar-flex Waterproofing & Building Products: www.mar-flex.com/#sle.
 - 3. W.R. Meadows, Inc: www.wrmeadows.com/#sle.
 - 4. Substitutions: Approved equal.

2.02 FLUID-APPLIED WATERPROOFING MATERIALS

- A. Water-Based Asphalt Emulsion Waterproofing:
 - 1. Cured Thickness: 60 mil, 0.060 inch, minimum.
 - 2. Suitable for installation over concrete substrates.
 - 3. Water Vapor Permeability: 0.02 perm, maximum, measured in accordance with ASTM E96/E96M.
 - 4. Products:
 - a. Carlisle Coatings & Waterproofing, Inc; BarriCoat-R: www.carlisleccw.com/#sle.
 - b. Mar-flex Waterproofing & Building Products: www.mar-flex.com/#sle.
 - c. W. R. Meadows, Inc; MEL-ROL LM: www.wrmeadows.com/#sle.
 - d. Substitutions: Approved equal.
- B. Flexible Flashings: Type recommended by membrane manufacturer.

2.03 ACCESSORIES

- A. Sealant for Joints and Cracks in Substrate: Type compatible with waterproofing material and as recommended by waterproofing manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.
- C. Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of waterproofing materials.
- D. Verify that items penetrating surfaces to receive waterproofing are securely installed.
- E. Do not proceed with this work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Protect adjacent surfaces from damage not designated to receive waterproofing.
- B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.
- C. Do not apply waterproofing to surfaces unacceptable to waterproofing manufacturer.
- D. Fill non-moving joints and cracks with a filler compatible with waterproofing materials.
- E. Seal moving cracks with sealant and non-rigid filler, using procedures recommended by sealant and waterproofing manufacturers.

3.03 INSTALLATION

- A. Install waterproofing to specified minimum thickness in accordance with manufacturers instructions and NRCA (WM) applicable requirements.
- B. Apply primer or surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

- C. Apply extra thickness of waterproofing material at corners, intersections, and angles.
- D. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.
- E. Seal membrane and flashings to adjoining surfaces.
 - 1. Install termination bar along edges.
 - 2. Install counterflashing over exposed edges.

3.04 PROTECTION

- A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION

SECTION 07 21 00 THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation and integral vapor retarder at cavity wall construction, perimeter foundation wall, underside of floor slabs, over roof deck, and exterior wall behind brick wall finish.
- B. Batt insulation and vapor retarder in exterior wall and ceiling construction.
- C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

- A. Section 07 26 00 - Vapor Retarders: Separate vapor retarder materials.
- B. Section 07 27 00 - Air Barriers: Separate air barrier materials.
- C. Section 07 53 00 - Elastomeric Membrane Roofing: Installation requirements for board insulation over low slope roof deck.

1.03 DEFINITIONS

- A. Mineral Fiber Material Composition: Insulation referred to as mineral fiber block, board, and blanket insulation is composed of fibers from mineral based substances such as rock, slag, or glass and processed from the molten state into fibrous form.
 - 1. Based on type of insulation substance, the material will be referred to as a mineral fiber when having a rock or slag base, and glass fiber with a glass or silica sand base, also considered a mineral.
 - 2. Insulation blankets are flexible units consisting of felted, bonded, or unbonded fibers formed into rolls or flat cut pieces referred to as batts; rolls are simply longer versions of batts.
 - 3. For additional information about mineral fiber and the various classification types, refer to the following reference standards; ASTM C553, ASTM C612, ASTM C665, and ASTM C726.

1.04 REFERENCE STANDARDS

- A. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.
- B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).
- C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.
- D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
- E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.
- F. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board; 2017.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.06 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.
- B. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.
- C. Insulation Inside Masonry Cavity Walls: Expanded polystyrene (EPS) board.
- D. Insulation in Metal Framed Walls: Batt insulation with separate vapor retarder.

2.02 FOAM BOARD INSULATION MATERIALS

- A. Expanded Polystyrene (EPS) Board Insulation: Comply with ASTM C578.
 - 1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
- B. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.
 - 1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 - 3. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.
 - 4. Products:
 - a. DuPont de Nemours, Inc: building.dupont.com/#sle.
 - b. Kingspan Insulation LLC; GreenGuard GG25-LG XPS Insulation Board: www.kingspan.com/#sle.
 - c. Owens Corning Corporation; FOAMULAR Type ____ Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com/#sle.
 - d. Substitutions: Approved equal.

2.03 MINERAL FIBER BLANKET INSULATION MATERIALS

- A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - 2. Formaldehyde Content: Zero.
 - 3. Facing: Unfaced.
 - 4. Products:
 - a. CertainTeed Corporation: www.certainteed.com/#sle.
 - b. Johns Manville: www.jm.com/#sle.
 - c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.
 - d. Knauf Insulation.
 - e. Substitutions: Approved equal.
- B. Mineral Wool Blanket Thermal Insulation: Flexible or semi-rigid preformed insulation, complying with ASTM C665.
 - 1. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - 2. Products:
 - a. Johns Manville; MinWool Sound Attenuation Fire Batts: www.jm.com/#sle.
 - b. ROCKWOOL; COMFORTBATT: www.rockwool.com/#sle.
 - c. Thermafiber, Inc; SAFB: www.thermafiber.com/#sle.
 - d. Substitutions: Approved equal.

2.04 ACCESSORIES

- A. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.
 - 1. Application: Sealing of interior circular penetrations, such as pipes or cables.
 - 2. Width: Are required for application.
- B. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.
- C. Insulation Fasteners: Appropriate for purpose intended.
 - 1. Length as required for thickness of insulation material and penetration of deck substrate.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. Install boards horizontally on foundation perimeter.
 - 1. Install in running bond pattern.
 - 2. Butt edges and ends tightly to adjacent boards and to protrusions.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT EXTERIOR WALLS

- A. Install boards horizontally on walls.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.04 BOARD INSTALLATION AT CAVITY WALLS

- A. Install boards to fit snugly between wall ties.
- B. Install boards horizontally on walls.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.05 BOARD INSTALLATION UNDER CONCRETE SLABS

- A. Place insulation under slabs on grade after base for slab has been compacted.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.06 BATT INSTALLATION

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install in exterior wall and ceiling spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. Staple or nail facing flanges in place at maximum 6 inches on center.
- F. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.
- G. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over face of member
- H. Tape seal tears or cuts in vapor retarder.

- I. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane; tape seal in place.

3.07 PROTECTION

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

END OF SECTION

SECTION 07 21 01

THERMAL INSULATION (FLUID APPLIED)

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes the following:
 - 1. A fluid-applied, thermal insulating coating utilizing aerogel particles that imparts exceptional insulative properties to a variety of substrates. To be applied to all steel structural elements that pass from the interior to exterior of the building.

1.02 SUBMITTALS

- A. Product Data: Submit product data for specified products.

PART 2 PRODUCTS

2.01 MANUFACTURES

- A. Tnemec
 - 1. 6800 Corporate Drive Kansas City, MI 64120-1372
 - 2. Tele: (816)483-3400
- B. Substitutions: Approved equal.

2.02 PRODUCT REQUIREMENTS

- A. Product: Tnemec Series 971 Aerolon
- B. Thermal Performance: Must achieve a thermal conductivity of approximately 35 mW/m·K (milliwatts per meter-Kelvin).
- C. Flame/Smoke: Must meet ASTM E84 Class A (Flame Spread < 25, Smoke Developed < 50).

2.03 SURFACE PREPARATION

- A. Steel Substrates: Clean in accordance with SSPC-SP6/NACE No. 3 Commercial Blast Cleaning.
- B. Primer: Steel must be primed with a compatible corrosion-resistant primer, such as Tnemec Series 90-97 (Zinc-Rich) or Series N69 (Epoxy), before applying Aerolon.

2.04 APPLICATION & THICKNESS (THE THERMAL BREAK)

- A. For structural steel penetrations (beams protruding from inside to outside), the following thickness is required to prevent condensation:
 - 1. Thickness: 80 to 120 mils (2.0 to 3.0 mm) Dry Film Thickness (DFT).
 - 2. Method: Applied in multiple coats (40–50 mils per coat) using specialized airless spray equipment.
 - 3. Termination: Extend the coating at least 12 inches onto the interior portion of the steel beam to effectively "buffer" the thermal bridge.

2.05 FINISH AND PROTECTION

- A. Topcoat: Aerolon is a functional "insulation" layer and is not designed for UV exposure or aesthetics. It must be topcoated if exposed to the elements or for a finished interior look.
- B. Recommended Topcoat: Series 1028 or 1029 Enduratone (for interior/exterior color and UV stability).

PART 3 EXECUTION

3.01 INSTALLATION

- A. Installation shall follow the manufacturer's written installation instructions.

END OF SECTION

SECTION 07 21 19
FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Foamed-in-place insulation.
 - 1. In underside of roofs and ceilings.

1.02 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- C. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.
- C. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.
- D. Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.
- E. Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of all contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience, and approved by manufacturer.

1.05 FIELD CONDITIONS

- A. Do not apply foam when temperature is within 5 degrees F of dew point.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Foamed-In-Place Insulation:
 - 1. BASF Corporation; WALLTITE US Series Closed Cell: www.spf.basf.com/#sle.
 - 2. NCFI Polyurethanes: www.ncfi.com/#sle.
 - 3. Substitutions: Approved equal.

2.02 MATERIALS

- A. Foamed-In-Place Insulation: Low-density, flexible, open cell or closed cell, water vapor permeable polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
 - 1. Thermal Resistance: R-value of 3.0, minimum, per 1 inch thickness at 75 degrees F mean temperature when tested in accordance with ASTM C518.
 - 2. Air Permeance: 0.04 cfm per square foot, maximum, when tested at intended thickness in accordance with ASTM E2178 at 1.57 psf.

3. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
4. Products:
 - a. BASF Corporation; ENERTITE NM: www.spf.basf.com/#sle.
 - b. Substitutions: Approved equal.

2.03 ACCESSORIES

- A. Primer: As required by insulation manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify work within construction spaces or crevices is complete before insulation application.
- B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation 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 a minimum cured thickness of 2 inch.
- D. Patch damaged areas.
- E. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.
- F. Trim excess away for applied trim or remove as required for continuous sealant bead.

3.04 PROTECTION

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

END OF SECTION

SECTION 07 22 10
NAILBASE INSULATION PANELS

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes the following:
 - 1. The work shall consist of covering all areas shown on the drawings with nail base roof insulation.

1.02 SYSTEM DESCRIPTION

- A. Description of system:
 - 1. The insulated sheathing shall be a preassembled panel consisting of one layer of 5/8" fire-treated oriented strand board top surface (FSC or standard) bonded to 1" spacers to create an airspace bonded to 5" thick polyiso insulation.
 - 2. The Long Term Thermal Resistance (LTTR) R-Value of the vented roof insulation shall be no less than 29.5.
 - 3. Wood panel edges shall be rabbetted to allow the foam edges to fit together while providing clearance between the wood sheathing on adjoining panels.
 - 4. Foam sides and ends shall have a machined tongue and groove profile to reduce heat loss at the joints.
- B. Performance Requirements:
 - 1. The foam insulation shall have a Flame Spread Rating of 40-60.

1.03 SUBMITTALS

- A. Product Data: Submit product data for specified products.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. The nail base insulation shall be protected in the transit by plastic covers and by truck tarps. When material is stored at the jobsite, a reasonably level, drained storage area shall be provided. The insulation shall rest on firm blocking and shall be covered with tarps.

PART 2 PRODUCTS

2.01 MANUFACTURES

- A. GAF Cornell
 - 1. 1361 Alps Rd. Wayne, NJ 07470
 - 2. Tele: (800)766-3411 Fax: 877-271-6588
- B. Substitutions: Approved equal.

2.02 MATERIALS

- A. ThermaCal® 1 Ventilated Roof Insulation Panels by GAF Cornell (Fire-treated).

2.03 ACCESSORIES

- A. ThermaCal® Fasteners as required per the appropriate fastener pattern.

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

- A. The Structural roof deck shown in the plans shall be smooth and level and free of water or debris before the nail base insulation is installed.

3.02 INSTALLATION

- A. Installation shall follow the manufacturer's written installation instructions.
- B. Fasten with ThermaCal® Fasteners to the supporting roof deck shown in the plans.
- C. Protect nail base insulation work from exposure to moisture damage and deterioration, primarily by prompt installation of the roofing, sheet metal and waterproofing work.

END OF SECTION

SECTION 07 24 00
EXTERIOR INSULATION AND FINISH SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Composite wall cladding of rigid insulation and reinforced finish coating (Class PB).
- B. Drainage and water-resistive barriers behind insulation board.

1.02 RELATED REQUIREMENTS

- A. Section 05 40 00 - Cold-Formed Metal Framing: Sheathing on metal studs.
- B. Section 07 25 00 - Weather Barrier.
- C. Section 07 62 00 - Sheet Metal Flashing and Trim: Perimeter flashings.
- D. Section 07 92 00 - Joint Sealants: Sealing joints between EIFS and adjacent construction and penetrations through EIFS.

1.03 REFERENCE STANDARDS

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).
- B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.
- C. ASTM C1397 - Standard Practice for Application of Class PB Exterior Insulation and Finish Systems (EIFS) and EIFS with Drainage; 2025.
- D. ASTM D968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive; 2025.
- E. ASTM D2247 - Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity; 2025.
- F. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- H. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).
- I. ASTM E2273 - Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies; 2025.
- J. ASTM E2486/E2486M - Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS); 2022.
- K. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013 (Reapproved 2021).
- L. ASTM G155 - Standard Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials; 2021.
- M. ICC-ES AC219 - Acceptance Criteria for Exterior Insulation and Finish Systems; 2009, with Editorial Revision (2022).
- N. ICC-ES AC235 - Acceptance Criteria for EIFS Clad Drainage Wall Assemblies; 2015, with Editorial Revision (2022).
- O. ISO 9001 - Quality Management Systems — Requirements; 2015, with Amendment (2024).
- P. NFPA 259 - Standard Test Method for Potential Heat of Building Materials; 2023, with Errata.

- Q. NFPA 268 - Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source; 2022.
- R. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on system materials, product characteristics, performance criteria, and system limitations.
- C. Shop Drawings: Indicate wall joint patterns, joint details, and molding profiles.
- D. Selection Samples: Submit manufacturer's standard range of samples illustrating available coating colors and textures.
- E. Verification Samples: Submit actual samples of selected coating on specified substrate, minimum 6 inches square, illustrating project colors and textures.

1.05 QUALITY ASSURANCE

- A. Maintain copy of specified installation standard and manufacturer's installation instructions at project site during installation.
- B. EIFS Manufacturer Qualifications: Provide EIFS products other than insulation from the same manufacturer with qualifications as follows:
 - 1. Member in good standing of EIMA (EIFS Industry Members Association).
 - 2. Manufacturer of EIFS products for not less than 5 years.
 - 3. Manufacturing facilities ISO 9001 certified.
- C. Insulation Manufacturer Qualifications: Approved by manufacturer of EIFS and approved and labeled under third party quality program as required by applicable building code.
- D. Installer Qualifications: Company specializing in the type of work specified and with at least three years of documented experience.

1.06 MOCK-UP

- A. Construct mock-up of typical EIFS application on specified substrate, size as required to include examples of all key conditions, and including flashings, joints, and edge conditions.
- B. Locate mock-up at approved location convenient for comparison to finished work.
- C. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to project site in manufacturer's original, unopened containers with labels intact. Inspect materials and notify manufacturer of any discrepancies.
- B. Storage: Store materials as directed by manufacturer's written instructions.
 - 1. Protect adhesives and finish materials from freezing, temperatures below 40 degrees F and temperatures in excess of 90 degrees F.
 - 2. Protect Portland cement based materials from moisture and humidity. Store under cover off the ground in a dry location.
 - 3. Protect insulation materials from exposure to sunlight.

1.08 FIELD CONDITIONS

- A. Do not prepare materials or apply EIFS under conditions other than those described in the manufacturer's written instructions.
- B. Do not prepare materials or apply EIFS during inclement weather unless areas of installation are protected. Protect installed EIFS areas from inclement weather until dry.
- C. Do not install coatings or sealants when ambient temperature is below 40 degrees F.

- D. Do not leave installed insulation board exposed to sunlight for extended periods of time.

1.09 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's standard material warranty, covering a period of not less than 5 years.
- C. Provide separate warranty from installer covering labor for repairs or replacement for a period of not less than 5 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers:
 - 1. BASF Wall Systems.
 - 2. Dryvit Systems.
 - 3. Parex.
 - 4. Sto Corp.
 - 5. Substitutions: Approved Equal.

2.02 EXTERIOR INSULATION AND FINISH SYSTEM

- A. Fire Characteristics:
 - 1. Flammability: Pass, when tested in accordance with NFPA 285.
 - 2. Ignitibility: No sustained flaming when tested in accordance with NFPA 268.
 - 3. Potential Heat of Foam Plastic Insulation Tested Independently of Assembly: No portion of the assembly having potential heat that exceeds that of the insulation sample tested for flammability (above), when tested in accordance with NFPA 259 with results expressed in Btu per square foot.
- B. Water Penetration Resistance: No water penetration beyond the plane of the base coat/insulation board interface after 15 minutes, when tested in accordance with ASTM E331 at 6.24 psf differential pressure with tracer dye in the water spray; include in tested sample at least two vertical joints and one horizontal joint of same type to be used in construction; disassemble sample if necessary to determine extent of water penetration.
- C. Drainage Efficiency: Average minimum efficiency of 90 percent, when tested in accordance with ASTM E2273 for 75 minutes.
- D. Salt Spray Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 300 hours exposure in accordance with ASTM B117, using at least three samples matching intended assembly, at least 4 by 6 inches in size.
- E. Freeze-Thaw Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 10 cycles, when tested in accordance with ICC-ES AC219 or ICC-ES AC235.
- F. Weathering Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 2000 hours of accelerated weathering conducted in accordance with ASTM G153 Cycle 1 or ASTM G155 Cycles 1, 5, or 9.
- G. Water Degradation Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 14 days exposure, when tested in accordance with ASTM D2247.
- H. Mildew Resistance: No growth supported on finish coating during 28 day exposure period, when tested in accordance with ASTM D3273.
- I. Abrasion Resistance Of Finish: No cracking, checking or loss of film integrity when tested in accordance with ASTM D968 with 113.5 gallons of sand.

- J. Impact Resistance: Construct system to provide the following impact resistance without exposure of broken reinforcing mesh, when tested in accordance with ASTM E2486/E2486M:
1. Medium: 50 to 89 in-lb, for all areas.

2.03 MATERIALS

- A. Finish Coating Top Coat: Water-based, air curing, acrylic or polymer-based finish with integral color and texture.
1. Texture: Match existing, verify with Architect.
 2. Color: As selected by Architect from manufacturer's standard range.
- B. Base Coat: Fiber-reinforced, acrylic or polymer-based product compatible with insulation board and reinforcing mesh, Class PB.
- C. Reinforcing Mesh: Balanced, open weave glass fiber fabric, treated for compatibility and improved bond with coating, weight, strength, and number of layers as required to meet required system impact rating.
- D. Expanded Polystyrene (EPS) Board Insulation: Complies with ASTM C578.
1. Grooved Board: Back side of board adjacent to sheathing grooved with vertical channels designed to allow moisture to drain; at drainage points provide board configuration that permits drainage to the exterior.
 2. Board Size: 24 by 48 inches.
 3. Board Size Tolerance: Plus/minus 1/16 inch from square and dimension.
 4. Board Thickness: 2 inches.
 5. Board Edges: Square.
 6. Type and Thermal Resistance, R-value (RSI-value): Type XI, 3.1 (0.55) per 1 inch thickness at 75 degrees F mean temperature using ASTM C177 test method.
 7. Type and Board Density: Type I, 0.90 pcf (15 kg/cu m), minimum.
 8. Type and Compressive Resistance: Type I, 10 psi (69 kPa), minimum.
 9. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, when tested in accordance with ASTM E84.
 10. Manufacturers:
- E. Drainage System: As specified in Section 07 25 00 - Weather Barriers.

2.04 ACCESSORY MATERIALS

- A. Insulation Adhesive: Type required by EIFS manufacturer for project substrate.
- B. Insulation Fasteners: Fastener and plate system appropriate for substrate and as recommended by EIFS manufacturer.
- C. Metal Flashings: As specified in Section 07 62 00.
- D. Flashing Tape: Self-adhering rubberized asphalt tape with polyethylene backing for maintenance of continuous weather barrier at substrate transitions and intersections with other materials.
- E. Drainage track.
- F. Trim: EIFS manufacturer's standard PVC or galvanized steel trim accessories, as required for a complete project and including starter track and drainage accessories.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate is sound and free of oil, dirt, other surface contaminants, efflorescence, loose materials, or protrusions that could interfere with EIFS installation and is of a type and construction that is acceptable to EIFS manufacturer. Do not begin work until substrate and adjacent materials are complete and thoroughly dry.

- B. Verify that substrate surface is flat, with no deviation greater than 1/4 in when tested with a 10 ft straightedge.

3.02 PREPARATION

- A. Apply primer to substrate as recommended by EIFS manufacturer for project conditions.

3.03 INSTALLATION - GENERAL

- A. Install in accordance with EIFS manufacturer's instructions and requirements and recommendations of ASTM C1397.
- B. Install in accordance with EIFS manufacturer's instructions and requirements and recommendations of EIMA Guideline Specification for Exterior Insulation and Finish Systems, Class PB.

3.04 INSTALLATION - INSULATION

- A. Install in accordance with manufacturer's instructions.
- B. Prior to installation of boards, install starter track and other trim level and plumb and securely fastened. Install only in full lengths, to minimize moisture intrusion; cut horizontal trim tight to vertical trim.
- C. Install back wrap reinforcing mesh at all openings and terminations that are not to be protected with trim.
- D. On wall surfaces, install boards horizontally.
- E. Place boards in a method to maximize tight joints. Stagger vertical joints and interlock at corners. Butt edges and ends tight to adjacent board and to protrusions. Achieve a continuous flush insulation surface, with no gaps in excess of 1/16 inch.
- F. Fill gaps greater than with strips or shims cut from the same insulation material.
- G. Rasp irregularities off surface of installed insulation board.
- H. Mechanical Fastening: Space fasteners as recommended by EIFS manufacturer.
- I. Adhesive Attachment: Use method recommended by EIFS manufacturer.

3.05 INSTALLATION - FINISH

- A. Base Coat: Apply in thickness as necessary to fully embed reinforcing mesh, wrinkle free, including back-wrap at terminations of EIFS. Install reinforcing fabric as recommended by EIFS manufacturer.
 - 1. Lap reinforcing mesh edges and ends a minimum of 2-1/2 inches.
 - 2. Allow base coat to dry a minimum of 24 hours before next coating application.
- B. Apply finish coat after base coat has dried not less than 24 hours, embed finish aggregate, and finish to a uniform texture and color.
- C. Finish Coat Thickness: As recommended by manufacturer.
- D. Seal control and expansion joints within the field of exterior finish and insulation system, using procedures recommended by sealant and finish system manufacturers.

3.06 CLEANING

- A. Do not permit finish surface to become soiled or damaged throughout construction.
- B. Remove excess and waste EIFS materials from the project site.
- C. Clean EIFS surfaces and work areas of foreign materials resulting from EIFS operations.

3.07 PROTECTION

- A. Protect completed work from damage and soiling by subsequent work.

END OF SECTION

SECTION 07 26 00 VAPOR RETARDERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vapor retarders.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.
- B. Section 07 21 00 - Thermal Insulation: Vapor retarder installed in conjunction with batt insulation.

1.03 DEFINITIONS

- A. Vapor Retarder: Airtight barrier made of material that is relatively water vapor impermeable, to degree specified, with seams and joints sealed to adjacent surfaces.
- B. Vapor Retarder Class: A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class is defined using Procedure A, Desiccant Method at 73 degrees F and 50 percent Relative Humidity (RH), in accordance with ASTM E96/E96M and ICC (IBC)-2018, as follows:
 - 1. Class I: 0.1 perm or less.
 - 2. Class II: Greater than 0.1 perm to 1.0 perm.
 - 3. Class III: Greater than 1.0 perm to 10 perms.

1.04 REFERENCE STANDARDS

- A. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications; 2016 (Reapproved 2023).
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.
- D. ICC (IBC)-2018 - International Building Code; 2018.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on material characteristics, performance criteria, and limitations.
- C. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

1.06 MOCK-UPS

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Locate where directed.
- C. Mock-up may remain as part of work.

PART 2 PRODUCTS

2.01 VAPOR RETARDERS

- A. Underslab Vapor Retarders: See Section 03 30 00.
- B. Vapor Retarder Sheet: Polyamide nylon sheet intended for use with unfaced, vapor-permeable insulation such as fiberglass and mineral wool in wall and ceiling cavities.
 - 1. Thickness: 2 mil, 0.002 inch.
 - 2. Water Vapor Permeance: 1.0 perm, maximum, when tested in accordance with ASTM E96/E96M using Desiccant Method.

3. Surface Burning Characteristics: Smoke developed index of 450 or less, and flame spread index of 25 or less, Class A, when tested in accordance with ASTM E84.
4. Seam Lap and Perimeter Adhesive: Provide manufacturer's recommended method using either tape or sealants.
5. Products:
 - a. CertainTeed Corporation; MemBrain Continuous Air Barrier and Smart Vapor Retarder: www.certainteed.com/#sle.
 - b. Substitutions: Approved Equal..

2.02 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Vapor Retarder and Adjacent Substrates: As indicated, complying with vapor retarder manufacturer's installation instructions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and conditions comply with requirements of this section.

3.02 PREPARATION

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's installation instructions.
- B. Vapor Retarders: Install continuous airtight barrier over surfaces indicated, with sealed seams and sealed joints to adjacent surfaces.
- C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.
- D. Mechanically Fastened Sheets - Vapor Retarder On Interior:
 1. When insulation is installed within assembly, install vapor retarder over insulation.
 2. Anchor to wood framing using large-headed nails or staples at 12 to 18 inches on center along each framing member covered; cover fasteners with seam tape.
 3. Anchor to metal framing using seam tape, adhering at least one-half of tape width to metal substrate.
 4. Seal seams, laps, perimeter edges, penetrations, tears, and cuts with self-adhesive tape, providing an airtight seal.
 5. Locate laps at framing members; at laps fasten one sheet to framing member then tape overlapping sheet to first sheet in shingle fashion to shed water.
 6. Seal entire perimeter to structure, window and door frames, and other penetrations.
 7. Where conduits, pipes, wires, ducts, outlet boxes, and other items are installed within insulation cavity, pass vapor retarder sheet behind these items and over insulation to maintain airtight seal.

3.04 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07 27 00 AIR BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air barriers.

1.02 DEFINITIONS

- A. Air Barrier: Airtight barrier made of material that is virtually air impermeable but water vapor permeable, both to amount as specified, with sealed seams and sealed joints to adjacent surfaces.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- B. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.
- C. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on material characteristics, performance criteria, and limitations.

PART 2 PRODUCTS

2.01 AIR BARRIER MATERIALS (AIR IMPERMEABLE AND WATER VAPOR PERMEABLE)

- A. Air Barrier Sheet, Mechanically Fastened:
 - 1. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
 - 2. Water Vapor Permeance: 10 perms, minimum, when tested in accordance with ASTM E96/E96M using Procedure A - Desiccant Method, at 73.4 degrees F.
 - 3. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 90 days of weather exposure.
 - 4. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, Class A, when tested in accordance with ASTM E84.
 - 5. Seam and Perimeter Tape: Polyethylene self-adhering type, mesh reinforced, 2-1/2 inches wide, compatible with sheet material; unless otherwise indicated.
 - 6. Products:
 - a. DuPont de Nemours, Inc; Tyvek CommercialWrap D with Tyvek Fluid Applied Flashing - Brush Formulation, Tyvek Fluid Applied Flashing and Joint Compound, FlexWrap NF, StraightFlash, StraightFlash VF, Tyvek Wrap Caps, and Tyvek Tape: building.dupont.com/#sle.
 - b. Substitutions: Approved Equal.

2.02 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Air Barrier and Adjacent Substrates: As indicated or in compliance with air barrier manufacturer's installation instructions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and conditions are ready for work of this section.
- B. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.

- C. Do not proceed with this work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's installation instructions.
- B. Air Barriers: Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.
- D. Mechanically Fastened Sheets - On Exterior:
 - 1. Install sheets shingle fashion to shed water, with seams generally horizontal.
 - 2. Overlap seams as recommended by manufacturer, 6 inches, minimum.
 - 3. Overlap at outside and inside corners as recommended by manufacturer, 12 inches, minimum.
 - 4. For applications indicated to be airtight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners as recommended by manufacturer.
 - 5. Install air barrier underneath jamb flashings.
 - 6. At framed openings with frames having nailing flanges, extend sheet into opening and over flanges; at head of opening, seal sheet over flange and flashing.
- E. Openings and Penetrations in Exterior Air Barriers:
 - 1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto air barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
 - 2. At openings with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
 - 3. At openings with nonflanged frames, seal air barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
 - 4. At head of openings, install flashing under air barrier extending at least 2 inches beyond face of jambs; seal air barrier to flashing.
 - 5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
 - 6. Service and Other Penetrations: Form flashing around penetrating item and seal to air barrier surface.

3.04 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

**SECTION 07 31 13
ASPHALT SHINGLES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Asphalt shingle roofing.
- B. Flexible sheet membranes for eave protection, underlayment, and valley protection.
- C. Flashing.

1.02 RELATED REQUIREMENTS

- A. Section 07 22 10 - Nailbase Insulation Panels: Roof sheathing.
- B. Section 07 22 10 - Nailbase Insulation Panels: Nailable rigid insulation.
- C. Section 07 62 00 - Sheet Metal Flashing and Trim: Edge and cap flashings.
- D. Section 07 71 23 - Manufactured Gutters and Downspouts.

1.03 REFERENCE STANDARDS

- A. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.
- B. ASTM D3161/D3161M - Standard Test Method for Wind Resistance of Steep Slope Roofing Products (Fan-Induced Method); 2020 (Reapproved 2025).
- C. ASTM D3462/D3462M - Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules; 2023.
- D. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).
- E. ASTM D6380/D6380M - Standard Specification for Asphalt Roll Roofing (Organic Felt); 2003 (Reapproved 2022).
- F. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2020a.
- G. ASTM F1667/F1667M - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples; 2021a.
- H. ICC-ES AC207 - Acceptance Criteria for Polypropylene Roof Underlayments; 2012, with Editorial Revision (2015).
- I. NRCA (RM) - The NRCA Roofing Manual; 2025.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data indicating material characteristics, performance criteria, and limitations.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacture of roofing systems similar to those required for this project, with not less than 5 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store materials with labels intact in manufacturer's unopened packaging until ready for installation.

- B. Store materials under dry and waterproof cover, well ventilated, and elevated above grade on a flat surface.
- C. Protect materials from harmful environmental elements, construction dust, direct sunlight, and other potentially detrimental conditions.
- D. When storing roofing materials on roofing system ensure that no damage occurs to supporting members and other materials.

1.07 FIELD CONDITIONS

- A. Do not install shingles, eave protection membrane or underlayment when surface, ambient air, or wind chill temperatures are below 45 degrees F.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Warranty: 50 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Asphalt Shingles:
 - 1. Malarkey, Legacy.
 - 2. Substitutions: Approved equal.

2.02 ASPHALT SHINGLES

- A. Asphalt Shingles: Asphalt-coated glass felt, mineral granule surfaced, complying with ASTM D3462/D3462M.
 - 1. Fire Resistance: Class A, complying with ASTM E108.
 - 2. Wind Resistance: Class A, when tested in accordance with ASTM D3161/D3161M.
 - 3. Warranted Wind Speed: Not greater than 110 mph.
 - 4. Self-sealing type.
 - 5. Color: As selected by Architect.

2.03 SHEET MATERIALS

- A. Underlayment: Synthetic non-asphaltic sheet, intended by manufacturer for mechanically fastened roofing underlayment without sealed seams.
 - 1. Type: Woven polypropylene with anti-slip polyolefin coating on both sides.
 - 2. Minimum Requirements: Comply with requirements of ICC-ES AC207 for non-self-adhesive sheet.
 - 3. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
 - 4. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
 - 5. Fasteners: As recommended by manufacturer or building code qualification report or approval.
 - 6. Products:
 - a. DuPont roofliner with Elvaloy.
 - b. Grace Tri-flex Extreme.
 - c. Malarkey Synthetic Underlayment 1030.
 - d. Substitutions: Approved equal.
- B. Underlayment: Self-adhering rubber-modified asphalt sheet complying with ASTM D1970/D1970M; 22 mil total thickness; with strippable release film and woven polypropylene sheet top surface.
 - 1. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
 - 2. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
 - 3. Products:
 - a. Malarkey, Artic Seal 401.

2.04 FLASHING

- A. Metal Flashing: Galvanized steel; see Section 07 62 00.

2.05 ACCESSORIES

- A. Roofing Nails: Standard round wire shingle type, galvanized steel, stainless steel, aluminum roofing nails, or copper roofing nails, minimum 3/8-inch head diameter, 12-gauge, 0.109-inch nail shank diameter, 1-1/2 inches long and complying with ASTM F1667/F1667M.
- B. Asphalt Roof Cement: ASTM D4586/D4586M, asbestos-free.
- C. Plastic Ridge Vents: Extruded plastic with vent openings that do not permit direct water or weather entry; flanged to receive shingles.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions prior to starting this work.
- B. Verify that roof deck is of sufficient thickness to accept fasteners.
- C. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.
- D. Verify roof openings are correctly framed.
- E. Verify deck surfaces are dry, free of ridges, warps, or voids.

3.02 PREPARATION

- A. Seal roof deck joints wider than 1/16 inch as recommended by shingle manufacturer.
- B. At areas where eave protection membrane is to be adhered to substrate, fill knot holes and surface cracks with latex filler.
- C. Broom clean deck surfaces before installing underlayment or eave protection.
- D. Protect surrounding areas and adjacent surfaces from damage during execution of this work.
- E. Install eave edge flashings tight with fascia boards, weather lap joints 2 inches and seal with roof cement, and secure flange with nails.

3.03 INSTALLATION

- A. Eave Protection Membrane:
 - 1. Install eave protection membrane from eave edge to minimum 48 inches up-slope beyond interior face of exterior wall.
 - 2. Install eave protection membrane in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
 - 3. Starting from lower edge of starter strip, lay additional 36-inch wide strips in lap cement to produce a 2-ply membrane. Weather lap plies minimum 19 inches and nail in place; lap ends minimum 6 inches and stagger end joints of each consecutive ply.
- B. Underlayment:
 - 1. Roof Slopes Up to 4:12: Install two layers of underlayment over area not protected by eave protection, with ends and edges weather lapped minimum 4 inches; stagger end laps of each consecutive layer and nail in place.
 - 2. Roof Slopes Greater Than 4:12: Install underlayment perpendicular to slope of roof, with ends and edges weather lapped minimum 4 inches; stagger end laps of each consecutive layer, nail in place, and weather lap minimum 4 inches over eave protection.
 - 3. Weather lap and seal watertight with plastic cement any items projecting through or mounted on roof.
- C. Valley Protection:
 - 1. Install one ply of smooth surfaced roll roofing, minimum 18 inches wide, centered over valleys.
 - 2. Weather lap joints minimum 2 inches.

3. Nail in place minimum 18 inches on center, 1 inch from edges.
 4. At Exposed Valleys: Install one layer of sheet metal flashing, minimum 24 inches wide, centered over open valley and crimped to guide water flow. Weather lap joints minimum 2-inch wide band of lap cement along each edge of first layer, press roll roofing into cement, and nail in place minimum 18 inches on center and 1 inch from edges.
- D. Metal Flashing:
1. Weather lap joints minimum 2 inches and seal weather tight with plastic cement.
 2. Secure in place with nails and conceal fastenings.
 3. Items Projecting Through or Mounted on Roofing: Flash and seal weather tight with plastic cement.
- E. Shingles:
1. Install shingles in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
 - a. Fasten individual shingles using two nails per shingle, or as required by manufacturer and local building code, whichever is greater.
 - b. Fasten strip shingles using four nails per strip, or as required by manufacturer and local building code, whichever is greater.
 2. Place shingles in straight coursing pattern with 5-inch weather exposure to produce double thickness over full roof area, and provide double course of shingles at eaves.
 3. Project first course of shingles 3/4 inch beyond fascia boards.
 4. Extend shingles 1/2 inch beyond face of gable edge fascia boards.
 5. Complete installation to provide weathertight service.

3.04 CLEANING

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Clean exposed work upon completion of installation; remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to finish.

3.05 PROTECTION

- A. Do not permit traffic over finished roof surface; protect roofing until completion of project.
- B. Touch-up, repair, or replace damaged asphalt shingles or accessories before Date of Substantial Completion.

END OF SECTION

SECTION 07 53 00
ELASTOMERIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Elastomeric roofing membrane application.
- B. Insulation, flat and tapered.
- C. Cover boards.
- D. Roofing cant strips, stack boots, and walkway pads.

1.02 RELATED REQUIREMENTS

- A. Section 05 31 00 - Steel Decking: Placement of acoustical insulation for deck flutes.

1.03 REFERENCE STANDARDS

- A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.
- B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2025.
- C. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).
- D. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers; 2000 (Reapproved 2020).
- E. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact; 2020.
- F. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).
- G. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2015, with Editorial Revision (2022).
- H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.
- I. FM (AG) - FM Approval Guide; Current Edition.
- J. FM DS 1-28 - Wind Design; 2015, with Editorial Revision (2024).
- K. NRCA (WM) - The NRCA Waterproofing Manual; 2021.
- L. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.
- C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, and paver layout.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

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

- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.
- B. Store materials in weather protected environment, clear of ground and moisture.
- C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.
- D. Protect foam insulation from direct exposure to sunlight.

1.07 FIELD CONDITIONS

- A. Do not apply roofing membrane during unsuitable weather.
- B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above ____ degrees F.
- C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a two year period after Date of Substantial Completion.
- C. Provide twenty year manufacturer's material and labor warranty to cover failure to prevent penetration of water.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. EPDM Membrane Materials:
 - 1. Carlisle SynTec Systems; Sure-Tough EPDM: www.carlisle-syntec.com/#sle.
 - 2. Elevate; Low Slope Fire Retardant (LSFR) RubberGard EPDM Membrane: www.holcimelevate.com/#sle.
 - 3. GenFlex Roofing Systems, LLC; ____: www.genflex.com/#sle.
 - 4. Versico Roofing Systems; VersiGard EPDM: www.versico.com/#sle.
 - 5. Substitutions: Approved equal.
- B. Insulation:
 - 1. Owens Corning Corporation: www.owenscorning.com/#sle.
 - 2. Versico Roofing Systems; SecurShield Insulation: www.versico.com/#sle.
 - 3. Substitutions: Approved equal.

2.02 ROOFING - UNBALLASTED APPLICATIONS

- A. Elastomeric Membrane Roofing: One ply membrane, fully adhered, over insulation.
- B. Roofing Assembly Requirements:
 - 1. Roof Covering External Fire Resistance Classification: UL (DIR) certified Class A.
- C. Acceptable Insulation Types - Constant Thickness Application: Any of types specified.
- D. Acceptable Insulation Types - Tapered Application: Any of types specified.
 - 1. Tapered polyisocyanurate board.

2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

- A. Membrane: Ethylene-propylene-diene-monomer (EPDM); internally reinforced with fabric or scrim; complying with minimum properties of ASTM D4637/D4637M.
 - 1. Thickness: 60 mil, 0.060 inch, minimum.
 - 2. Sheet Width: 76 inches, maximum; factory fabricate into widest possible sheets.
 - 3. Color: Black.
 - 4. Tensile Strength: 1400 psi, minimum, measured in accordance with ASTM D412.
 - 5. Ultimate Elongation: 300 percent, minimum, measured in accordance with ASTM D412.
 - 6. Durometer Hardness, Type A: 30, minimum, in accordance with ASTM D2240.
 - 7. Water Vapor Permeability: 0.5 perm inch, measured in accordance with ASTM E96/E96M.
 - 8. Brittleness Temperature: -60 degrees F, measured in accordance with ASTM D746.
- B. Seaming Materials: As recommended by membrane manufacturer.
- C. Membrane Fasteners: As recommended by and approved by membrane manufacturer.
- D. Flexible Flashing Material: Same material as membrane.
 - 1. Thickness: 60 mil.
 - 2. Color: Black.

2.04 COVER BOARDS

- A. Cover Boards: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
 - 1. Thickness: 1/2 inch, fire-resistant.

2.05 INSULATION

- A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
 - 1. Classifications:
 - a. Type I: Faced with aluminum foil on both major surfaces of the core foam.
 - 1) Class 2 - Glass fiber reinforced or non-reinforced core foam.
 - 2) Compressive Strength: 16 psi, minimum.
 - 3) Thermal Resistance, R-value: At 1-1/2 inch thick; 9.0 at 75 degrees F.
 - 2. Board Size: 48 by 96 inches.
 - 3. Board Thickness: 1.5 inch.
 - 4. Tapered Board: Slope as indicated; minimum thickness 1 inch; fabricate of fewest layers possible.
 - 5. Board Edges: Square.

2.06 ACCESSORIES

- A. Cant and Edge Strips: Wood fiberboard, compatible with roofing materials ; cants formed to 45 degree angle.
- B. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
 - 1. Length as required for thickness of insulation material and penetration of deck substrate.
- C. Membrane Adhesive: As recommended by membrane manufacturer.
- D. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.
- E. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.
- F. Insulation Adhesive: As recommended by insulation manufacturer.
- G. Roofing Nails: Galvanized, hot-dipped type, size and configuration as required to suit application.
- H. Sealants: As recommended by membrane manufacturer.

- I. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
 1. Composition: Asphaltic with mineral granule surface or Roofing membrane manufacturer's standard.
 2. Size: 18 by 18 inches.
 3. Surface Color: Manufacture's standard.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 PREPARATION - METAL DECK

- A. Install preformed acoustical glass fiber insulation strips in roof deck flutes in accordance with manufacturer's instructions; see Section 05 31 00.

3.03 INSTALLATION - INSULATION, UNDER MEMBRANE

- A. Attachment of Insulation: Mechanically fasten insulation to deck in accordance with roofing manufacturer's instructions and FM (AG) Factory Mutual requirements.
- B. Cover Boards: Mechanically fasten cover boards in accordance with roofing manufacturer's instructions and FM (AG) Factory Mutual requirements.
- C. Lay subsequent layers of insulation with joints staggered minimum 6 inches from joints of preceding layer.
- D. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
- E. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.
- F. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- G. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 18 inches.
- H. Do not apply more insulation than can be covered with membrane in same day.

3.04 INSTALLATION - MEMBRANE

- A. Install elastomeric membrane roofing system in accordance with manufacturer's recommendations and NRCA (WM) applicable requirements.
- B. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
- C. Shingle joints on sloped substrate in direction of drainage.
- D. Fully Adhered Application: Apply adhesive to substrate at rate of ____ gal per 100 sq ft. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
- E. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

- F. Mechanical Attachment: Install membrane and mechanical attachment devices in accordance with manufacturer's instructions.
- G. At intersections with vertical surfaces:
 - 1. Extend membrane over cant strips and up a minimum of 4 inches onto vertical surfaces.
 - 2. Fully adhere flexible flashing over membrane and up to nailing strips.
- H. Around roof penetrations, seal flanges and flashings with flexible flashing.
- I. Coordinate installation of roof drains and sumps and related flashings.

3.05 CLEANING

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Remove bituminous markings from finished surfaces.
- C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.
- D. Repair or replace defaced or damaged finishes caused by work of this section.

3.06 PROTECTION

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashings, and fascia wrap.
- B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

- A. Section 07 71 23 - Manufactured Gutters and Downspouts.

1.03 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. ASTM B32 - Standard Specification for Solder Metal; 2020.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).
- E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).
- F. CDA A4050 - Copper in Architecture - Handbook; Current Edition.
- G. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch thick base metal, shop pre-coated with PVDF coating.
 - 1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
 - 2. Color: As selected by Architect from manufacturer's standard colors.

2.02 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.

- F. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

2.03 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Slip Sheet: Rosin-sized sheathing paper.
- C. Primer Type: Zinc chromate.
- D. Protective Backing Paint: Zinc molybdate alkyd.
- E. Concealed Sealants: Non-curing butyl sealant.
- F. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- G. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.
- H. Reglets: Surface-mounted type, galvanized steel; face and ends covered with plastic tape.
- I. Solder: ASTM B32, Alloy Grade - Sn50 (50/50).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.
- C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.03 INSTALLATION

- A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- B. Apply plastic cement compound between metal flashings and felt flashings.
- C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Solder metal joints for full metal surface contact, and after soldering wash metal clean with neutralizing solution and rinse with water.

END OF SECTION

SECTION 07 71 23
MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pre-finished aluminum gutters and downspouts.
- B. Precast concrete splash pads.

1.02 RELATED REQUIREMENTS

- A. Section 07 62 00 - Sheet Metal Flashing and Trim.

1.03 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. ASTM B32 - Standard Specification for Solder Metal; 2020.
- D. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- E. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on prefabricated components.
- C. Samples: Submit two samples, 6 inch long illustrating component design, finish, color, and configuration.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.
- B. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Gutters and Downspouts:
 - 1. EDCO; aluma-kore rainware.
 - 2. Rollex.
 - 3. Substitutions: Approved equal.

2.02 MATERIALS

- A. Pre-Finished Galvanized Steel Sheet: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch thick base metal.
 - 1. Finish: Shop pre-coated with modified silicone coating.
 - 2. Color: As selected by Architect from manufacturer's standard colors.
- B. Pre-Finished Aluminum Sheet: ASTM B209/B209M; 0.032 inch thick.
 - 1. Finish: Plain, shop pre-coated with polyvinylidene fluoride (PVDF) coating.
 - 2. Color: To match Existing.

2.03 COMPONENTS

- A. Gutters: size and shape to match existing

- B. Downspouts: size and shape to match existing.
- C. Anchors and Supports: Profiled to suit gutters and downspouts.
 - 1. Anchoring Devices: In accordance with CDA requirements.
 - 2. Gutter Supports: Straps.
 - 3. Downspout Supports: Straps.
- D. Fasteners: Galvanized steel, with soft neoprene washers.

2.04 FABRICATION

- A. Form gutters and downspouts of profiles and size indicated.
- B. Fabricate with required connection pieces.
- C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.
- D. Hem exposed edges of metal.
- E. Fabricate gutter and downspout accessories; seal watertight.

2.05 FINISHES

- A. Fluoropolymer Coating: Superior Performance Organic Finish, AAMA 2605, multiple coat, thermally cured fluoropolymer finish system; color as indicated, match existing.

2.06 ACCESSORIES

- A. Splash Pads: Precast concrete type, profiles size(s) as indicated; minimum 3,000 psi compressive strength at 28 days, with minimum 5 percent air entrainment.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that surfaces are ready to receive work.

3.02 PREPARATION

- A. Paint concealed sheet metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.03 INSTALLATION

- A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.
- B. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.
- C. Slope gutters 1/4 inch per foot .
- D. Set splash pans under downspouts.

END OF SECTION

SECTION 07 84 00 FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2024.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.
- C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).
- D. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems; 2024.
- E. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2024.
- F. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2023b.
- G. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2023a.
- H. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
- I. ITS (DIR) - Directory of Listed Products; Current Edition.
- J. FM 4991 - Approval Standard of Firestop Contractors; 2013.
- K. FM (AG) - FM Approval Guide; Current Edition.
- L. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.
- M. UL (DIR) - Online Certifications Directory; Current Edition.
- N. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.

1.05 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
 - 1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
 - 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
 - 3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and:
 - 1. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
 - 2. Verification of minimum three years documented experience installing work of this type.
 - 3. Verification of at least five satisfactorily completed projects of comparable size and type.
 - 4. Licensed by local authorities having jurisdiction (AHJ).

1.06 FIELD CONDITIONS

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Firestopping Manufacturers:
 - 1. 3M Fire Protection Products: www.3m.com/firestop/#sle.
 - 2. A/D Fire Protection Systems Inc: www.adfire.com/#sle.
 - 3. Hilti, Inc: www.hilti.com/#sle.
 - 4. Nelson FireStop Products: www.nelsonfirestop.com/#sle.
 - 5. Specified Technologies Inc: www.stfirestop.com/#sle.
 - 6. Tremco Commercial Sealants & Waterproofing; TREMstop Acrylic: www.tremcosealants.com/#sle.
 - 7. Substitutions: Approved equal.

2.02 MATERIALS

- A. Firestopping Materials: Any materials meeting requirements.
- B. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.
- C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- D. Fire Ratings: Refer to drawings for required systems and ratings.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.
 - 1. Movement: Provide systems that have been tested to show movement capability as indicated.
 - 2. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
 - 3. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
 - 4. Where floor assembly is not required to have a fire rating, provide systems that have been tested to show L Rating as indicated.
- B. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.

1. Movement: Provide systems that have been tested to show movement capability as indicated.
- C. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
 1. Movement: Provide systems that have been tested to show movement capability as indicated.
 2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
 3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
 4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.
- D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
 1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
 2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
 3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
 4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

2.04 FIRESTOPPING SYSTEMS

- A. Firestopping: Any material meeting requirements.
 1. Fire Ratings: See drawings for required systems and ratings.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

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

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

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

3.05 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 92 00 JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 09 21 16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- B. Section 09 30 00 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.03 REFERENCE STANDARDS

- A. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).
- B. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).
- C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).
- E. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.
- F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- G. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Backing material recommended by sealant manufacturer.
 - 4. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 5. Substrates the product should not be used on.
 - 6. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
- C. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.
- D. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.
- E. Executed warranty.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

- C. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
 - 1. Adhesion Testing: In accordance with ASTM C794.
 - 2. Compatibility Testing: In accordance with ASTM C1087.
 - 3. Allow sufficient time for testing to avoid delaying the work.
 - 4. Deliver sufficient samples to manufacturer for testing.
 - 5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Nonsag Sealants:
 - 1. Dow: www.dow.com/#sle.
 - 2. Master Builders Solutions: www.master-builders-solutions.com/en-us/#sle.
 - 3. Sika Corporation: www.usa.sika.com/#sle.
 - 4. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
 - 5. Substitutions: Approved equal.
- B. Self-Leveling Sealants:
 - 1. Dow: www.dow.com/#sle.
 - 2. Master Builders Solutions: www.master-builders-solutions.com/en-us/#sle.
 - 3. Sika Corporation: www.usa.sika.com/#sle.
 - 4. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.

2.02 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Exterior Joints:
 - a. Seal the following joints:
 - 1) Wall expansion and control joints.
 - 2) Joints between doors, windows, and other frames or adjacent construction.
 - 3) Joints between different exposed materials.
 - 2. Interior Joints:
 - a. Do not seal interior joints indicated on drawings as not sealed.
 - b. Seal the following joints:
 - 1) Joints between door frames and window frames and adjacent construction.
 - 2) In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, and piping penetrations.
 - 3) In sound-rated wall and ceiling assemblies, seal joints between wall assemblies and ceiling assemblies; between wall assemblies and other construction; between ceiling assemblies and other construction.
 - 3. Do Not Seal:
 - a. Intentional weep holes in masonry.
 - b. Joints indicated to be covered with expansion joint cover assemblies.
 - c. Joints where sealant installation is specified in other sections.
- B. Exterior Joints: Use nonsag nonstaining silicone sealant, unless otherwise indicated.
- C. Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.

1. Wall and Ceiling Joints in Nonwet Areas: Acrylic emulsion latex sealant.

2.03 NONSAG JOINT SEALANTS

- A. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
 1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Color: To be selected by Architect from manufacturer's standard range.
- B. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
 1. Color: To be selected by Architect from manufacturer's standard range.

2.04 ACCESSORIES

- A. Sealant Backing Materials, General: Materials placed in joint before applying sealants; assists sealant performance and service life by developing optimum sealant profile and preventing three-sided adhesion; type and size recommended by sealant manufacturer for compatibility with sealant, substrate, and application.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- E. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Install acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- E. Install bond breaker backing tape where backer rod cannot be used.

- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
- C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

END OF SECTION

SECTION 07 95 13
EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Expansion joint cover assemblies for Roof surfaces.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Custom fabricated metal expansion and control joint devices.
- B. Section 07 62 00 - Sheet Metal Flashing and Trim: Roof expansion and control joint covers.
- C. Section 07 92 00 - Joint Sealants: Sealing expansion and control joints using gunnable and pourable sealants.

1.03 REFERENCE STANDARDS

- A. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Installation Templates: For frames and anchors to be embedded in concrete or masonry, furnish templates to relevant installers; include installation instructions and tolerances.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices and available colors and finish.
- C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction and anchorage locations.
- D. Samples: Submit two samples 3 inch long, illustrating profile, dimension, color, and finish selected.
- E. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Expansion Joint Cover Assemblies:
 - 1. Construction Specialties, Inc: www.c-sgroup.com/#sle.
 - 2. Inpro: www.inprocorp.com/#sle.
 - 3. MM Systems Corp: www.mmsystemscorp.com/#sle.
 - 4. Nystrom, Inc: www.nystrom.com/#sle.
 - 5. Substitutions: Approved equal.

2.02 EXPANSION JOINT COVER ASSEMBLY APPLICATIONS

- A. Exterior Roof Expansion Joint Covers:
 - 1. Manufacturers:
 - a. Inpro 672 Series Bellows canted exterior expansion joint.

2.03 EXPANSION JOINT COVER ASSEMBLIES

- A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
 - 1. Joint Dimensions and Configurations: As indicated on drawings.
 - 2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.

3. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
4. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.

3.02 INSTALLATION

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

3.03 PROTECTION

- A. Do not permit traffic over unprotected floor joint surfaces.

END OF SECTION

**SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.
- D. Thermally insulated hollow metal doors with frames.

1.02 RELATED REQUIREMENTS

- A. Section 08 71 00 - Door Hardware.
- B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.
- C. Section 09 91 13 - Exterior Painting: Field painting.
- D. Section 09 91 23 - Interior Painting: Field painting.

1.03 ABBREVIATIONS AND ACRONYMS

- A. ANSI: American National Standards Institute.
- B. HMMA: Hollow Metal Manufacturers Association.
- C. NFPA: National Fire Protection Association.
- D. SDI: Steel Door Institute.
- E. UL: Underwriters Laboratories.

1.04 REFERENCE STANDARDS

- A. ADA Standards - 2010 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; 2024.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.
- E. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
- F. ASTM C476 - Standard Specification for Grout for Masonry; 2023.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- H. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.
- I. NAAMM HMMA 860 - Guide Specifications for Hollow Metal Doors and Frames; 2018.
- J. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.
- K. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.
- L. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.
- M. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.

1.05 SUBMITTALS

- A. See Section 01 30 00 - 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 standards/guidelines.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- B. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 3. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
 - 4. Steelcraft, an Allegion brand: www.allegion.com/#sle.
 - 5. Substitutions: Approved equal.

2.02 PERFORMANCE REQUIREMENTS

- A. Hollow Metal Panels: Same construction, performance, and finish as doors.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. L-Series by Steelcraft , Exterior Doors: Thermally insulated.
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 1 - Standard-duty.
 - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 20 gauge, 0.032 inch, minimum.
 - 2. Door Core Material: Polyisocyanurate, 2 lbs/cu ft minimum density.
 - a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
 - 3. Door Thermal Resistance: R-Value of 9.9, minimum, for installed thickness of polyisocyanurate.
 - 4. Door Thickness: 1-3/4 inches, nominal.

- B. Type CE Series by Steelcraft , Interior Doors, Non-Fire-Rated:

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. Exterior Door Frames: Full profile/continuously welded type.
 - 1. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.
 - 2. Frame Finish: Factory primed and field finished.
 - 3. Weatherstripping: Separate, see Section 08 71 00.
- D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
 - 1. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.
 - 2. Frame Finish: Factory primed and field finished.
- E. Door Frames, Fire-Rated: Full profile/continuously welded type.
 - 1. Fire Rating: Same as door, labeled.
 - 2. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.
 - 3. Frame Finish: Factory primed and field finished.

2.05 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
 - 1. Fire-Rated Frames: Comply with fire rating requirements indicated.

2.06 ACCESSORIES

- A. Door Window Frames: Door window frames with glazing securely fastened within door opening.
- B. Glazing: As specified in Section 08 80 00, factory installed.
- C. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.
- D. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

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 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and 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. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- E. Install door hardware as specified in Section 08 71 00.
- F. Coordinate installation of electrical connections to electrical hardware items.
- G. Touch up damaged factory finishes.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.

END OF SECTION

**SECTION 08 14 16
FLUSH WOOD DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 08 11 13 - Hollow Metal Doors and Frames.
- B. Section 08 71 00 - Door Hardware.
- C. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

- A. AWI (QCP) - Quality Certification Program; Current Edition.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- D. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.
- F. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2025.
- G. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.
- H. UL (DIR) - Online Certifications Directory; Current Edition.
- I. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- J. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2021, with Errata (2022).

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
- D. Samples: Submit two samples of door veneer, 3 by 3 inches in size illustrating wood grain, stain color, and sheen.
- E. Specimen warranty.
- F. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.

- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide manufacturer's warranty on interior doors for the life of the installation. Complete forms in Owner's name and register with manufacturer.
 - 1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wood Veneer Faced Doors:
 - 1. Masonite Architectural: www.architectural.masonite.com/#sle.
 - 2. VT Industries, Inc: www.vtindustries.com/#sle.
 - 3. Algoma Harwoods, Inc.
 - 4. Substitutions: Approved equal.

2.02 DOORS

- A. Doors: See drawings for locations and additional requirements.
 - 1. Quality Standard: Premium Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
 - 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at each location.
 - 2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with ICC (IBC) - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
 - 3. Wood veneer facing with factory transparent finish as selected by Architect.

2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.
- B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.04 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: Red oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
 - 1. Vertical Edges: Same species as face veneer.
 - 2. "Running Match" each pair of doors and doors in close proximity to each other.
 - 3. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.

2.05 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
 - 1. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.
 - 2. Provide solid blocking for other throughbolted hardware.

- C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- E. Provide edge clearances in accordance with the quality standard specified.

2.06 FINISHES - WOOD VENEER DOORS

- A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
- B. Factory finish doors in accordance with approved sample.
- C. Seal door top edge with color sealer to match door facing.

2.07 ACCESSORIES

- A. Glazing: See Section 08 80 00.
- B. Glazing Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamper proof screws.
- C. Door Hardware: See Section 08 71 00.

PART 3 EXECUTION

3.01 EXAMINATION

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

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
 - 1. Install fire-rated doors in accordance with NFPA 80 requirements.
 - 2. Install smoke and draft control doors in accordance with NFPA 105 requirements.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Field-Finished Doors: Trimming to fit is acceptable.
 - 1. Adjust width of non-rated doors by cutting equally on both jamb edges.
 - 2. Trim maximum of 3/4 inch off bottom edges.
 - 3. Trim fire-rated doors in strict compliance with fire rating limitations.
- D. Use machine tools to cut or drill for hardware.
- E. Coordinate installation of doors with installation of frames and hardware.
- F. Coordinate installation of glazing.

3.03 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

END OF SECTION

**SECTION 08 33 23
OVERHEAD COILING DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior non-fire-rated coiling doors.
- B. Fire-rated coiling doors.
- C. Electric operators and control stations.
- D. Wiring from electric circuit disconnect to operators and control stations.

1.02 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- B. See Division 26 for wiring connections and requirements.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
- C. ITS (DIR) - Directory of Listed Products; Current Edition.
- D. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).
- F. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025.
- G. UL (DIR) - Online Certifications Directory; Current Edition.
- H. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide general construction, electrical equipment, and component connections and details.
- C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.
- D. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.
- E. Manufacturer's qualification statement.
- F. Specimen warranty.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for purpose specified and indicated.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Overhead Coiling Metal Doors:
 - 1. C.H.I. Overhead Doors: www.chiohd.com/#sle.
 - 2. Clopay Building Products: www.clopaydoor.com/#sle.
 - 3. Overhead Door Corporation: www.overheaddoor.com/#sle.
 - 4. Raynor Garage Doors: www.raynor.com/#sle.
 - 5. Substitutions: Approved equal.

2.02 COILING DOORS

- A. Interior Non-Fire-Rated Coiling Doors: Steel slat curtain.
 - 1. Single Thickness Slats: Manufacturer's standard.
 - 2. Nominal Slat Size: 2 inches wide by required length.
 - 3. Finish: Factory painted, color as selected.
 - 4. Guides, Angles: Galvanized steel.
 - 5. Hood Enclosure: Manufacturer's standard; Factory painted.
 - 6. Manual hand crank lift operation.
 - 7. Electric operation.
 - 8. Mounting: Within framed opening.
- B. Fire-Rated Coiling Doors: Steel slat curtain; comply with NFPA 80.
 - 1. 1-1/2 hour fire rating.
 - 2. Provide products listed and labeled by ITS (DIR) or UL (DIR) as suitable for purpose specified and indicated on drawings.
 - 3. Oversized Openings: Provide certificate of compliance from authorities having jurisdiction indicating approval of fire rated units and operating hardware assembly.
 - 4. Single Thickness Slats: Manufacturer's standard.
 - a. Nominal Slat Size: 2 inches wide by required length.
 - 5. Finish: Factory painted, color as selected.
 - 6. Guides, Angles: Galvanized steel.
 - 7. Hood Enclosure: Manufacturer's standard; Factory painted.
 - 8. Coiling Door Release Mechanism: Fire alarm system activated with automatically governed closing speed.
 - 9. Fire Alarm Release Mechanism: Electric-motor operated from fire alarm system and local heat or smoke detectors.
 - a. Provide fail-secure, fail-closed, locking device upon power loss.
 - b. Provide resettable device without replacement of parts, except when release triggered by exposure to local heat.
 - c. Provide automatic reset device, except when release triggered by exposure to local heat.
 - 10. Manual hand crank lift operation.
 - 11. Electric operation.
 - 12. Mounting: Within framed opening.

2.03 MATERIALS

- A. Metal Curtain Construction: Interlocking slats.
 - 1. Curtain Bottom for Slat Curtains: Fitted with angles to provide reinforcement and positive contact in closed position.
 - 2. Weatherstripping for Exterior Doors: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of all doors.
- B. Guide Construction: Continuous, of profile to retain door in place with snap-on trim, mounting brackets of same metal.

- C. Guides - Angle: ASTM A36/A36M metal angles, size as indicated.
 - 1. Hot-dip galvanized in compliance with ASTM A123/A123M.
- D. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.

2.04 ELECTRIC OPERATION

- A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
 - 1. Provide interlock switches on motor operated units.
- B. Electric Operators:
 - 1. Mounting: Side mounted.
 - 2. Motor Enclosure:
 - 3. Motor Rating: 1/3 HP; continuous duty.
 - 4. Motor Voltage: 120 volts, single phase, 60 Hz.
 - 5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
 - 6. Controller Enclosure: NEMA EN 10250, Type 4.
 - 7. Opening Speed: 12 inches per second.
 - 8. Brake: Manufacturer's standard type, activated by motor controller.
 - 9. Manual override in case of power failure.
 - 10. See Section 26 05 83 for electrical connections.
- C. Control Station: Provide standard three button, 'Open-Close-Stop' momentary-contact control device for each operator complying with UL 325.
 - 1. 24 volt circuit.
 - 2. Surface mounted, at interior door jamb.
 - 3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
 - a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.
- D. Safety Edge: Located at bottom of coiling door, full width, electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object, hollow neoprene covered.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that adjacent construction is suitable for door installation.
- B. Verify that electrical services have been installed and are accessible.
- C. Verify that door opening is plumb, header is level, and dimensions are correct.
- D. Notify Architect of any unacceptable conditions or varying dimensions.
- E. Commencement of installation indicates acceptance of substrate and door opening conditions.

3.02 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install fire-rated doors in accordance with NFPA 80.
- C. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- D. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- E. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- F. Coordinate installation of electrical service with Section 26 05 83.
- G. Complete wiring from disconnect to unit components.

- H. Complete wiring from fire alarm system.
- I. Install enclosure and perimeter trim.

3.03 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation From Plumb: 1/16 inch.
- C. Maximum Variation From Level: 1/16 inch.
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 feet straight edge.

3.04 ADJUSTING

- A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING

- A. Clean installed components.
- B. Remove labels and visible markings.

END OF SECTION

SECTION 08 36 13
SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Overhead sectional doors, manually operated.
- B. Operating hardware and supports.
- C. Electrical controls.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Steel channel opening frame.
- B. Section 06 10 00 - Rough Carpentry: Rough wood framing for door opening.
- C. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- D. See Division 26 for wiring connections and requirements.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.
- E. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2024.
- F. DASMA 102 - American National Standard Specifications for Sectional Doors; 2018.
- G. ITS (DIR) - Directory of Listed Products; Current Edition.
- H. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).
- I. NEMA MG 00001 - Motors and Generators; 2024.
- J. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL (DIR) - Online Certifications Directory; Current Edition.
- M. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
- C. Samples: One panel finish samples, 2 by 2 inch in size, illustrating color and finish.
- D. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.
- E. Operation Data: Include normal operation, troubleshooting, and adjusting.
- F. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.

- G. Specimen warranty.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Comply with applicable code for motor and motor control requirements.
- C. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction, as suitable for purpose specified.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for warranty requirements.
- B. Extended Correction Period: Correct defective work within a 5-year period commencing on Date of Substantial Completion.
- C. Manufacturer Warranty: Provide 5-year manufacturer warranty for electric operating equipment. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sectional Doors:
 - 1. Raynor Garage Doors: www.raynor.com/#sle.
 - 2. Midland Garage Door Mfg Co: www.midlandgaragedoor.com.
 - 3. North Central Door Company: www.northcentraldoor.com
 - 4. Substitutions: Approved equal.

2.02 STEEL DOORS

- A. Type SSD-1 - Doors: Flush steel, insulated; high lift operating style with track and hardware; complying with DASMA 102, Commercial application.
 - 1. Door Panels: Steel construction; outer steel sheet of 24 gauge, 0.0239 inch minimum thickness, flush profile; inner steel sheet of 24 gauge, 0.0239 inch minimum thickness, flat profile; core reinforcement sheet steel roll formed to channel shape, rabbeted weather joints at meeting rails; expanded polystyrene (EPS) insulation.
 - 2. Door Nominal Thickness: 3 inches thick.
 - 3. Exterior Finish:
 - a. Factory finished with standard factory finish; color as selected from manufacturers standard line.
 - 4. Interior Finish:
 - a. Factory finished with standard factory finish; color as selected from manufacturers standard line.
 - 5. Glazed Lites: Full panel width, one row; set in place with resilient glazing channel.
 - 6. Window Frame: Manufacturers standard, finish to match.
 - a. Size: 24"x12"
 - 7. Glazing: Fully tempered glass; insulated glass units; clear; 1 inch overall thickness.

2.03 ALUMINUM DOORS

- A. Type ASD-1 - Doors: Stile and rail aluminum with glazed panels; high lift operating style with track and hardware; complying with DASMA 102, Commercial application.
 - 1. Door Nominal Thickness: 2 inches thick.
 - 2. Glazed Lites: Full panel width, each row; set in place with resilient glazing channel.
 - a. Glazing: Laminated safety glass; single pane; clear; 1/4 inch overall thickness.
 - 3. Manual Operation: Pull rope.
 - 4. Electric Operation: Electric control station.

2.04 COMPONENTS

- A. Track: Rolled galvanized steel, 0.090 inch minimum thickness; 3 inch wide, continuous one piece per side; galvanized steel mounting brackets 1/4 inch thick.
- B. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.
- C. Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables.
 - 1. For Manual Operation: Requiring maximum exertion of 25 lbs force to open.
- D. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.
- E. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.
- F. Head Weatherstripping: EPDM rubber seal, one piece full length.
- G. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.
- H. Lock: No lock required, all doors have openers.

2.05 MATERIALS

- A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.
- B. Float Glass: Provide float glass glazing, unless noted otherwise.
 - 1. Heat-Strengthened and Fully Tempered Types: ASTM C1048.
- C. Laminated Safety Glass: ASTM C1172 with at least 0.030 inch thick polyvinyl butyral (PVB) interlayer, and in compliance with safety criteria 16 CFR 1201 Categories 1 and 2, and ANSI Z97.1.
- D. Insulation: Expanded polystyrene (EPS), bonded to facing.
 - 1. 3" door: R-value of 17 minimum.
 - 2. Same thickness as core framing members.

2.06 ELECTRIC OPERATION

- A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
 - 1. Provide interlock switches on motor operated units.
- B. Electric Operators:
 - 1. Mounting: Side mounted on cross head shaft.
 - 2. Motor Enclosure:
 - a. Exterior Doors: NEMA MG 00001, Type 4; open drip proof.
 - b. Interior Doors: NEMA MG 00001, Type 1; open drip proof.
 - 3. Motor Rating: Horsepower as required for size of door , minimum of 1/2 hp; continuous duty.
 - a. Verify motor rating listed above is suitable for door sizes indicated in the drawings.
 - 4. Motor Voltage: 120 volts, single phase, 60 Hz.
 - 5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
 - 6. Controller Enclosure: NEMA EN 10250, Type 1.
 - 7. Opening Speed: 8-9 inches per second.
 - 8. Brake: Adjustable friction clutch type, activated by motor controller.
 - 9. Manual override in case of power failure.
 - 10. Refer to Division 26 for electrical connections and requirements.

- C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to comply with NFPA 70.
- D. Control Station: Provide standard three button (Open-Close-Stop) momentary-contact control device for each operator complying with UL 325.
 - 1. 24 volt circuit.
 - 2. Surface mounted, at location to be verified with Architect.
 - 3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
 - a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.
- E. Safety Edge: Located at bottom of sectional door panel, full width; electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object; hollow neoprene covered to provide weatherstrip seal.
- F. Operator shall include inherent automatic safety reversal of door (on close)/automatic stop of door (on open) upon encountering an obstruction and shall be provided with fully monitored, non-contact, infrared beam photo sensors to be mounted 6 inches maximum and no lower than 4 inches minimum above the floor that reverse a closing door to the full open position when an obstruction is sensed.
 - 1. Manufacturers:
 - a. LiftMaster H Jack Shaft Operator
 - b. Substitutions: Approved equal.
- G. Provide (1) Hand Held Transmitter: Digital control, and resettable.
- H. Single button.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.
- B. Verify that electric power is available and of the correct characteristics.

3.02 PREPARATION

- A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.
- B. Apply primer to wood frame.

3.03 INSTALLATION

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Anchor assembly to wall construction and building framing without distortion or stress.
- C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- D. Fit and align door assembly including hardware.
- E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

3.04 TOLERANCES

- A. Maximum Variation from Plumb: 1/16 inch.
- B. Maximum Variation from Level: 1/16 inch.
- C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.

- D. Maintain dimensional tolerances and alignment with adjacent work.

3.05 ADJUSTING

- A. Adjust door assembly for smooth operation and full contact with weatherstripping.

3.06 CLEANING

- A. Clean doors and frames and glazing.
- B. Remove temporary labels and visible markings.

3.07 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.
- B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION

**SECTION 08 51 13
ALUMINUM WINDOWS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Extruded aluminum windows with fixed sash.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Rough opening framing.
- B. Section 07 25 00 - Weather Barriers: Sealing frame to water-resistive barrier installed on adjacent construction.
- C. Section 07 92 00 - Joint Sealants: Sealing joints between window frames and adjacent construction.
- D. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.
- B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
- C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Include component dimensions, information on glass and glazing, internal drainage details, and descriptions of hardware and accessories.
- C. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, anchorage locations, and installation requirements.
- D. Samples:
 - 1. Framing: Two samples, 12 by 12 inch in size illustrating typical corner construction, accessories, and finishes.
- E. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.
- F. Specimen warranty.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of AAMA CW-10.

- B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.07 FIELD CONDITIONS

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

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Manufacturer Warranty: Provide 5-year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units. Complete forms in Owner's name and register with manufacturer.
- D. Manufacturer Warranty: Provide 20-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Kawneer; Trifab 451-T Storefront.
- B. Other Acceptable - Aluminum Windows Manufacturers:
 - 1. Tubelite: T14000.
 - 2. Substitutions: Approved equal.

2.02 ALUMINUM WINDOWS

- A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
 - 1. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.
 - 2. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
 - 3. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
 - 4. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 - 5. Thermal Movement: Design to accommodate thermal movement caused by 180 degrees F surface temperature without buckling stress on glass, joint seal failure, damaging loads on structural elements, damaging loads on fasteners, reduction in performance or other detrimental effects.
- B. Fixed, Non-Operable Type:
 - 1. Construction: Thermally broken.
 - 2. Glazing: Double; 1 inch; as specified in Section 08 80 00.

2.03 COMPONENTS

- A. Frames: 2 inch wide by 4-1/2 inch deep profile, of 0.070 inch thick section; thermally broken with interior portion of frame insulated from exterior portion; flush glass stops of snap-on type.
- B. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

2.05 FINISHES

- A. Superior Performing Organic Coatings System: Manufacturer's standard multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch.
- B. Finish Color: As selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that wall openings and adjoining water-resistive barrier materials are ready to receive aluminum windows; see Section 07 25 00.

3.02 PRIME WINDOW INSTALLATION

- A. Install windows in accordance with manufacturer's instructions.
- B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- D. Install sill.
- E. Set sill members and sill flashing in continuous bead of sealant.
- F. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- G. Install glass in accordance with requirements; see Section 08 80 00.

3.03 TOLERANCES

- A. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft non-cumulative or 1/8 inches per 10 ft, whichever is less.

3.04 ADJUSTING

- A. Adjust hardware for smooth operation and secure weathertight closure.

3.05 CLEANING

- A. Remove protective material from factory finished aluminum surfaces.
- B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.
- C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.
- D. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant and window manufacturer.

END OF SECTION

SECTION 08 80 00 GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

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

1.02 RELATED REQUIREMENTS

- A. Section 07 25 00 - Weather Barriers.
- B. Section 07 26 00 - Vapor Retarders.
- C. Section 07 27 00 - Air Barriers.
- D. Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.
- E. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- F. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.
- G. Section 08 51 13 - Aluminum Windows: On site glazed windows.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).
- D. ASTM C1036 - Standard Specification for Flat Glass; 2025.
- E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.
- F. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2024.
- G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- H. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.
- I. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.
- J. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.
- K. GANA (GM) - GANA Glazing Manual; 2022.
- L. GANA (SM) - GANA Sealant Manual; 2008.
- M. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (Reaffirmed 2016).
- N. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2023.
- O. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2023.
- P. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2023.
- Q. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Submit one samples 6 by 6 inch in size of glass and plastic units, showing coloration and design.
- E. Certificate: Certify that products of this section meet or exceed specified requirements.
- F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods. Maintain one copy on site.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.06 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Float Glass Manufacturers:
 - 1. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
 - 2. Guardian Glass, LLC: www.guardianglass.com/#sle.
 - 3. Pilkington North America Inc: www.pilkington.com/na/#sle.
 - 4. Saint Gobain North America: www.saint-gobain.com/#sle.
 - 5. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
 - 6. Substitutions: Approved equal.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
 - 1. Design Pressure: Calculated in accordance with applicable codes.
 - 2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 - 3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
 - 4. Glass thicknesses listed are minimum.

- B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
 - 1. In conjunction with weather barrier related materials described in other sections, as follows:
 - a. Water-Resistive Barriers: See Section 07 25 00.
 - b. Vapor Retarders: See Section 07 26 00.
 - c. Air Barriers: See Section 07 27 00.
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
 - 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 - 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 - 3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
 - 1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
 - 2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
 - 3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
 - 4. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality - Q3, with color and performance characteristics as indicated.
 - 5. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.
- B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
 - 1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

2.04 INSULATING GLASS UNITS

- A. Manufacturers:
 - 1. Glass: Any of the manufacturers specified for float glass.
- B. Insulating Glass Units: Types as indicated.
 - 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 - 2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
 - 3. Spacer Color: Black.
 - 4. Edge Seal:
 - a. Color: Black.
 - 5. Purge interpane space with dry air, hermetically sealed.
- C. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.
 - 1. Applications: Exterior glazing unless otherwise indicated.
 - 2. Space between lites filled with air.
 - 3. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
 - a. Tint: Clear.
 - 4. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.
 - a. Tint: Clear.
 - 5. Total Thickness: 1 inch.
 - 6. Glazing Method: Dry glazing method, gasket glazing.

2.05 ACCESSORIES

- A. Setting Blocks: Neoprene, with 80 to 90 Shore A durometer hardness; ASTM C864 Option I. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option I. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.
- C. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air barrier and vapor retarder seal; ____x____ inch size.
- D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option I; color as per manufacture's standard colors.
- E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that the minimum required face and edge clearances are being provided.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- D. Verify that sealing between joints of glass framing members has been completed effectively.
- E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, and paint.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

- A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

- B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove nonpermanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.06 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

**SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Acoustic insulation.
- C. Cementitious backing board.
- D. Gypsum wallboard.
- E. Joint treatment and accessories.
- F. Textured finish system.

1.02 RELATED REQUIREMENTS

- A. Section 05 40 00 - Cold-Formed Metal Framing: Structural steel stud framing.
- B. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.
- C. Section 07 21 00 - Thermal Insulation: Acoustic insulation.
- D. Section 07 25 00 - Weather Barriers: Water-resistive barrier over sheathing.
- E. Section 07 84 00 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
- F. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
- G. Section 09 22 16 - Non-Structural Metal Framing.
- H. Section 09 30 00 - Tiling: Tile backing board.

1.03 REFERENCE STANDARDS

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).
- B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.
- C. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2023.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- E. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
- F. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board; 2004 (Reapproved 2020).
- G. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).
- H. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.
- I. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.
- J. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.
- K. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

- L. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2024.
- M. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2018.
- N. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2017.
- O. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2018 (Reapproved 2023).
- P. ASTM C1288 - Standard Specification for Fiber-Cement Interior Substrate Sheets; 2023.
- Q. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2022, with Editorial Revision (2023).
- R. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.
- S. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2023.
- T. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- U. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- V. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.
- W. GA-600 - Fire Resistance and Sound Control Design Manual; 2024.
- X. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- Y. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.
- B. Sequencing: Install service utilities in an orderly and expeditious manner.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data:
- C. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- D. Samples: Submit two samples of predecorated gypsum board, 12 by 12 inches in size, indicating finish color and texture.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.
- B. Store metal products to prevent corrosion.

PART 2 PRODUCTS

2.01 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 - 1. American Gypsum Company: www.americangypsum.com/#sle.
 - 2. CertainTeed Corporation: www.certainteed.com/#sle.
 - 3. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
 - 4. Gold Bond Building Products, LLC provided by National Gypsum Company: www.goldbondbuilding.com/#sle.

5. USG Corporation: www.usg.com/#sle.
 6. Substitutions: Approved equal.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 2. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 3. Thickness:
 - a. Vertical Surfaces: 5/8 inch.
 - b. Ceilings: 5/8 inch.
- C. Backing Board For Wet Areas: One of the following products:
1. Application: Surfaces behind tile in wet areas including tub and shower surrounds, shower ceilings, and Restrooms.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
 - a. Thickness: 5/8 inch.
 - b. Products:
 - 1) PermaBASE Building Products, LLC provided by National Gypsum Company; PermaBase Cement Board: www.goldbondbuilding.com/#sle.
 - 2) USG Corporation; Fiberock Brand Aqua-Tough AR Interior Panels Regular 5/8 in. (15.9 mm): www.usg.com/#sle.
 - 3) Substitutions: Approved Equal.
 4. ASTM Cement-Based Board: Non-gypsum-based, cementitious board complying with ASTM C1288.
 - a. Thickness: 1/2 inch.
 - b. Products:
 - 1) James Hardie Building Products, Inc: www.jameshardie.com/#sle.
 - 2) Substitutions: Approved Equal.
- D. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
1. Application: Vertical surfaces behind thinset tile, except in wet areas.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. Type: Regular and Type X, in locations indicated.
 4. Type X Thickness: 5/8 inch.
 5. Regular Board Thickness: 5/8 inch.
 6. Edges: Tapered.
 7. Products:
 - a. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board: www.gpgypsum.com/#sle.
 - b. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Fire-Shield Gypsum Board: www.goldbondbuilding.com/#sle.
 - c. Substitutions: Approved Equal.
- E. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
1. Application: Exterior sheathing, unless otherwise indicated.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
 4. Regular Board Thickness: 1/2 inch.
 5. Edges: Square.

6. Glass Mat Faced Products:
 - a. Georgia-Pacific Gypsum; DensGlass Sheathing: www.gpgypsum.com/#sle.
 - b. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Fire-Shield Sheathing: www.goldbondbuilding.com/#sle.
 - c. Substitutions: Approved Equal.
- F. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
 1. Paper-Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.
 2. Paper-Faced Products:
 - a. Georgia-Pacific Gypsum; ToughRock Shaftliner: www.gpgypsum.com/#sle.
 - b. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond Shaftliner XP: www.goldbondbuilding.com/#sle.
 - c. Substitutions: Approved Equal.

2.02 GYPSUM BOARD ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed mineral-fiber, friction fit type, unfaced; thickness shown on the drawings.
- B. Sound Isolation Tape: Elastomeric foam tape for sound decoupling.
 1. Surface Burning Characteristics: Provide assemblies with flame spread index of 75 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 2. Tape Thickness: 1/4 inch.
- C. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- D. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
 1. Expansion Joints:
- E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
- F. Finishing Compound: Surface coat and primer, takes the place of skim coating.
- G. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.
- H. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 SHAFT WALL INSTALLATION

- A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
- B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Sound Isolation Tape: Apply to vertical studs and top and bottom tracks/runners in accordance with manufacturer's instructions.

- C. Acoustic Sealant: Install in accordance with manufacturer's instructions.
 - 1. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.04 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board perpendicular to framing, with ends and edges occurring over firm bearing.
- C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- D. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
 - 1. Seal joints, cut edges, and holes with water-resistant sealant.
- E. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- F. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.
- G. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For nonrated assemblies, install as follows:
 - 1. Single-Layer Applications: Screw attachment.
 - 2. Double-Layer Application: Install base layer using screws or nails. Install face layer using adhesive.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
 - 2. At exterior soffits, not more than 30 feet apart in both directions.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.
- B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 5: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 2. Level 3: Walls to receive textured wall finish.
 - 3. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
- E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.
- F. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.07 TEXTURE FINISH

- A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions.
- B. Texture Required: smooth walls in all new areas, match existing finish in existing/remodeled areas.

3.08 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.09 PROTECTION

- A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION

SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal partition, ceiling, and soffit framing.
- B. Framing accessories.

1.02 RELATED REQUIREMENTS

- A. Section 05 21 00 - Steel Joists: Execution requirements for anchors for attaching work of this section.
- B. Section 05 40 00 - Cold-Formed Metal Framing: Requirements for structural, load-bearing, metal stud framing and exterior wall stud framing.
- C. Section 06 10 00 - Rough Carpentry: Wood blocking within stud framing.
- D. Section 07 21 00 - Thermal Insulation: Insulation.
- E. Section 07 25 00 - Weather Barriers.
- F. Section 07 62 00 - Sheet Metal Flashing and Trim: Head and sill flashings.
- G. Section 07 84 00 - Firestopping: Sealing top-of-wall assemblies at fire-resistance-rated walls.
- H. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
- I. Section 08 51 13 - Aluminum Windows: Product requirements for window anchors.
- J. Section 09 21 16 - Gypsum Board Assemblies: Metal studs for gypsum board partition framing.

1.03 REFERENCE STANDARDS

- A. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.
- B. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).
- C. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- D. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Member of Steel Stud Manufacturers Association (SSMA): www.ssma.com/#sle.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Framing, Connectors, and Accessories:
 - 1. ClarkDietrich: www.clarkdietrich.com/#sle.
 - 2. SCAFCO Corporation: www.scafco.com/#sle.
 - 3. Substitutions: Approved equal.

2.02 FRAMING MATERIALS

- A. Fire-Resistance-Rated Assemblies: Comply with applicable code and as indicated on drawings.
- B. Non-Loadbearing Framing System Components: AISI S220; sheet steel, of size and properties necessary for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
 - 1. Studs: C-shaped with flat faces.
 - 2. Runners: U-shaped, sized to match studs.

- C. Non-Loadbearing Framing Accessories:
 - 1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
 - 2. Sheet Metal Backing: 0.0395 inch thick.
 - 3. Fasteners: ASTM C1002 self-piercing self-tapping screws.
 - 4. Anchorage Devices: Powder actuated.
 - 5. Acoustic Insulation: See Section 07 21 00.
 - 6. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

2.03 FABRICATION

- A. Fabricate assemblies of framed sections to sizes and profiles required.
- B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that rough-in utilities are in proper location.

3.02 INSTALLATION OF STUD FRAMING

- A. Install structural members and connections in accordance with ASTM C1007.
- B. Extend partition framing to structure where indicated and to ceiling in other locations.
- C. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
- D. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
- E. Align and secure top and bottom runners at 24 inches on center.
- F. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- G. Install studs vertically at spacing indicated on drawings.
- H. Align stud web openings horizontally.
- I. Secure studs to tracks using crimping method. Do not weld.
- J. Stud splicing is not permissible.
- K. Fabricate corners using a minimum of three studs.
- L. Install double studs at wall openings, door and window jambs, not more than 2 inches from each side of openings.
- M. Coordinate erection of studs with requirements of door frames and window frames; install supports and attachments.
- N. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.
- O. Blocking: Use wood blocking secured to studs. Provide blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and opening frames.

3.03 CEILING AND SOFFIT FRAMING

- A. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.
- B. Install furring independent of walls, columns, and above-ceiling work.

- C. Securely anchor hangers to structural members or embed them in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.
- D. Space main carrying channels at maximum 72 inches on center, and not more than 6 inches from wall surfaces. Lap splice securely.
- E. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.
- F. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.

3.04 TOLERANCES

- A. Maximum Variation From True Position: 1/8 inch in 10 feet.
- B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION

SECTION 09 30 00 TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

- A. Section 07 92 00 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- B. Section 09 21 16 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

- A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2023.
- B. ANSI A108.1b - Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar; 2023.
- C. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar; 2023.
- D. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive; 2023.
- E. ANSI A108.5 - Setting of Ceramic Tile with Dry-Set Cement Mortar, Modified Dry-Set Cement Mortar, EGP (Exterior Glue Plywood) Modified Dry-Set Cement Mortar, or Improved Modified Dry-Set Cement Mortar; 2023.
- F. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy; 2023.
- G. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2024).
- H. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 2023.
- I. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2017 (Reaffirmed 2022).
- J. ANSI A108.12 - Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Modified Dry-Set Mortar; 2023.
- K. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2021).
- L. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2020.
- M. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs; 2020.

- N. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2021.
- O. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation; 2019.
- P. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2019.
- Q. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014 (Reaffirmed 2019).
- R. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2023.
- S. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products; 2018 (Reapproved 2023).
- T. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2025.
- U. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation; 2023.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Samples: Mount tile and apply grout on one plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.
- D. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Tile: 5 percent of each size, color, and surface finish combination.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- B. Installer Qualifications:
 - 1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

- A. Distributer:
 - 1. Ceramic Tileworks

- a. Jo Marie Jensen
 - b. 701-799-7595
 - 2. Substitutions: Approved equal.
- B. Porcelain Tile:
- 1. Tile-1
 - a. Product: Advantage
 - b. Size: 12 x 24
 - c. Pattern: As shown on drawings.
 - d. Location: Floor:Silver, Walls:Graphite

2.02 TRIM AND ACCESSORIES

- A. Non-Ceramic Trim: Brushed Aluminum, style and dimensions to suit application, set with tile mortar or adhesive.
- 1. Applications:
 - a. Open edges of wall tile.
 - b. Inside and outside wall corners.
 - c. Floor-to-wall joints.
 - d. Floor-to-floor joints.
 - 2. Products:
 - a. Schluter-Systems: www.schluter.com/#sle.
 - b. Substitutions: Approved equal

2.03 SETTING MATERIALS

- A. Provide setting and grout materials from same manufacturer.
- B. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
- 1. Products:
 - a. H.B. Fuller Construction Products, Inc; TEC TotalFlex 150 Universal Mortar: www.tecspecialty.com/#sle.
 - b. LATICRETE International, Inc; MULTIMAX LITE: www.laticrete.com/#sle.
 - c. Mapei Corporation; Granirapid System: www.mapei.com/#sle.
 - d. Substitutions: Approved equal.

2.04 GROUTS

- A. Provide setting and grout materials from same manufacturer.
- B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
- 1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
 - 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
 - 3. Products:
 - a. H.B. Fuller Construction Products, Inc; TEC AccuColor Plus Grout: www.tecspecialty.com/#sle.
 - b. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.
 - c. Mapei Corporation; Ultracolor Plus FA: www.mapei.com/#sle.
 - d. Substitutions: Approved equal.
- C. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
- 1. Applications: All Restrooms..
 - 2. Color(s): As selected by Architect from manufacturer's full line.
 - 3. Products:
 - a. H.B. Fuller Construction Products, Inc; TEC AccuColor EFX Epoxy Special Effects Grout: www.tecspecialty.com/#sle.

- b. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: www.laticrete.com/#sle.
- c. Mapei Corporation; Kerapoxy CQ: www.mapei.com/#sle.
- d. Substitutions: Approved equal.

2.05 ACCESSORY MATERIALS

- A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
 - 1. Crack Resistance: No failure at 1/8 inch gap, minimum.
 - 2. Fluid or Trowel Applied Type:
 - a. Thickness: 20 mils, maximum.
 - b. Products:
 - 1) H.B. Fuller Construction Products, Inc; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com/#sle.
 - 2) LATICRETE International, Inc; LATICRETE FRACTURE BAN SC: www.laticrete.com/#sle.
 - 3) Mapei Corporation; Mapelastic CI: www.mapei.com/#sle.
 - 4) Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: www.merkrete.com/#sle.
 - 5) Substitutions: Approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
 - 1. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

- A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.20, manufacturer's instructions, and TCNA (HB) or TCNA (HB-GP) recommendations, as applicable.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install non-ceramic trim in accordance with manufacturer's instructions.
- G. Sound tile after setting. Replace hollow sounding units.
- H. Keep control and expansion joints free of mortar, grout, and adhesive.
- I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- J. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout.
 - 1. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

3.05 CLEANING

- A. Clean tile and grout surfaces.

3.06 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

**SECTION 09 51 00
ACOUSTICAL CEILINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.02 REFERENCE STANDARDS

- A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019 (Reapproved 2025).
- C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2024a.
- D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on suspension system components and acoustical units.
- C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.05 QUALITY ASSURANCE

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

1.06 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
 - 2. Certainteed Architectural: www.certainteed.com/ceilings-and-walls/#sle.
 - 3. USG Corporation: www.usg.com/ceilings/#sle.
 - 4. Substitutions: Approved equal.
- B. Suspension Systems:
 - 1. Same as for acoustical units.

2.02 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
- B. Acoustical Panels: Mineral fiber with membrane-faced overlay, with the following characteristics:
 - 1. Classification: ASTM E1264 Type IV.
 - 2. Size: 24 by 24 inches.
 - 3. Thickness: 3/4 inch.
 - 4. Light Reflectance: 0.90 percent, determined in accordance with ASTM E1264.
 - 5. NRC Range: 0.70 determined in accordance with ASTM E1264.
 - 6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
 - 7. Panel Edge: Beveled Tegal.
 - 8. Color: White.
 - 9. Suspension System Type Prelude 15/16": Exposed grid.
 - 10. Products:
 - a. Armstrong World Industries, Inc; Ultima: www.armstrongceilings.com/#sle.
 - b. USG Corporation; Mars Acoustical Panels: www.usg.com/ceilings/#sle.
 - c. Substitutions: Approved equal.

2.03 SUSPENSION SYSTEM(S)

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
- B. Exposed Suspension System, Type Prelude XL 15/16": Hot-dipped galvanized steel grid with aluminum cap.
 - 1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
 - 2. Profile: Tee; 15/16 inch face width.
 - 3. Color: White.
 - 4. Products:
 - a. Substitutions: Approved equal.

2.04 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.
- C. Hold-Down Clips: Manufacturer's standard clips to suit application.
- D. Seismic Clips: Manufacturer's standard clips for seismic conditions and to suit application.
- E. Perimeter Moldings: Same metal and finish as grid.
- F. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.
- C. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

3.03 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Locate system on room axis according to reflected plan.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
- E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
 - 1. Cut to fit irregular grid and perimeter edge trim.
 - 2. Make field cut edges of same profile as factory edges.
 - 3. Double cut and field paint exposed reveal edges.
- F. Install hold-down clips on panels within 20 ft of an exterior door.

3.05 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.06 CLEANING

- A. Clean surfaces.
- B. Replace damaged or abraded components.

END OF SECTION

**SECTION 09 65 00
RESILIENT FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient tile flooring.
- B. Resilient base.
- C. Installation accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.

1.03 REFERENCE STANDARDS

- A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- B. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.
- C. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2018.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- D. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
- E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Flooring Material: 50 square feet of each type and color.
 - 3. Extra Wall Base: 20 linear feet of each type and color.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Protect roll materials from damage by storing on end.
- E. Do not double stack pallets.

1.07 FIELD CONDITIONS

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 TILE FLOORING

- A. VCT 1: Printed film type, with transparent or translucent wear layer.
 - 1. Manufacturers:
 - a. Tarkett
 - b. Substitutions: Approved equal.
 - 2. Tile Size: 9.84 by 39.3 inch.
 - 3. Pattern: Unidirectional.
 - 4. Color: To be selected by Architect from manufacturer's full range.

2.02 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TP, rubber, thermoplastic; Style B, Cove.
 - 1. Manufacturers:
 - a. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
 - b. Roppe Corporation: www.roppe.com/#sle.
 - c. VPI: www.vpiflooring.com.
 - d. Substitutions: Approved equal.
 - 2. Height: 4 inches.
 - 3. Thickness: 0.125 inch.
 - 4. Finish: Satin.
 - 5. Length: Roll.
 - 6. Color: To be selected by Architect from manufacturer's full range.

2.03 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Moldings, Transition and Edge Strips: Same material as flooring.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
 - 1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI (RWP).
- B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

- C. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
- D. Prohibit traffic until filler is fully cured.
- E. Clean substrate.
- F. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation:
 - 1. Spread only enough adhesive to permit installation of materials before initial set.
 - 2. Fit joints and butt seams tightly.
 - 3. Set flooring in place, press with heavy roller to attain full adhesion.
- D. Loose-Laid Installation: Set flooring in place in accordance with manufacturer's instructions.
- E. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- F. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
 - 1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.
 - 2. Resilient Strips: Attach to substrate using adhesive.
- G. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- H. Install flooring in recessed floor access covers, maintaining floor pattern.
- I. At movable partitions, install flooring under partitions without interrupting floor pattern.
- J. Install feature strips where indicated.

3.04 INSTALLATION - TILE FLOORING

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.
- B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.
- C. Install plank tile with a random offset of at least 6 inches from adjacent rows.

3.05 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Install base on solid backing. Bond tightly to wall and floor surfaces.
- C. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

**SECTION 09 68 13
TILE CARPETING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.

1.03 REFERENCE STANDARDS

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).
- C. CRI 104 - Standard for Installation of Commercial Carpet; 2018.
- D. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Samples: Submit one carpet tiles illustrating color and pattern design for each carpet color selected.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.06 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 MATERIALS

- A. Tile Carpeting: Tufted, manufactured in one color dye lot.
 - 1. Product: Sky Atlas manufactured by Tarkett.
 - a. Substitutions: Approved equal.
 - 2. Tile Size: 18 x 36, nominal.
 - 3. Color: To be selected by Architect.
 - 4. Pattern: vertical ashlar.

2.03 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

- B. Edge Strips: Rubber, color as selected by Architect if required. Goal is to have product thickness match with no transitions.
- C. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
 - 1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
- C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- D. Vacuum clean substrate.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions and CRI 104 (Commercial).
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
- F. Locate change of color or pattern between rooms under door centerline.
- G. Trim carpet tile neatly at walls and around interruptions.
- H. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 91 13
EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
 - 1. Exposed surfaces of steel lintels and ledge angles.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Shop-primed items.
- B. Section 09 91 23 - Interior Painting.

1.03 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; 2020.
- C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- D. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- E. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.
- F. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit two paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified approved by manufacturer.

1.06 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.

1.07 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
- 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 paint and finishes 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: 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 paints and finishes from the same manufacturer to the greatest extent possible.
 1. If a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
 2. All Products submitted must be currently approved by MPI in the same category as the Basis of Design product. No Exceptions.
 3. All Products submitted must be equal to or better than that of the Basis of Design. This includes, but is not limited to; resin/vehicle, volume solids, DFT per coat, performance and additive attributes, VOC content limits, finish and sheen, design intent, and certifications.
- B. Paints:
 1. Base Manufacturer: Sherwin-Williams Company.
 2. Behr Process Corporation: www.behr.com/#sle.
 3. Diamond Vogel Paints: www.diamondvogel.com/#sle.
 4. PPG Paints: www.ppgpaints.com/#sle.
 5. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- C. Primer Sealers: Same manufacturer as top coats.
- D. Block Fillers: Same manufacturer as top coats.
- E. Substitutions: Approved equal.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. 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 paint material in quantity required to complete entire project's work from a single production run.
 - 4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
 - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- D. Colors: To be selected from manufacturer's full range of available colors.
 - 1. Selection to be made by Architect after award of contract.
 - 2. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
 - 3. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 PAINT SYSTEMS - EXTERIOR

- A. Paint WE-OP-3A - Wood, Unprimed Ferrous Metals, Galvanized Metals, Opaque, Waterbased, 3 Coat:
 - 1. One coat of acrylic metal primer sealer.
 - 2. Semi-gloss: Two coats of alkyd enamel; DTM Acrylic semi-gloss coating, B66-1100 Series (MPI #163).
- B. Paint ME-OP-2A - Ferrous Metals, Primed, Acrylic, 2 Coat:
 - 1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
 - 2. Semi-gloss: Two coats of acrylic enamel; DTM Acrylic semi-gloss coating, B66-1100 Series (MPI #163).

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.

- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. 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. Exterior Plaster and Stucco: 12 percent.
 - 2. Fiber Cement Siding: 12 percent.
 - 3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
 - 4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
 - 5. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Concrete:
 - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - 2. Prepare surface as recommended by top coat manufacturer and in accordance with SSPC-SP 13/NACE No.6.
- H. Masonry:
 - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 - 2. Prepare surface as recommended by top coat manufacturer.
- I. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
- J. Exterior Gypsum Board: Fill minor defects with exterior filler compound. Spot prime defects after repair.
- K. Exterior Plaster: Fill hairline cracks, small holes, and imperfections with exterior patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- L. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- M. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- N. Galvanized Surfaces:

1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- O. Ferrous Metal:
 1. Solvent clean according to SSPC-SP 1.
 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.
- P. 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 calking compound after prime coat has been applied. Back prime concealed surfaces before installation.
- Q. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.
- R. 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 written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance.
- F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.
- G. Sand wood and metal surfaces lightly between coats to achieve required finish.
- H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 91 23
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Mechanical and Electrical:
 - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
 - b. In finished areas, paint shop-primed items.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 - Metal Fabrications: Shop-primed items.
- B. Section 05 51 00 - Metal Stairs: Shop-primed items.
- C. Section 09 91 13 - Exterior Painting.

1.03 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; 2020.
- C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- D. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- E. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.
- F. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
 - 2. MPI product number (e.g., MPI #47).
 - 3. Cross-reference to specified paint system products to be used in project; include description of each system.

- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.06 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.

1.07 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 materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 fc measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
 - 1. If a single manufacturer cannot provide specified products; minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
 - 2. All Products submitted must be currently approved by MPI in same category as Basis of Design product. No Exceptions.
 - 3. All Products submitted must be equal to or better than that of the Basis of Design. This includes, but is not limited to; resin/vehicle, volume solids, DFT per coat, performance and additive attributes, VOC content limits, finish and sheen, design intent, and certifications.
- B. Paints:
 - 1. Behr Paint Company: www.behr.com/#sle.
 - 2. Diamond Vogel Paints: www.diamondvogel.com/#sle.
 - 3. Pittsburgh Paints: www.ppgpaints.com/#sle.
 - 4. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- C. Primer Sealers: Same manufacturer as top coats.
- D. Block Fillers: Same manufacturer as top coats.
- E. Substitutions: Approved equal.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. 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. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 4. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
 - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- D. Colors: To be selected from manufacturer's full range of available colors.
 - 1. Selection to be made by Architect after award of contract.
 - 2. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
 - 3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

2.03 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, brick, wood, plaster, uncoated steel, shop primed steel, galvanized steel, aluminum, and acoustical ceilings.
 - 1. Two top coats and one coat primer.
 - 2. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint I-OP-DF - Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, galvanized piping, and _____.
 - 1. Shop primer by others.
 - 2. One top coat.
 - 3. Top Coat: Latex Dry Fall.
 - a. Products:
 - 1) Sherwin-Williams Waterborne Acrylic Dryfall, Flat. (MPI #118)
- C. Paint CI-OP-3L - Concrete/Masonry, Opaque, Latex, 3 Coat:
 - 1. One coat of block filler.
 - 2. Semi-gloss: Two coats of latex enamel; Pro Mar 200 Zero VOC Interior Latex semi-gloss enamel B31-2600 Series. (MPI #43).
- D. Paint MI-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:
 - 1. One coat of acrylic metal primer.

2. Semi-gloss: Two coats of latex enamel; Pro Industrial Acrylic semi-gloss, B66 Series. (MPI #147).
- E. Paint Mgl-OP-3L - Galvanized Metals, Latex, 3 Coat:
 1. One coat galvanize primer.
 2. Semi-gloss: Two coats of latex enamel; Pro Industrial Acrylic semi-gloss, B66 Series. (MPI #147).
- F. Paint GI-OP-3LA - Gypsum Board/Plaster, Latex-Acrylic, 3 Coat:
 1. One coat of alkyd primer sealer.
 2. Semi-gloss: Two coats of latex-acrylic enamel; ProMar 200 Zero VOC Interior Latex semi-gloss enamel B31-2600 Series.

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been adequately prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
 1. Gypsum Wallboard: 12 percent.
 2. Plaster and Stucco: 12 percent.
 3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
 4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 5. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Concrete:

1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 2. Prepare surface as recommended by top coat manufacturer and in accordance with SSPC-SP 13/NACE No.6.
- H. Masonry:
1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 2. Prepare surface as recommended by top coat manufacturer.
- I. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- J. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- K. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high-alkali surfaces.
- L. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- M. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- N. Galvanized Surfaces:
1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- O. Ferrous Metal:
1. Solvent clean according to SSPC-SP 1.
 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.
- P. 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.
- Q. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.
- R. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.
- S. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Sand wood and metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 93 00
STAINING AND TRANSPARENT FINISHING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Field application of stains.
- B. Field application of transparent finishes.

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; 2020.
- C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and catalog number, and general product category.
 - 2. MPI product number (e.g. MPI #33).
- C. Samples: Two samples on actual wood substrate to be finished, 12 by 12 inch in size, indicating selected colors and sheens for each system, with specified coats cascaded.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements for additional provisions.
 - 2. Label each container with color and type in addition to the manufacturer's label.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of stain or transparent finish, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Stain and Transparent Finish Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.06 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by manufacturer of stains and transparent finishes.
- 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 materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.
- D. Minimum Application Temperature: 50 degrees F unless required otherwise by manufacturer's instructions.

- E. Provide lighting level of 80 fc measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide finishes from the same manufacturer to the greatest extent possible.
 - 1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
- B. Transparent Finishes:
 - 1. Behr Process Corporation: www.behr.com/#sle.
 - 2. PPG Paints: www.ppgpaints.com/#sle.
 - 3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
 - 4. Substitutions: Approved equal.
- C. Stains:
 - 1. Behr Process Corporation: www.behr.com/#sle.
 - 2. PPG Paints: www.ppgpaints.com/#sle.
 - 3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
 - 4. Substitutions: Approved equal.

2.02 STAINS AND TRANSPARENT FINISHES - GENERAL

- A. Finishes:
 - 1. Provide finishes 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 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 finish material in quantity required to complete entire project's work from a single production run.
 - 4. Do not reduce, thin, or dilute finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
 - 1. Provide stains and transparent finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

2.03 INTERIOR STAIN AND TRANSPARENT FINISH SYSTEMS

- A. Finish on Wood:
 - 1. one-coat varnish over one-coat stain.
 - 2. Stain: Semi-transparent stain for wood, solvent based.
 - a. Products:
 - 1) Match Existing.
 - 2) Substitutions: Approved equal.
 - 3. Top Coat: Clear water-based varnish.
 - a. Products:
 - 1) Match Existing.
 - 2) Substitutions: Approved equal.

2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of finished surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of stains and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- 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. Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. 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.
- G. 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.
- H. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- D. Sand wood surfaces lightly between coats to achieve required finish.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

- G. Reinstall items 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 finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

**SECTION 10 21 13.13
METAL TOILET COMPARTMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal toilet compartments.
- B. Urinal screens.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Blocking and supports.
- B. Section 10 28 00 - Toilet, Bath, and Laundry Accessories.

1.03 REFERENCE STANDARDS

- A. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2018.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall, floor, and ceiling supports, door swings.
- C. Product Data: Provide data on panel construction, hardware, and accessories.
- D. Samples: Submit one samples of partition panels, 2 x 2 inch in size illustrating panel finish, color, and sheen.
- E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Toilet Compartments:
 - 1. ASI Accurate Partitions; Powder Coated Steel: www.asi-accuratepartitions.com/#sle.
 - 2. ASI Global Partitions; Powder Coated Steel: www.asi-globalpartitions.com/#sle.
 - 3. General Partitions Mfg. Corp: www.generalpartitions.com/#sle.
 - 4. Substitutions: Approved equal.

2.02 MATERIALS

- A. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

2.03 COMPONENTS

- A. Toilet Compartments: Powder coated steel, floor-mounted headrail-braced.
- B. Doors, Panels, and Pilasters: Sheet steel faces, pressure bonded to sound deadening core, formed and closed edges; corners made with corner clips or mitered, welded, and ground smooth.
 - 1. Panel Faces: 20 gauge, 0.0359 inch.
 - 2. Door Faces: 20 gauge, 0.0359 inch.
 - 3. Pilaster Faces: 18 gauge, 0.0478 inch.

4. Reinforcement: 12 gauge, 0.1046 inch.
 5. Internal Reinforcement: Provide in areas of attached hardware and fittings. Mark locations of reinforcement for partition mounted washroom accessories.
- C. Door and Panel Dimensions:
1. Thickness: 1 inch.
 2. Door Width: 24 inch.
 3. Door Width for Handicapped Use: 34 inch .
 4. Height: 58 inch.
- D. Urinal Screens: Wall mounted with a continuous panel brackets.

2.04 ACCESSORIES

- A. Pilaster Shoes: Formed chromed steel with satin finish, 3 inch high, concealing floor fastenings.
1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
- B. Head Rails: Hollow anodized aluminum tube, 1 by 1-5/8 inch size, with anti-grip strips and cast socket wall brackets.
- C. Brackets: Polished chrome-plated non-ferrous cast metal.
- D. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.
- E. Hardware: Satin chrome plated non-ferrous cast metal:
1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
 2. Thumb turn or sliding door latch with exterior emergency access feature.
 3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
 4. Coat hook with rubber bumper; one per compartment, mounted on door.
 5. Provide door pull for outswinging doors.

2.05 FINISHING

- A. Powder Coated Steel Compartments: Clean, degrease, and neutralize. Follow immediately with a phosphatizing treatment, prime coat and two finish coats powder coat enamel.
- B. Color: as selected by Architect from manufacture's standards.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that field measurements are as indicated.
- C. Verify correct spacing of and between plumbing fixtures.
- D. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.
- E. Field touch-up of scratches or damaged enamel finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch.
- B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out swinging doors to closed position.
- C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

**SECTION 10 26 00
WALL AND DOOR PROTECTION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner guards.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Blocking for wall and corner guard anchors.
- B. Section 09 21 16 - Gypsum Board Assemblies: Placement of supports in stud wall construction.
- C. Section 09 22 16 - Non-Structural Metal Framing: Placement of supports in stud wall construction.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
- C. Shop Drawings: Include plans, elevation, sections, and attachment details. Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.
- D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- F. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Protect work from moisture damage.
- C. Protect work from UV light damage.
- D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.
- E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

1.06 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 5-year manufacturer warranty for metal crash rails. Complete forms in Owner's name and register with manufacturer.
 - 1. Failures include, but are not limited to, the following:

- a. Structural failures or internal connection failures.
- b. Deterioration of materials beyond that expected of normal use, as intended by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Corner Guards:
 - 1. Construction Specialties, Inc: www.c-sgroup.com/#sle.
 - 2. Inpro: www.inprocorp.com/#sle.
 - 3. Substitutions: Approved Equal.

2.02 PRODUCT TYPES

- A. Corner Guards - Flush Mounted:
 - 1. Material: High impact vinyl rigid; textured surface tape on corner guards.
 - 2. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 - 3. Width of Wings: 1-1/2 x 1-1/2 inches.
 - 4. Corner: Provide 90 degree corners, 135 degree corners, and wall end protectors. Including columns.
 - 5. Color: As selected from manufacturer's standard colors.
 - 6. Length: 8'-0" One piece.

2.03 FABRICATION

- A. Fabricate components with tight joints, corners and seams.

2.04 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Provide wall and door protection systems of each type from a single source and manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that field measurements are as indicated on drawings.
- C. Verify that substrate surfaces for adhered items are clean and smooth.
 - 1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.
- D. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B.

3.03 TOLERANCES

- A. Maximum Variation From Required Height: 1/4 inch.
- B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.04 CLEANING

- A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Diaper changing stations.

1.02 RELATED REQUIREMENTS

- A. Section 09 30 00 - Tiling: Ceramic washroom accessories.
- B. Section 10 21 13.13 - Metal Toilet Compartments.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
- C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2022.
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- E. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.
- F. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2017 (Reapproved 2022).
- G. ASTM C1036 - Standard Specification for Flat Glass; 2025.
- H. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2024.
- I. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2022.
- J. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Commercial Toilet, Shower, and Bath Accessories:
 - 1. American Specialties, Inc: www.americanspecialties.com/#sle.
 - 2. Bradley Corporation: www.bradleycorp.com/#sle.
 - 3. Bobrick Washroom Equip., Inc.
 - 4. Substitutions: Approved equal.
- B. Diaper Changing Stations:

1. Koala Kare Products; KB311-SSRE : www.koalabear.com/#sle.
2. Substitutions: Approved equal.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 1. Grind welded joints smooth.
 2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.
- B. Keys: Provide two keys for each accessory to Owner; master key lockable accessories.
- C. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- D. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 COMMERCIAL TOILET ACCESSORIES

- A. Toilet Paper Dispenser: Double roll, surface mounted bracket type, chrome-plated zinc alloy brackets.
 1. Products:
 - a. Bradley 5234.
 - b. Substitutions: Approved equal.
- B. Paper Towel Dispenser: Folded paper type, stainless steel, surface-mounted, with viewing slots on sides as refill indicator and tumbler lock.
 1. Capacity: 500 multifold minimum.
 2. Products:
 - a. Bradley 250-15.
 - b. Substitutions: Approved equal.
- C. Soap Dispenser: Liquid soap dispenser, sink-mounted, surface, stainless steel.
 1. Products:
 - a. Bradley 6-3500 brushed stainless steel.
 - b. Substitutions: Approved equal.
- D. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
 1. Products:
 - a. Bradley 780-2436.
 - b. Substitutions: Approved equal.
- E. Grab Bars: Stainless steel, smooth surface.
 1. Standard Duty Grab Bars:
 - a. Dimensions: 1-1/2 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
 - b. Length and Configuration: As indicated on drawings.
 - c. Products:
 - 1) Bradley 812-18.
 - 2) Bradley 812-36.
 - 3) Bradley 812-42.
 - 4) Substitutions: Approved Equal.

2.04 DIAPER CHANGING STATIONS

- A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
 1. Material: Stainless steel.
 2. Mounting: Recessed.
 3. Products:
 - a. Koala Kare: KB311-SSRE .

- b. Substitutions: Approved equal.
- B. Adult Changing Station: Wall-mounted, folding diaper changing station for use in commercial toilet facilities, height adjustable, with moveable safety rail.
 - 1. Mounting: Surface.
 - 2. Maximum Rated Load: 500 lb.
 - 3. Products:
 - a. Koala Kare: KB3000-AHL Adult Changing Station
 - b. Substitutions: Approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
- D. Verify that field measurements are as indicated on drawings.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

3.04 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

**SECTION 10 44 00
FIRE PROTECTION SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.
- B. FM (AG) - FM Approval Guide; Current Edition.
- C. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.
- D. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, anchorage details, and installation instructions.
- C. Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, rough-in measurements for recessed cabinets, mounting measurements for wall bracket, installation procedures, and accessories required for complete installation.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguishers:
 - 1. Ansul, a Tyco Business; Sentry: www.ansul.com/#sle.
 - 2. Larsen's Manufacturing Co.
 - 3. JL Industries, Inc; Cosmic 10E.
 - 4. Substitutions: Approved equal.
- B. Fire Extinguisher Cabinets and Accessories:
 - 1. JL Industries, Inc; Academy 1027W18: www.jlindustries.com.
 - 2. Larsen's Manufacturing Co: www.larsensmfg.com/#sle.
 - 3. Substitutions: Approved equal.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 - 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.

- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
 - 1. Class: A:B:C type.
 - 2. Size: 10 pound.
 - 3. Temperature range: Minus 40 degrees F to 120 degrees F.

2.03 FIRE EXTINGUISHER CABINETS

- A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.
- B. Cabinet Construction: Non-fire rated.
 - 1. Formed primed steel sheet; 0.036 inch thick base metal.
- C. Cabinet Configuration: Semi-recessed type.
 - 1. Size to accommodate accessories.
 - 2. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.
- D. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- E. Fabrication: Weld, fill, and grind components smooth.
- F. Finish of Cabinet Exterior Trim and Door: Baked enamel, color as selected.
- G. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, chrome-plated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure rigidly in place.
- C. Place extinguishers and accessories in cabinets and on wall brackets.

END OF SECTION

SECTION 12 34 00
LAMINATE CLAD CASEWORK - COMMERCIAL

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Fixed modular laminate clad casework and components.
- B. Countertops.
- C. Window Sills
- D. Integrated restroom sinks in countertops.

1.02 RELATED SECTIONS

- A. Blocking within walls where indicated: Division 6.
- B. Sinks and service fixtures, service waste lines, connections, and vents: Division 22.
- C. Electrical service fixtures: Division 26.

1.03 DEFINITIONS

- A. Identification of casework components and related products by surface visibility.
 - 1. Open Interiors: Any open storage unit without solid door or drawer fronts, units with full glass insert doors and/or acrylic doors, and units with sliding solid doors.
 - 2. Closed Interiors: Any closed storage unit behind solid door or drawer fronts.
 - 3. Exposed Ends: Any storage unit exterior side surface that is visible after installation.
 - 4. Other Exposed Surfaces: Faces of doors and drawers when closed, and tops of cabinets less than 72 inches above furnished floor.
 - 5. Semi-Exposed Surfaces: Interior surfaces which are visible, bottoms of wall cabinets and tops of cabinets 72 inches or more above finished floor.
 - 6. Concealed Surfaces: Any surface not visible after installation.

1.04 QUALITY ASSURANCE

- A. Manufacturer: Minimum of 5 years experience in providing manufactured casework systems for similar types of projects, produce evidence of financial stability, bonding capacity, and adequate facilities and personnel required to perform on this project.
- B. Manufacturer: Provide products certified as meeting or exceeding ANSI-A 161.1-2000 testing standards.
- C. Single Source Manufacturer: Casework, countertops and architectural millwork products must all be engineered and built by a single source manufacturer in order to ensure consistency and quality for these related products. Splitting casework, countertops and/or architectural millwork between multiple manufacturers will not be permitted.
- D. Quality Standard: Unless otherwise indicated, comply with AWI's Architectural Woodwork Quality Standards for grades of interior architectural woodwork, construction, finishes and other requirements.
 - 1. Provide AWI Quality Certification Program LABELS indicating that the woodwork complies with requirements of the grade specified. This project has been registered as AWI/QCP project number.
 - 2. Provide AWI Quality Certification Program CERTIFICATE indicating that the woodwork complies with requirements of the grade specified. This project has been registered as AWI/QCP project number.
 - 3. The contractor, upon award of work, shall register the work under this section with the AWI Quality Certification Program (Phone: 800.449.8811).

1.05 SUBMITTALS

- A. Comply with Section 01 30 00, unless otherwise indicated.

- B. Product Data: Manufacturer's catalog with specifications and construction details.
- C. Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.
 - 1. Include section drawings of typical and special casework, work surfaces and accessories.
 - 2. Indicate locations of plumbing and electrical service field connection by others.
 - 3. Provide one set of shop drawings which includes all products within this section, engineered and built by a single source manufacturer, with seamless coordination amongst all products.
- D. Casework Samples (To be available upon request):
 - 1. Base cabinet: Cabinet conforming to specifications, with drawer and door.
 - 2. Wall cabinet: Cabinet conforming to specifications, with door.
 - 3. Cabinet samples shall be complete with specified hardware for doors, drawers and shelves.
 - 4. Component samples: Two sets of samples for each of the following:
 - a. Decorative laminate color charts / PVC and ABS edgings.

1.06 PRODUCT HANDLING

- A. Deliver completed laminate clad casework, countertops, and related products only after wet operations in building are completed, store in ventilated place, protected from the weather, with relative humidity range of 25 percent to 55 percent.
- B. Protect finished surfaces from soiling and damage during handling and installation with a protective covering.

1.07 JOB CONDITIONS

- A. Environmental Requirements: Do not install casework until permanent HVAC systems are operating and temperature and humidity have been stabilized for at least 1 week.
 - 1. Manufacturer/Supplier shall advise Contractor of temperature and humidity requirements for architectural casework installation areas.
 - 2. After installation, control temperature and humidity to maintain relative humidity between 25 percent and 55 percent.
- B. Conditions: Do not install casework until interior concrete work, masonry, plastering and other wet operations are complete.

1.08 WARRANTY

- A. All materials and workmanship covered by this section will carry a five (5) year warranty from date of acceptance.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Manufacturer:
 - 1. TMI Systems Design Corporation.
 - a. 50 South Third Avenue West, Dickinson, North Dakota, 58601, Phone: 800-456-6716.
 - 2. Minot Sash and Door Company
 - a. PO Box 479, Minot, ND 58701, Phone: 701-852-2181.
 - 3. Sidney Millwork Company
 - a. PO Box 1125, Sidney, MT 59270, Phone: 406-482-2858
 - 4. Manufacturers that are AWI QCP certified prior to the Bid Opening are approved to submit bids.

2.02 MATERIALS

- A. Core Materials:

1. Particleboard up to 7/8 inch thick: Industrial Grade average 45-pound density particleboard, ANSI A 208.1-2009, M-2 requirements.
 2. Particleboard 1 inch thick and thicker: Industrial Grade average 45-pound density particleboard, ANSI A 208.1-2009, M-2 requirements.
 3. Medium Density Fiberboard 1/4 inch thick: Average 54-pound density grade, ANSI A208.2-2009 requirements.
- B. Decorative Laminates: GREENGAURD Indoor Air Quality Certified
1. High-pressure decorative laminate VGS (.028), NEMA Test LD 3-2005.
 2. High-pressure decorative laminate HGS (.048), NEMA Test LD 3-2005.
 3. High-pressure decorative laminate HGP (.039), NEMA Test LD 3-2005.
 4. High-pressure cabinet liner CLS (.020), NEMA Test LD 3-2005.
 5. High-pressure backer BKH (.048), (.039), (.028), NEMA Test LD3-2005.
 6. Thermally fused melamine TFM laminate, NEMA Test LD 3-2005. (TFM allowed on casework interiors only, as specified below. Utilization of TFM on any exterior casework surfaces, including door and drawer faces and finished ends, will not be permitted.)
- C. Laminate Color Selection: Maximum 1 color per unit face and 5 colors per project. (See Color Selection in section 3.05).
- D. Edging Materials:
1. 1mm PVC banding, machine applied.
 2. 3mm PVC banding, machine applied and machine profiled to 1/8 inch radius.

2.03 SPECIALTY ITEMS

- A. Support Members:
1. Countertop support brackets: Epoxy powder coated, 11 gauge steel with integral cleat mount opening and wire management opening.
 2. Undercounter support frames: Epoxy powder coated.
 3. Legs: Epoxy powder coated.

2.04 CABINET HARDWARE

- A. Hinges:
1. Concealed 120-degree swing, self-closing, clip-on style.
 - a. Doors up to 34 inches in height have 2 hinges per door.
 - b. Doors 35 inches to 62 inches in height have 3 hinges per door.
 - c. Doors 63 inches to 80 inches in height have 4 hinges per door.
 - d. All doors have rubber bumpers.
- B. Pulls:
1. Select from the TMI Vendor Stock Pull Program or other manufacturer's pre-approved equivalent program.
 2. Pull program offering must include minimum of 20 metal pull design and finish option combinations including:
 - a. Bar Pull (Finish options: Satin Bronzed Copper, Chrome Polished, Chrome Matte, and Brushed Nickel)
 - b. Bow Pull (Finish options: Black Matte, Oil Rubbed Bronze, Satin Bronzed Copper, Chrome Polished, Chrome Matte, and Nickel Matte)
 - c. Contemporary Pull (Finish option: Brushed Nickel)
 - d. Heavy Bow Pull (Finish option: Brushed Nickel)
 - e. Petite Bow Pull (Finish option: Brushed Nickel)
 - f. Metal Wire Pull (Finish options: Epoxy Powder Coated Gray, Beige, White, Black, Slate, Chrome, and Satin Chrome US26D)
 3. Door and drawer front pulls, are epoxy powder coated metal wire, 96mm spacing on screws. Pull design shall comply with the Americans with Disability Act (ADA).

- C. Drawer Slides:
 - 1. Regular, kneespace and pencil: 100-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers. Positive stop both directions with self-closing feature. Paper storage, 150-pound load rated epoxy coated steel slides.
 - 2. File: Full extension, 150-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers. Positive stop both directions with self-closing feature.
- D. Adjustable Shelf Supports:
 - 1. Injection molded transparent polycarbonate friction fit into cabinet end panels and vertical dividers, adjustable on 32mm centers. Each shelf support has 2 integral support pins, 5mm diameter, to interface pre-drilled holes, and to prevent accidental rotation of support. The support automatically adapts to 3/4 inch or 1 inch thick shelving and provides non-tip feature for shelving. Supports may be field fixed if desired. Structural load to 1200 pounds (300 pounds per support) without failure.
- E. Locks: (as shown on Drawings)
 - 1. Removable core, disc tumbler, cam style lock with strike. Lock for sliding 3/4 inch thick doors is a disc type plunger lock, sliding door type with strike. Lock for sliding glass/acrylic doors is a ratchet type sliding showcase lock.
 - 2. Elbow catch or chain bolt used to secure inactive door on all locked cabinets.

2.05 FABRICATION:

- A. Fabricate casework, countertops and related products to dimensions, profiles, and details shown.
- B. All casework panel components must go through a supplemental sizing process after cutting, producing a panel precisely finished in size and square to within 0.010 inches, ensuring strict dimensional quality and structural integrity in the final fabricated product.
- C. Cabinet Body Construction:
 - 1. Tops and bottoms are glued and doweled to cabinet sides and internal cabinet components such as fixed horizontals, rails and verticals. Minimum 6 dowels each joint for 24 inch deep cabinets and a minimum of 4 dowels each joint for 12 inch deep cabinets. (Mechanical or metal hardware fasteners joining cabinet top and bottom panels to the sides will not be accepted.)
 - a. Tops, bottoms and sides of all cabinets are particleboard core.
 - 2. Cabinet backs: 1/4 inch thick medium density fiberboard panel fully captured by the cabinet top, bottom and side panels. Finish to match cabinet interior. 3/4 inch x 4 inch particleboard rails will be placed behind the back panel at the top and bottom, and doweled to the sides utilizing 10mm hardwood fluted dowels. A third intermediate rail will be included on all cabinets taller than 56 inches. Utilize hot melt glue to further secure back and increase overall strength.
 - a. Exposed back on fixed or movable cabinets: 3/4 inch thick particleboard with the exterior surface finished in VGS laminate as selected.
 - 3. Fixed base and tall units have an individual factory-applied base, constructed of 3/4 inch thick plywood. Base is 102mm (nominal 4 inch) high unless otherwise indicated on the drawings.
 - 4. Base units, except sink base units: Full sub-top glued and doweled to cabinet sides. (Mechanical or metal hardware fasteners joining cabinet sub-top panel to the sides will not be accepted.)
 - a. Sink base units are provided with open top and a stretcher at the front, attached to the sides. Back to be split removable access panel.
 - 5. Side panels and vertical dividers shall receive adjustable shelf hardware at 32mm line boring centers. Mount door hinges, drawer slides and pull-out shelves in the line boring for consistent alignment.
 - 6. Exposed and semi exposed edges.

- a. Edging: 1mm PVC machine applied.
- 7. Adjustable Shelves in Cabinets and base units
 - a. Core: Particleboard.
 - b. Core Thickness: 3/4 inch up to 30 inches wide, 1 inch over 30 inches wide.
 - c. Edge: 1mm PVC on Front Edge Only.
 - d. Quantity: 2 shelves in all units taller than 24 inches unless otherwise stated on the drawings.
- 8. Interior finish, units with open Interiors:
 - a. Top, bottom, back, sides, horizontal and vertical members, and adjustable shelving faces with high-pressure decorative VGS laminate. Use of TFM on exposed open interiors will not be permitted.
- 9. Interior finish, units with closed Interiors:
 - a. Top, bottom, back, sides, horizontal and vertical members, and adjustable shelving faces with TFM Thermally Fused Melamine laminate.
- 10. Exposed ends:
 - a. Faced with high-pressure decorative VGS laminate. Use of TFM on exposed ends will not be permitted.
- 11. Wall unit bottom:
 - a. Faced with high-pressure decorative VGS laminate. Use of TFM on wall unit bottoms will not be permitted.
- 12. Balanced construction of all laminated panels is mandatory. Unfinished core stock surfaces, even on concealed surfaces (excluding edges), are not permitted.
- D. Drawers:
 - 1. Sides, back and sub front: Minimum 1/2 inch thick particleboard, laminated with TFM Thermally Fused Melamine, doweled and glued into sides. Top edge banded with 1mm PVC.
 - 2. Drawer bottom: Minimum 1/2 inch thick particleboard laminated with TFM Thermally Fused Melamine, screwed directly to the bottom edges of drawer box.
- E. Door/Drawer Fronts:
 - 1. Core: 3/4 inch thick particleboard.
 - 2. High-pressure decorative VGS laminate exterior, balanced with high-pressure cabinet liner CLS. Use of TFM on exterior or interior surfaces of door/drawer fronts will not be permitted.
 - 3. Edges: 3mm PVC, machine applied, external edges and outside corners machine profiled to 1/8 inch radius.
 - 4. Provide double doors in opening in excess of 24 inches wide.

2.06 DECORATIVE LAMINATE COUNTERTOPS:

- A. Core:
 - 1. All countertops: 1-1/8 inch thick ANSI A208.1-1993 M-2 particleboard.
- B. Surface: High-pressure decorative HGS/HGP laminate with balanced backer sheeting.
- C. Exposed edges, except applied backsplash: 3mm PVC banding, machine applied with waterproof hot melt adhesive.
- D. Exposed edges of applied backsplash: 3mm PVC to match tops.
- E. All countertops joints must be dry fit at the factory to check for consistency in color from one panel to the other and overall finished panel thickness, resulting in a high quality product easy to install.

2.07 SOLID SURFACE COUNTERTOPS:

- A. Avonite, Formica and Corian by Dupont or approved equal.
- B. Corian solid surface tops with integrated 8254 sinks.

- C. Sizes as per drawings.
- D. Color and Patterns from groups A, B, C and D. To be selected by Architect.

2.08 WINDOW SILLS:

- A. Avonite, Formica and Corian by Dupont or approved equal.
- B. Sizes as per drawings.
- C. Color and Patterns from groups A, B, C and D. To be selected by Architect.

PART 3 – EXECUTION

3.01 INSPECTION:

- A. The casework contractor must examine the job site and the conditions under which the work under this section is to be performed, and notify the building owner in writing of unsatisfactory conditions. Do not proceed with work under this Section until satisfactory conditions have been corrected in a manner acceptable to the installer.

3.02 PREPARATION:

- A. Condition casework to average prevailing humidity conditions in installation areas prior to installing.

3.03 INSTALLATION:

- A. Erect casework, plumb, level, true and straight with no distortions. Shim as required. Where laminate clad casework abuts other finished work, scribe and cut to accurate fit.
- B. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind.
- C. Repair minor damage per plastic laminate manufacturer's recommendations.

3.04 CLEANING:

- A. Remove and dispose of all packing materials and related construction debris.
- B. Clean cabinets inside and out. Wipe off fingerprints, pencil marks, and surface soil etc., in preparation for final cleaning by the building owner.

3.05 COLOR SELECTION:

- A. Laminate Color Selection:
 - 1. Select from the full range of standard Wilsonart® and Formica® stock color charts.
 - 2. Thermally fused melamine laminate available in White, Beige or Gray color.
- B. Hardware Color Selection:
 - 1. Pulls: Select from design specific finish options available in the TMI Vendor Stock Pull Program.
 - 2. Miscellaneous Hardware (support brackets, table frames, etc.): Select from your choice of epoxy powder coating stock colors matched to White, Beige, Gray, Black, Slate and Chrome.
- C. PVC Edge Banding Color Selection:
 - 1. 3mm PVC: Select from the TMI Vendor Stock PVC Program, including over 171 pattern, woodgrain and solid colors matched to Wilsonart® and Formica® laminates.
 - 2. 1mm PVC: Select from the TMI Vendor Stock PVC Program, including over 171 pattern, woodgrain and solid colors matched to Wilsonart® and Formica® laminates.

END OF SECTION

DICKINSON MUSEUM CENTER EXPANSION
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DIVISION 21 – FIRE SUPPRESSION

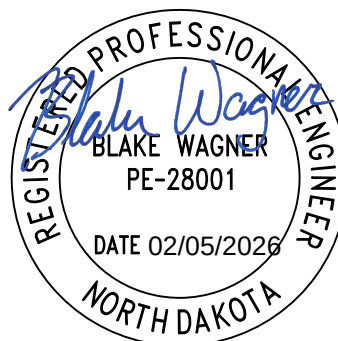
SECTION 210500	FIRE PROTECTION GENERAL PROVISIONS
SECTION 210510	COMMON WORK RESULTS FOR FIRE PROTECTION
SECTION 211000	FIRE SPRINKLER SYSTEM

DIVISION 22 – PLUMBING

SECTION 220500	PLUMBING GENERAL PROVISIONS
SECTION 220510	COMMON WORK RESULTS FOR PLUMBING
SECTION 220520	GENERAL MOTOR REQUIREMENTS
SECTION 220700	PLUMBING INSULATION
SECTION 221100	PLUMBING PIPING
SECTION 221200	PLUMBING SPECIALTIES
SECTION 221300	SANITARY WASTE SPECIALTIES
SECTION 221400	STORM DRAINAGE SPECIALTIES
SECTION 223000	PLUMBING EQUIPMENT
SECTION 224000	PLUMBING FIXTURES

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

SECTION 230500	HVAC GENERAL PROVISIONS
SECTION 230510	COMMON WORK RESULTS FOR HVAC
SECTION 230520	GENERAL MOTOR REQUIREMENTS
SECTION 230590	TESTING ADJUSTING AND BALANCING
SECTION 230700	HVAC INSULATION
SECTION 232000	HVAC PIPING
SECTION 233000	AIR DISTRIBUTION
SECTION 233400	FANS AND FAN SYSTEMS
SECTION 233700	AIR OUTLETS AND INLETS
SECTION 235400	FURNACES
SECTION 235500	FUEL-FIRED HEATERS
SECTION 236000	CENTRAL COOLING EQUIPMENT
SECTION 237000	CENTRAL HVAC EQUIPMENT



SECTION 21 05 00
FIRE PROTECTION GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Specification Format

1. These Specifications are written in imperative and abbreviated form. This imperative language of the technical sections is directed at the Contractors, unless specifically noted otherwise. Incomplete sentences shall be completed by inserting "shall", "the Contractor shall", and "shall be", and similar mandatory phrases by inference in the same manner as they are applied to notes on the Drawings. The words "shall be" shall be supplied by inference where a colon (:) is used within sentences or phrases. Except as worded to the contrary, perform all indicated requirements whether stated imperatively or otherwise.
2. Three Part Format
 - a. "Part 1 - General": Covers those areas which relate to the Work, and which define the general administrative and technical requirements specific to a particular section.
 - b. "Part 2 - Products": Defines, in detail, the acceptance equipment and materials to be incorporated into the Work.
 - c. "Part 3 - Execution": Describes, in detail, the manner in which items covered by Part 2 are to be incorporated into the Work.
3. Where Codes, Specifications and Drawings are in conflict, the Contractor will be deemed to have bid the more expensive method. Refer all such discrepancies immediately to the Engineer prior to commencing related work.

B. Definitions

1. Furnish: Supply equipment as required by these Drawings and Specifications, delivered to the job site for installation or use by others.
2. Install: Fix in position for total operational use all apparatus as shown, specified or required. Provide all miscellaneous fittings and wiring supplies.
3. Or Approved Equal: Equipment or materials selected by Contractor subject to Engineer's acceptance.
4. Or Equivalent: Equipment or materials selected by Contractor matching the function and performance of equipment or materials listed.
5. Provide: Furnish and install in place, total and operational.
6. Complete/Completely: All pipes, fittings, ducts, wiring supplies, and accessories provided for the noted equipment from the equipment to the mains or noted termination points.

1.2 NOMENCLATURE

- A. NICET: National Institute for Certification in Engineering Technologies.
- B. Pipe sizes listed are nominal pipe sizes throughout this Division except where otherwise noted.

1.3 SCOPE OF WORK

- A. The work covered by this Division consists in furnishing all labor, equipment, accessories and materials and in performing all operations necessary for the installation of the fire protection systems, in strict accordance with Division 21 of this Specification and applicable Drawings and subject to the terms and conditions of the Contract.

- B. Work of this Division is subject to requirements of Instructions to Bidders, General Conditions, Supplementary Conditions, Division One, and all other sections of this Specification.
- C. Examine site and all Contract documents prior to submittal of bid.
 - 1. Submittal of a Bid shall indicate the Contractor has examined the Site and Drawings and has included all required allowances in this Bid. No allowance shall be made for errors resulting from the Contractor's failure to visit job sites and to review Drawings.
- D. Division 21 Work: Includes the following system types:
 - 1. Wet-Pipe Sprinkler System.
 - 2. Dry-Pipe Sprinkler System.
- E. Delegated-Design: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data by a NICET Level III certified designer or licensed Professional Engineer responsible for their preparation.
 - 1. Everything necessary for the complete and successful operation of this system, whether or not definitely specified on the Drawings shall be furnished and installed as if specified or indicated.
- F. The Fire Protection Contractor will be a sub-contractor to the Division 23 Contractor.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design system for Class A, B, and C fires as appropriate for areas being protected, and include safety factor.
- B. Fire-extinguishing system design shall be approved by authorities having jurisdiction and shall be in accordance to architectural drawings and code plans.

1.5 WORK BY OTHERS

- A. Painting.
- B. Wiring by Division 26.
- C. Water Service into Building.
- D. Exterior Fire Protection Mains.
- E. Fire Hydrants.

1.6 SUBMITTALS

- A. General:
 - 1. Preferred Submittal Format: PDF, unless otherwise noted.
 - 2. Preferred Submittal Nomenclature: Unless otherwise noted, PDF submittals are to be named according to the following:
 - a. [Specification Section Number] – [Specification Name or Equipment Included]
 - 3. Distribution: Unless otherwise noted, direct all correspondence concerning Division 21 submittals to:

STEVE BUTTERFIELD
PRAIRIE ENGINEERING, P.C.
619 RIVERWOOD DRIVE, SUITE 205
BISMARCK, ND 58504
sbutterfield@prairieengineeringpc.com

- B. Substitution and Prior Approval to Quote.
1. Format and Content: Complete descriptive technical data on the proposed item consisting of model numbers, type, size and performance characteristics.
 2. Submission Timing: Minimum of 192 hours (eight days) prior to bid opening.
 - a. Substitutions will not be permitted after bid opening except where such substitution is considered by the Engineer to be in the best interest of the Owner.
 3. Bidder Notification: Prior to bid opening via Addenda, sent to all planholders.
 4. Contractor Responsibility: This contractor will be responsible for all coordination, construction costs, and Architectural/Engineering design fees required to substitute equipment that has different characteristics than designed including weights, physical dimensions, clearances, mechanical characteristics, electrical characteristics, and other characteristics deemed important to the design by the Architect/Engineer.
 5. Alternative Format: Printed paper, two copies; Self-addressed, stamped envelope required for return reply.
- C. Schedule of Values.
1. Format and Content: When included with the Bid, at minimum the following categories shall be indicated:
 - a. "Sprinkler Riser"
 - b. "Controls"
 - c. "Wet Pipe Suppression System"
 - d. "Dry Pipe Suppression System"
 - e. "Dry Agent Suppression System"
 2. Submission Timing: Prior to first payment application.
- D. Shop Drawings: Submit to Engineer via the Prime Contractor for each item indicated.
1. Format and Content: Include catalog numbers, performance data, dimensions and other descriptive information.
 2. Contractor Review: Dated and signed cover sheet or review stamp for each Shop Drawing file to indicate thorough review. **Email message text not acceptable.**
 3. Non-Conforming: Returned to Contractor without review.
 4. Submission Timing: Prior to delivery of materials to job site.
- E. Shop Drawings, Wet-pipe and/or Dry-pipe Sprinkler Systems:
1. Include plans, elevations, sections, details, and attachments to other work.
 2. Wiring Diagrams: For power, signal, and control wiring.
 3. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- G. Record Drawings
1. Format and Content: Paper copy of Drawings project site.
 - a. As work progresses, Contractor's field supervisor shall mark Record Drawings in red pencil to indicate actual conditions of installation.
 - b. Give particular attention to marking actual locations of underground piping.
 - c. Affix all addendum and change order descriptions to appropriate record drawing sheet, utilizing spray adhesive.
 - d. Make Record Drawings available to Engineer during project visitation.
 2. Submission Timing: Close of project with Record Manuals.

H. Spare Equipment and Devices

1. Distribution: Owner.
2. Format and Content: List quantities on contractor letterhead or invoice, obtain signature of Owner's representative acknowledging receipt, and include with each Record Manual.
3. Submission Timing: Close of project with Record Manuals.

I. Operation and Maintenance Manuals

1. Submission Timing: Close of project, as condition of its acceptance.
2. Record Manual information shall be included for all equipment/material where Shop Drawings are required.
3. Format and Content: Two copies, Loose-leaf hardcover binders, **and** in PDF format on CDs.
 - a. List project name, date, Contractor's name, address and telephone number on exterior label of each Record Manual and CD or USB drive.
 - b. Include an index sheet indicating subcontractor and subcontractor's phone number and each major piece of equipment, supplier and supplier's telephone number. Provide tabbed dividers indicating major groupings of equipment.
 - c. Include a copy of the Shop Drawings.
 - d. Include all installation, operation and maintenance data packaged with any equipment.
 - e. Include all signed and dated final punch lists from walkthroughs performed by the Engineer.

1.7 APPLICATIONS FOR PAYMENT

- A. Refer to Division 01 "Applications for Payment".
- B. Provide one additional copy, sent directly to the Engineer.
- C. Schedule of Values: At minimum, include items in Submittal article.

1.8 CHANGES TO CONTRACT

- A. Any required changes to the contract after bid date shall be in accordance with General Conditions/Division 01 and this section. Where any discrepancies between the sections are encountered, the more restrictive section shall apply.
- B. Proposed changes shall be accompanied with complete substantiating documentation.
 1. Provide an itemized list of quantities for materials, equipment, and supplies.
 - a. Include unit costs for each item and extended price.
 - b. Include unit labor for each item and extended time.
 2. Provide subcontractor proposals that include the same substantiating documentation.
 3. Provide quotations from suppliers for any specially ordered equipment.
- C. Material costs shall be actual costs to the contractor, obtaining the materials through normal supply channels, including trade and quantity discounts. Utilizing "suggested pricing" from national pricing organizations for unit costs shall not be accepted. Upon request, the contractor or subcontractor shall submit evidence to substantiate the costs.
- D. Labor units shall be industry accepted standard labor hours to perform one unit of work. If the work is being performed in a location that is not considered to be standard working conditions for that specific task, additional labor shall be itemized.

- E. Labor rates shall be the actual rate paid for the workman category along with associated labor burden. Labor burden shall consist only of the mandatory fringe benefits, labor taxes, and labor insurances as affected by payroll. The owner reserves the right to reject any labor burden which is inconsistent with other similar contractors or where the fringe benefit cost is in excess of established labor agreements.
- F. Allowable markups for contractor and subcontractors
 - 1. Overhead on work performed by own forces: 12% maximum.
 - 2. Profit on work performed by own forces: 10% maximum.
 - 3. Commission on work performed by Subcontractors: 5% maximum.
 - 4. Sales tax.
 - 5. Bond and permit increases where applicable.
- G. No additional markups shall be allowed for:
 - 1. Field and/or office supervision/administration time.
 - 2. Tool burden.
 - 3. Shop burden.
 - 4. Overhead/Profit applied to work performed by others.
- H. Additional costs for travel and subsistence shall only be allowed if the proposal includes a request for extension of the completion date. Furthermore, those costs shall be proportional to the number of working days of the extension.
- I. Subcontractors shall compute their costs in the same manner as the contractor. Subcontractors are subject to the same markup constraints as described herein.
- J. For changes resulting in credit to the costs, no restocking fees for materials shall be applied by the contractor or subcontractors.

1.9 AUTHORITIES AND AGENCIES

- A. All work will be installed for the approval and acceptance of the following:
 - 1. Insurance Services Office
 - 2. State Fire Marshall
 - 3. Local Fire Inspection Office
- B. Any permits for the installation or construction of any of the work included in this section, which are required by any of the Authorities or Agencies having jurisdiction, shall be obtained and paid for by the Fire Protection Contractor.
- C. All inspections, examinations and tests of any of the work included in this section, which are required by any of the Authorities or Agencies having jurisdiction, shall be obtained and paid for by the Fire Protection Contractor.

1.10 QUALITY ASSURANCE

- A. Qualifications of Installers
 - 1. For installation and testing, use only trained licensed and experienced workmen familiar with items required and manufacturer's recommended methods.
 - 2. In acceptance or rejection of installed work, no allowance will be made for lack of skill on the part of the workmen.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.11 WARRANTY

- A. The entire Fire Protection installation, as specified under this Section of the Specifications, shall be guaranteed for one (1) year against defective equipment, materials and workmanship. The liability of the Fire Protection Contractor under this guarantee is limited to repair or replacement of fire protection defective equipment, materials or workmanship. The guarantee period is to begin on the date the equipment is placed in operation at the Owner's request for his convenience or from the date a successful acceptance test is made, whichever occurs first.
- B. The guarantee shall not be construed as requiring the Fire Protection Contractor to render service or maintenance required in the normal operation of the equipment or to make repairs that may be needed due to normal wear and tear or the Owner's negligence, abuse or breakage.

1.12 TEMPORARY FACILITIES

- A. Refer to Special Conditions and/or Division 01 for details of temporary facilities.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. All material, equipment, valves and devices, installed or furnished under this Section, shall be listed or approved for use in the Fire Protection installation by the Authorities, Agencies, Codes and Standards named in this Section of the Specification.
 - 1. Underwriter's Laboratories - Approved Fire Protection Equipment List
 - 2. Factory Mutual Approved Equipment Manual
- B. Material and equipment shall be as shown or specified. Provide material not specifically described but required for a complete and proper installation of the Work, subject to the acceptance of the Engineer.
- C. Owner will not be liable for material installed in non-compliance with codes, standards, and these Contract Documents.
- D. Fire Stop System material shall be by 3M "Fire Barrier", Metacaulk, Hilti, Nelson Firestop Products, or AD Fire. See Division 07 for further details on approved materials.

2.2 ELECTRIC WIRING

- A. The Division 21 Contractor shall furnish and install all water flow switches, air pressure switches and alarms, valve supervisory switches, visual/audible alarms, fire pump and controller, control panels, pre-action detection devices, air compressor and controls, special controls and electrical devices as specified herein for proper operation of the equipment furnished.
- B. The Division 23 Contractor shall furnish and install all ventilation equipment and dampers, unless otherwise noted in the Drawings or Specifications.
- C. Division 26 Contractor shall furnish and install, as required, wiring to supervisory switches, flow switches and alarms; and power wiring to fire pump and controller; furnished separately by Division 21 Contractor, unless otherwise noted in Equipment Specifications.
 - 1. Clean Agent Fire Extinguishing System and Preaction Sprinkler System: Division 26 Contractor shall furnish and install, as required, 120 volt wiring to control panels, and interface wiring for equipment shut down.

PART 3 - EXECUTION

3.1 GENERAL

- A. Engineer, Architect, or Owner shall not be responsible for the means, methods, techniques, sequences or procedures of construction selected by Contractor.
- B. Engineer, Architect, or Owner shall not be responsible for safety precautions and programs incidental to work of Contractor.
- C. It is the sole responsibility of Contractor to initiate, maintain, and supervise all safety precautions and programs in connection with the Work.
- D. In general, it is intended that piping be installed parallel to building lines, unless otherwise shown on the Drawings, and that equipment be located symmetrical with the architectural elements of the building.
- E. Install piping above grid ceilings to allow easy removal of ceiling tiles. Install exposed piping as high as possible except where noted otherwise.
- F. Division 21 Contractor is to notify the Owners Staff of any work that may involve temporary disabling of the Fire Alarm System at least 1 week prior to the work occurring.

3.2 SURFACE CONDITIONS

- A. Prior to work, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- B. Verify that work of this Division may be installed in accordance with all pertinent codes, regulations and standards.

3.3 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect the materials of this Division before, during and after installation and to protect the installed work and materials of all other trades.
- B. Plugs: Install in ends of uncompleted piping at end of each day or when work stops.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

3.4 COORDINATION

- A. Order equipment and material in a timely fashion to assure it is on the job site when required.
- B. Coordinate installation of material with schedule of other trades to prevent unnecessary delay in construction schedule.
- C. Coordinate pipe routing with other trades to avoid conflicts with ductwork and other piping system.
- D. Division 21 piping and equipment installations shall comply with National Electrical Code requirements 110.26 "working spaces" and "dedicated spaces". Pipes shall not be installed in the space near electrical panels/equipment defined as "working spaces" or "dedicated spaces".

3.5 DISCREPANCIES, CONSTRUCTION CONFLICTS AND DRAWINGS

- A. Discrepancies
 - 1. Prior to submitting bid, Contractor shall refer any apparent discrepancies or omissions to Engineer for clarification.

2. The Architect, Engineer or Owner will not be responsible for any oral instructions or modifications to the contract documents prior to opening of bids.
 3. Written interpretation or clarification will be made by Addenda.
- B. Construction Conflicts
1. Conflicts discovered during construction shall be immediately called to the attention of the Engineer for decision.
 2. Do not proceed with installation in area of question until conflict has been fully resolved.
 3. When so directed by Engineer, Contractor shall make minor adjustment to avoid interferences with other trades. Such minor adjustments shall be performed at no additional cost to the Architect, Engineer or Owner.
- C. Drawings
1. Refer to the architectural drawings for dimensions and locations of walls, partitions, doors, windows, ceiling heights, door swings and other details of construction.

3.6 UNDERGROUND UTILITIES

- A. Locations of existing underground utilities are based on available site information and are shown approximately. Contractor shall determine exact utility locations before commencing work and shall be responsible for repair of damages resulting from his construction activities.
- B. Trench and backfill for installation of underground piping to depth shown or required. Remove any accumulated water in excavation by pumping. Shore and brace excavation as required by safety regulations. Provide temporary bridges to maintain normal traffic flow. Excavation and backfill required by mechanical installations shall be accomplished in accordance with Division 31 Specifications by this Contractor.

3.7 REMOVAL AND/OR REUSE OF EXISTING MATERIALS AND EQUIPMENT

- A. Existing equipment, which is indicated as being removed and not indicated for reuse, shall remain the property of the Owner, stored as directed. Any material the Owner does not wish to retain shall be removed and disposed by the Contractor.
- B. Contractor shall assume in his Bid that existing equipment and materials shown to be reused are in good working condition and can be installed without any repairs. If certain items are found to be in need of repair or in unusable condition, Contractor shall notify the Engineer for decision, however, Contractor shall be responsible for any damage by his personnel to equipment in removal or handling.
- C. Material and other equipment removed and to be reused shall be cleaned before reinstallation.

3.8 CUTTING AND PATCHING

- A. Refer to General Conditions. Unless specifically called out to be performed by other Contractors, the Division 21 Contractor shall perform all cutting and patching required for the installation of material and equipment furnished under his Contract.
- B. Opening/holes cut to allow passage of pipes through concrete floor shall be patched by the Contractor doing the cutting unless indicated otherwise on the Drawings.
- C. Fire-Barrier Penetrations
1. Pipe penetrations through fire rated walls and floors shall be sealed with a UL classified Fire Stop System. Fire Stops shall be provided in accordance with the appropriate System No. as it relates to pipe size/Material and wall or floor rating/material.
 2. See Specification Section 210510 for other Fire-Barrier Penetration requirements.
 3. See Section 2 article "Materials" of this Specification for approved fire stop system material.

- D. Restore damaged surfaces to their original condition by skilled mechanics of the trade involved. Contractor at fault shall assume all cost.
- E. Use only rotary type drilling tools to cut concrete.
- F. Do not endanger the stability of the structure. Do not at any time cut or alter work of any other Contractor without Architect's consent.

3.9 FIELD QUALITY CONTROL

- A. Perform field tests and inspections. Test new piping and parts of existing piping that have been altered, extended, or repaired.
- B. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained. Piping will be considered defective if it does not pass tests and inspections.

3.10 INSTRUCTIONS

- A. Provide written and oral operating and maintenance instructions to Owner's representatives. The oral instructions shall be given before the Owner occupies the buildings. Written instructions shall be graphical insofar as practical.
- B. Division 21 Contractor shall coordinate with Owner at Owner's convenience, formal instruction time for contractor personnel to instruct Owner's Representatives on all equipment.

END OF SECTION

SECTION 21 05 10
COMMON WORK RESULTS FOR FIRE PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Hangers.
 - 2. Escutcheons.
 - 3. Equipment and Warning labels.
 - 4. Pipe labels.

1.2 SUBMITTALS

- A. Shop Drawings: For equipment covered under this section as per Section 210500.
 - 1. Fire-Barrier Penetrations: UL Classified System, System Number.
- B. Operation and Maintenance Manual: Per section 210500.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. All hangers, installed or furnished under this Section, shall be listed or approved for use in the Fire Protection installation by the Authorities, Agencies, Codes and Standards named in this Section of the Specification.
- B. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: Clevis type with locknut to threaded extension rod, factory-fabricated components; MSS SP-58 types 1 through 58.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized or cadmium plated steel.
- C. Copper Pipe Hangers:
 - 1. Description: Clevis type with locknut to threaded extension rod, copper-coated-steel, factory-fabricated components; MSS SP-58 types 1 through 58.
 - 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.
- D. Trapeze Pipe Hangers:
 - 1. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.2 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.3 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

2.4 EQUIPMENT AND WARNING LABELS

A. General Requirements

1. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
2. Minimum Letter Size: 1/2 inch for name of units. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
3. Fasteners: Stainless-steel rivets or self-tapping screws.
4. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Metal Labels for Equipment:

1. Material and Thickness: Non-corroding metal, 20 gauge minimum thickness, and having predrilled or stamped holes for attachment hardware.

C. Plastic Labels for Equipment and Warning:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Equipment Label Color: Black letters on white background.
3. Warning Label Color: White letters on red background.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

D. Warning Label Content: Include caution and warning information, plus emergency notification instructions.

E. Equipment Label Content: Include equipment's Drawing designation or unique equipment number.

F. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing plan numbers where equipment is indicated, plus the Specification Section number and title where equipment is specified. Equipment schedule shall be provided to the Controls Contractor and included in operation and maintenance data.

2.5 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Arrange for grouping of parallel runs of horizontal piping, and support together on trapeze pipe hangers.

C. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

- D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- E. Install lateral bracing with pipe hangers and supports to prevent swaying.
- F. Install hangers and supports to not exceed maximum pipe deflections allowed by NFPA 13 for fire sprinkler piping.
- G. Comply with NFPA 13 for pipe-hanger selections and applications.
- H. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- I. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- J. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 °F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 - 3. Side-Beam or Channel Clamps (MSS Type 20 or 25): For attaching to bottom flange of beams, channels, or angles.
 - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 - 6. C-Clamps (MSS Type 23): For structural shapes.
 - 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod.
- M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of fire protection equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each branch connection, excluding short takeoffs for fixtures and terminal units.

2. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
3. At access doors, manholes, and similar access points that permit view of concealed piping.
4. Near major equipment items and other points of origination and termination.
5. Spaced at maximum intervals of 50 feet along each run.

3.4 ESCUTCHEON AND FLOOR PLATE INSTALLATION

- A. Install escutcheons for exposed piping penetrations of walls, ceilings, and floors of finished areas.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
- C. Replace broken and damaged escutcheons using new materials.

END OF SECTION

SECTION 21 10 00
FIRE SPRINKLER SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Wet-pipe sprinkler system.
 - 2. Dry-pipe sprinkler system.

1.2 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys fragile device. Hose connections are included if indicated.
- B. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Opening of sprinklers releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from sprinklers that are open.

1.3 RELATED SECTIONS

- A. Refer to Section 210520 "General Motor Requirements" for motor requirements.
- B. Refer to Section 210500 "Common Work Results for Results For Fire Protection" for requirements of hangers, sleeves, sleeve seals, escutcheons, and labels.

1.4 SUBMITTALS

- A. Shop Drawings: As per Section 210500 and prepared according to NFPA 13.
 - 1. Materials: As covered under this section.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
 - 3. Approved Sprinkler Piping Drawings: Working plans that have been approved by authorities having jurisdiction.
 - 4. Water Supply Capacity Information: Include flow test data.
 - 5. Approved Hydraulic Calculations: Include summary sheet, detailed worksheets, and a graph sheet.
- B. Operation and Maintenance Data: Per section 210500.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and engineering services.
 - 2. Experience: Minimum of 2 years in the successful installation and operation of Fire Protection systems.
- B. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13, "Installation of Sprinkler Systems."
 - 2. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height."

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Pressure Rating: 175 psig minimum unless otherwise noted.

2.2 FIRE-DEPARTMENT CONNECTIONS

- A. Description: Flush-Type, Fire-Department Connection.
 - 1. Standard: UL 405.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. Elkhart Brass Mfg. Company, Inc.
 - 2. Potter Roemer.
- C. Type: Flush, for wall mounting.
- D. Body Material: Corrosion-resistant metal.
- E. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
- F. Caps: Brass, lugged type, with gasket and chain.
- G. Escutcheon Plate: Rectangular, brass, wall type.

2.3 BACKFLOW PREVENTION

- A. Double Check Valve Backflow Preventer Assembly:
 - 1. Description: Double check valve assembly with UL/FM approved valves on inlet and outlet of assembly.
 - 2. Assembly Standard: ASSE 1015, AWWA C510-07
 - 3. Check Valves:
 - a. Type: Swing check.
 - b. Body Material: Epoxy coated cast iron.
 - c. Seats: Bronze.
 - 4. Shut-off Valves:
 - a. OS&Y gate valve, UL 262.
 - b. Butterfly valves.
 - c. Provide valve supervisory switches at each valve.

2.4 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Water-Flow Indicators:
 - 1. Standard: UL 346.
 - 2. Water-Flow Detector: Electrically supervised.
 - 3. Pressure Rating: 250 psig.
- C. Valve Supervisory Switches:
 - 1. Standard: UL 346.
 - 2. Type: Electrically supervised.
 - 3. Design: Signals that controlled valve is in other than fully open position.

2.5 SPRINKLERS

- A. General Requirements:
 - 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
- B. Automatic Sprinklers with Heat-Responsive Element:
 - 1. Early-Suppression, Fast-Response, Applications: UL 1767.
 - 2. Nonresidential Applications: UL 199.
 - 3. Residential Applications: UL 1626.
- C. Sprinkler Finishes:
 - 1. Chrome plated.
 - 2. Bronze.
- D. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 - 1. Ceiling Mounting: Plastic, white finish, one piece, flat.
 - 2. Sidewall Mounting: Plastic, white finish, one piece, flat.
- E. Sprinkler Guards:
 - 1. Standard: UL 199.
 - 2. Type: Wire cage with fastening device for attaching to sprinkler.

2.6 FLEXIBLE SPRINKLER HOSE

- A. Description: Flexible sprinkler hose fittings for use in commercial suspended ceilings and sheetrock ceilings.
 - 1. Standard: UL 2443.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. FlexHead Industries, Inc.
 - 2. Easyflex.
 - 3. Victaulic.
 - 4. Rascoflex.
- C. Materials: Fully welded non-mechanical fittings, braided, leak-tested with minimum 1 inch true-bore internal hose diameter.
 - 1. Braiding: Type 304 stainless steel.
 - 2. Nut and Nipple: Galvanized steel.
 - 3. Gaskets: EPDM/Nylon.
 - 4. Ceiling Bracket: Galvanized steel.
 - 5. Ratings: 175 psi and 225°F.

2.7 AUDIBLE VISUAL ALARMS

- A. Description: Weatherproof, strobe/horn unit, wall mounted, UL listed.
- B. Strobe: Xenon flash, high impact lens.
 - 1. Effective Candle Power: Minimum 15.0.
 - 2. Peak Candle Power: 135,000.
- C. Horn: 95dBA.

2.8 AIR COMPRESSOR

- A. Description: Oil-less riser mounted digital fire protection air compressors for dry pipe and pre-action sprinkler systems.
 - 1. Recovery Time: 30 minutes.
 - 2. Basis of Design: General Air Products; OL Advance Series
- B. Standards:
 - 1. UL 508
 - 2. UL 1450-VDUR
- C. Compressor Assembly:
 - 1. Oil-less piston compressor
 - 2. Direct drive
 - 3. ASME pressure safety valve
 - 4. Bubble-tight air check valve
- D. Electrical:
 - 1. Single point power connection with factory starter
 - 2. Connection:
 - a. 120/1/60 up to ¾ HP
 - b. 208-230/1/60 up to 1 HP
- E. Controller: Digital read out with adjustable pressure
 - 1. Pressure readout
 - 2. Displays & records run hours
 - 3. Displays amperage
 - 4. Displays & records cycles
 - 5. Annual automated maintenance reminders

PART 3 - EXECUTION

3.1 SERVICE-ENTRANCE PIPING

- A. Connect fire-protection standpipe piping to flange provided by mechanical contractor on water-service piping at service entrance into building.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories at connection to fire-protection water-service piping.

3.2 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
- B. Piping Standard: Comply with requirements in NFPA 14 for installation of fire-protection standpipe piping.
- C. Install drain valves on standpipes. Extend drain piping to outside of building.
- D. Install automatic (ball drip) drain valves to drain piping between fire-department connections and check valves. Drain to floor drain or outside building.
- E. Install alarm devices in piping systems.
- F. Install sleeves for piping penetrations of walls, ceilings, and floors.
- G. Install sleeve seals for piping penetrations of exterior concrete walls and slabs.
- H. Install escutcheons for piping penetrations of walls, ceilings, and floors.

- I. Bushings of any type to obtain reduction in size in fittings are not acceptable.

3.3 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
 - 1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
 - 2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.
- E. Install audible visual alarm above fire department connection.

3.4 SPRINKLER HEAD INSTALLATION

- A. Location of Sprinkler Heads: As shown on the shop drawings.
 - 1. Placed in the center of the ceiling tiles when practical.
 - 2. Avoid lights, ceiling grid, and other devices mounted in the ceiling tiles.

3.5 FLEXIBLE SPRINKLER HOSE INSTALLATION

- A. Install flexible sprinkler hose connections to heads in all areas with a finished suspended or sheetrock ceiling.
 - 1. Exceptions: Where limited space is a factor and minimum bend radius is not possible.
 - a. Verify these locations with design engineer and indicate them on the Fire Sprinkler Shop Drawings.
- B. Mount heads to bracket system manufactured by same manufacturer as flexible connector drops.
- C. Do not over-bend flexible hose. Do not exceed manufacturer recommended minimum radius.

3.6 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 14.
- B. Identify system components, wiring, cabling, and terminals.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Fire Sprinkler Service Piping Tests: Test service piping as required by the Authority Having Jurisdiction or, in absence of published procedures, as follows:
 - 2. Witness: Test shall be performed in the presence of the Authority Having Jurisdiction or the representative of the Owner.
 - 3. Testing: Before the joints are covered in order for leaks to be detected.

4. Pressure: Minimum of 200 psig, if maximum static pressure is 150 psig or greater the pressure test shall be 50 psig greater than maximum pressure test.
5. Duration: Two (2) hours.
6. Leakage Rate: Not to exceed two quarts/hr per 100 joints or gaskets irrespective of pipe diameter. Leakage for metal seated valves may increase above leakage rate by one fluid ounce per inch valve diameter per hour for each metal seated valve isolating the test section.
7. Control Valves: Operating test shall be performed on all control valves when system is under full pressure to ensure proper operation.
8. Certification: Upon completion, this Contractor shall complete the "Contractor's Material & Test Certificate For Underground Piping" contained in NFPA 2 and submit copies to the Owner, Engineer, Local Fire Chief and ISO Commercial Risk Services, Inc.
9. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
10. Flush, test, and inspect sprinkler systems according to NFPA 13, "System Acceptance" Chapter.
11. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter.
12. Energize circuits to electrical equipment and devices.
13. Coordinate with fire-alarm tests. Operate as required.
14. Coordinate with fire-pump tests. Operate as required.
15. Verify that equipment hose threads are same as local fire-department equipment.

3.8 BACKFLOW PREVENTION SCHEDULE

- A. Double Check Valve Assembly: Wet and dry systems.
- B. Reduced Pressure Backflow Preventer Assembly: Glycol/water solution systems.

3.9 SPRINKLER SCHEDULE

- A. Provide sprinkler types in subparagraphs below with finishes indicated.
 1. Flush Concealed Sprinklers: Rough brass, with white cover plate; install in areas with finished ceilings.
 2. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view with no ceilings; rough bronze in unfinished spaces with no ceilings not exposed to view.

END OF SECTION

SECTION 22 05 00
PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Specification Format

1. These Specifications are written in imperative and abbreviated form. This imperative language of the technical sections is directed at the Contractors, unless specifically noted otherwise. Incomplete sentences shall be completed by inserting "shall", "the Contractor shall", and "shall be", and similar mandatory phrases by inference in the same manner as they are applied to notes on the Drawings. The words "shall be" shall be supplied by inference where a colon (:) is used within sentences or phrases. Except as worded to the contrary, perform all indicated requirements whether stated imperatively or otherwise.
2. Three Part Format
 - a. "Part 1 - General": Covers those areas which relate to the Work, and which define the general administrative and technical requirements specific to a particular section.
 - b. "Part 2 - Products": Defines, in detail, the acceptance equipment and materials to be incorporated into the Work.
 - c. "Part 3 - Execution": Describes, in detail, the manner in which items covered by Part 2 are to be incorporated into the Work.
3. Where Codes, Specifications and Drawings are in conflict, the Contractor will be deemed to have bid the more expensive method. Refer all such discrepancies immediately to the Engineer prior to commencing related work.

B. Definitions:

1. Furnish: Supply equipment as required by these Drawings and Specifications, delivered to the job site for installation or use by others.
2. Install: Fix in position for total operational use all apparatus as shown, specified or required. Provide all miscellaneous fittings and wiring supplies.
3. Or Approved Equal: Equipment or materials selected by Contractor subject to Engineer's acceptance.
4. Or Equivalent: Equipment or materials selected by Contractor matching the function and performance of equipment or materials listed.
5. Provide: Furnish and install in place, total and operational.
6. Complete/Completely: All pipes, fittings, ducts, wiring supplies, and accessories provided for the noted equipment from the equipment to the mains or noted termination points.

1.2 SCOPE OF WORK

- A. The work covered by this Division consists in furnishing all labor, equipment, accessories and materials and in performing all operations necessary for the installation of the plumbing systems, in strict accordance with Division 22 of this Specification and applicable Drawings and subject to the terms and conditions of the Contract.
- B. Work of this Division is subject to requirements of Instructions to Bidders, General Conditions, Supplementary Conditions, Division One, and all other sections of this Specification.

- C. Examine site and all Contract documents prior to submittal of bid.
 - 1. Submittal of a Bid shall indicate the Contractor has examined the Site and Drawings and has included all required allowances in this Bid. No allowance shall be made for errors resulting from the Contractor's failure to visit job sites and to review Drawings.
- D. Division 22 Work: Includes, but is not limited to, providing the following:
 - 1. Potable Water Distribution System: Fixtures, piping, equipment.
 - 2. Waste and Vent Systems: Piping and specialties.
 - 3. Compressed Air Systems: Low pressure (below 150 psi) air piping.

1.3 ALTERNATES

- A. Refer to Division 01 for alternates.
- B. General
 - 1. The work of this Section is affected by the Alternates described in Division 1.
- C. Alternate M-1
 - 1. The Owner wishes to know in advance the possible cost to remodel the restrooms in the Joachim museum.
 - 2. Base Bid: No work
 - 3. Under Alternate Bid M-1 on the Bid Form, state the Contract Sum to remodel the restrooms as shown on drawing sheet M801.
- D. Alternate M-2
 - 1. The Owner wishes to know in advance the possible cost to remodel the restrooms in the 1992 dinosaur museum.
 - 2. Base Bid: No work
 - 3. Under Alternate Bid M-1 on the Bid Form, state the Contract Sum to remodel the restrooms as shown on drawing sheet M801.

1.4 SUBMITTALS

- A. General:
 - 1. Preferred Submittal Format: PDF, unless otherwise noted.
 - 2. Preferred Submittal Nomenclature: Unless otherwise noted, PDF submittals are to be named according to the following:
 - a. [Specification Section Number] – [Specification Name or Equipment Included]
 - 3. Distribution: Unless otherwise noted, direct all correspondence concerning Division 22 submittals to:

STEVE BUTTERFIELD
PRAIRIE ENGINEERING, P.C.
619 RIVERWOOD DRIVE, SUITE 205
BISMARCK, ND 58504
sbutterfield@prairieengineeringpc.com

- B. Substitution and Prior Approval to Quote:
 - 1. Format and Content: Complete descriptive technical data on the proposed item consisting of model numbers, type, size and performance characteristics.
 - 2. Submission Timing: Minimum of 192 hours (eight days) prior to bid opening.
 - a. Substitutions will not be permitted after bid opening except where such substitution is considered by the Engineer to be in the best interest of the Owner.
 - 3. Bidder Notification: Prior to bid opening via Addenda, sent to all planholders.

4. Contractor Responsibility: This contractor will be responsible for all coordination, construction costs, and Architectural/Engineering design fees required to substitute equipment that has different characteristics than designed including weights, physical dimensions, clearances, mechanical characteristics, electrical characteristics, and other characteristics deemed important to the design by the Architect/Engineer.
5. Alternative Format: Printed paper, two copies; Self-addressed, stamped envelope required for return reply.

C. Schedule of Values

1. Format and Content: When included with the Bid, at minimum the following categories shall be indicated:
 - a. "Project mobilization"
 - b. "Demolition"
 - c. "Excavation and Backfill"
 - d. "Insulation"
 - e. "Domestic Water Piping System" (all piping, valves, shock arrestors, fittings, hangers, installed in place)
 - f. "Waste and Vent System" (all piping, valves, fittings, hangers, floor drains, interceptors, installed in place)
 - g. "Storm and Rain System" (all piping, drains, downspouts, fittings, hangers, drain tile, installed in place)
 - h. "Plumbing Fixtures" (all fixtures, faucets/flush valves, drain assemblies, water coolers, installed in place)
 - i. "Plumbing Equipment" (all water heaters, recirculation pumps, expansion tanks, storage tanks, installed in place)
 - j. "Compressed Air System" (all piping, valves, fittings, specialties, installed in place)
 - k. "Medical Gas System" (all piping, valves, alarms, pumps, manifolds, installed in place)
2. Submission Timing: Prior to first payment application.

D. Shop Drawings

1. Distribution: Engineer via the Prime Contractor for each item indicated.
2. Format and Content: Include catalog numbers, performance data, dimensions and other descriptive information.
 - a. Contractor Review: Dated and signed cover sheet or review stamp for each Shop Drawing file to indicate thorough review. **Email message text not acceptable.**
 - b. Non-Conforming: Returned to Contractor without review.
3. Submission Timing: Prior to delivery of materials to job site.

E. Record Drawings

1. Format and Content: Paper copy of Drawings project site.
 - a. As work progresses, Contractor's field supervisor shall mark Record Drawings in red pencil to indicate actual conditions of installation.
 - b. Give particular attention to marking actual locations of underground piping.
 - c. Affix all addendum and change order descriptions to appropriate record drawing sheet, utilizing spray adhesive.
 - d. Make Record Drawings available to Engineer during project visitation.
2. Submission Timing: Close of project with Record Manuals.

F. Spare Equipment and Devices

1. Distribution: Owner.

2. Format and Content: List quantities on contractor letterhead or invoice, obtain signature of Owner's representative acknowledging receipt, and include with each Record Manual.
 3. Submission Timing: Close of project with Record Manuals.
- G. Operation and Maintenance Manuals
1. Submission Timing: Close of project, as condition of its acceptance.
 2. Record Manual information shall be included for all equipment/material where Shop Drawings are required.
 3. Format and Content: Two copies, Loose-leaf hardcover binders, **and** in PDF format on CDs or USB drive.
 - a. List project name, date, Contractor's name, address and telephone number on exterior label of each Record Manual and CD.
 - b. Include an index sheet indicating subcontractor and subcontractor's phone number; and each major piece of equipment, supplier and supplier's telephone number. Provide tabbed dividers indicating major groupings of equipment.
 - c. Include a copy of the Shop Drawings.
 - d. Include all installation, operation and maintenance data packaged with any equipment.
 - e. Include all signed and dated final punch lists from walkthroughs performed by the Engineer.

1.5 APPLICATIONS FOR PAYMENT

- A. Refer to Division 1 "Applications for Payment".
- B. Provide one additional copy, sent directly to the Engineer.
- C. Schedule of Values: At minimum, include items in Submittal article.

1.6 CHANGES TO CONTRACT

- A. Any required changes to the contract after bid date shall be in accordance with General Conditions/Division 1 and this section. Where any discrepancies between the sections are encountered, the more restrictive section shall apply.
- B. Proposed changes shall be accompanied with complete substantiating documentation.
 1. Provide an itemized list of quantities for materials, equipment, and supplies.
 - a. Include unit costs for each item and extended price.
 - b. Include unit labor for each item and extended time.
 2. Provide subcontractor proposals that include the same substantiating documentation.
 3. Provide quotations from suppliers for any specially ordered equipment.
- C. Material costs shall be actual costs to the contractor, obtaining the materials through normal supply channels, including trade and quantity discounts. Utilizing "suggested pricing" from national pricing organizations for unit costs shall not be accepted. Upon request, the contractor or subcontractor shall submit evidence to substantiate the costs.
- D. Labor units shall be industry accepted standard labor hours to perform one unit of work. If the work is being performed in a location that is not considered to be standard working conditions for that specific task, additional labor shall be itemized.
- E. Labor rates shall be the actual rate paid for the workman category along with associated labor burden. Labor burden shall consist only of the mandatory fringe benefits, labor taxes, and labor insurances as affected by payroll. The owner reserves the right to reject any labor burden which is inconsistent with other similar contractors or where the fringe benefit cost is in excess of established labor agreements.

- F. Allowable markups for contractor and subcontractors: Refer to Division 1. In absence of published allowable markups, as follows:
1. Overhead on work performed by own forces: 12% maximum.
 2. Profit on work performed by own forces: 10% maximum.
 3. Commission on work performed by Subcontractors: 5% maximum.
 4. Sales tax.
 5. Bond and permit increases where applicable.
 6. No additional markups shall be allowed for:
 - a. Field and/or office supervision/administration time.
 - b. Tool burden.
 - c. Shop burden.
 - d. Overhead/Profit applied to work performed by others.
 7. Additional costs for travel and subsistence shall only be allowed if the proposal includes a request for extension of the completion date. Furthermore, those costs shall be proportional to the number of working days of the extension.
- G. Subcontractors shall compute their costs in the same manner as the contractor. Subcontractors are subject to the same markup constraints as described herein.
- H. For changes resulting in credit to the costs, no restocking fees for materials shall be applied by the contractor or subcontractors.

1.7 QUALITY ASSURANCE

- A. Qualifications of Installers
1. For installation and testing, use only trained licensed and experienced workmen familiar with items required and manufacturer's recommended methods.
 2. In acceptance or rejection of installed work, no allowance will be made for lack of skill on the part of the workmen.

1.8 AUTHORITIES AND AGENCIES

- A. Materials, workmanship and installation: Comply with the latest editions of all applicable codes, local ordinances, industry standards, utility company regulations, insurance carrier requirements and these Specifications.
- B. Obtain and pay all permits, inspections, licenses and other charges pertaining to the Work. Upon completion of the Work, furnish proof of acceptance by proper agency having jurisdiction.
- C. Codes and standards shall include, but not necessarily be limited to, the following:
1. International Energy Conservation Code (IECC);
 2. Uniform Plumbing Code;
 3. North Dakota State Building Code;
 4. International Building Code (IBC);
 5. International Mechanical Code (IMC);
 6. International Fuel Gas Code (IFC);
 7. National Fire Protection Association (NFPA) – Sections as adopted by authority having jurisdiction.
- D. The more stringent provisions shall govern where provisions of pertinent codes and standards conflict with these Specifications or Drawings. Where Codes, Specifications or Drawings differ with one another, the Contractor will be deemed to have bid the more expensive method. Refer all such discrepancies to the Engineer immediately.
1. Pertinent codes and standards shall not be cited to furnish less than specifically shown or specified.

2. Meeting the minimum standards of the above Codes does not permit a lower grade of construction where Plans or Specifications call for workmanship or materials in excess of Code Requirements.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.9 GUARANTEE AND WARRANTY

- A. Except where otherwise noted, contractor shall guarantee materials, workmanship and the proper operation of equipment for a period of one year after Owner's beneficial use of the building or mechanical system. Contractor shall correct all equipment, material and workmanship found to be defective or non-conforming to the contract documents without cost to Owner during that one year period.
- B. Guarantee shall include trips to the project site by Contractor to adjust mechanical equipment as required, ensuring it is operating as intended.
- C. Specified guarantee shall not relieve Contractor from liability arising from improper installation or non-compliance with applicable codes.

1.10 TEMPORARY FACILITIES

- A. Refer to Special Conditions and/or Division 1 for details of temporary facilities.

1.11 NOMENCLATURE

- A. Pipe sizes listed are nominal pipe sizes throughout this Division except where otherwise noted.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Material and equipment shall be as shown or specified. Provide material not specifically described but required for a complete and proper installation of the Work, subject to the acceptance of the Engineer.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."
- C. Owner will not be liable for material installed in non-compliance with codes, standards, and these Contract Documents.
- D. Fire Stop System material shall be by 3M "Fire Barrier", Metacaulk, Hilti, Nelson Firestop Products, or AD Fire. See Division 07 for further details on approved materials.

2.2 ELECTRIC WIRING

- A. The Division 22 Contractor shall furnish all motors, special controls and electrical devices as specified herein for proper operation of the equipment furnished.
- B. Division 26 Contractor shall furnish and install, as required, disconnects, starters, switches, etc., and do all necessary power and control wiring including the installation of electrical devices such as thermostats, humidistats, remote control panels, etc., furnished separately by Division 22 Contractor, unless otherwise noted in Equipment Specifications.

PART 3 - EXECUTION

3.1 GENERAL

- A. Engineer, Architect, or Owner shall not be responsible for the means, methods, techniques, sequences or procedures of construction selected by Contractor.
- B. Engineer, Architect, or Owner shall not be responsible for safety precautions and programs incidental to work of Contractor.
- C. It is the sole responsibility of Contractor to initiate, maintain, and supervise all safety precautions and programs in connection with the Work.
- D. Division 22 Contractor is to notify the Owners Staff of any work that may involve temporary disabling of the Fire Alarm System at least 1 week prior to the work occurring.

3.2 SURFACE CONDITIONS

- A. Prior to work of each Section of Division 22, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- B. Verify that work of this Division may be installed in accordance with all pertinent codes, regulations and standards.

3.3 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect the materials of this Division before, during and after installation and to protect the installed work and materials of all other trades.
- B. Plugs: Install in ends of uncompleted piping at end of each day or when work stops.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

3.4 COORDINATION

- A. Order material in a timely fashion to assure it is on the job site when required.
- B. Coordinate installation of material with schedule of other trades to prevent unnecessary delay in construction schedule.
- C. Division 22 piping, duct and equipment installations shall comply with National Electrical Code requirements 110.26 "working spaces" and "dedicated spaces". Mechanical ducts and pipes shall not be installed in the space near electrical panels/equipment defined as "working spaces" or "dedicated spaces".

3.5 DISCREPANCIES, CONSTRUCTION CONFLICTS AND DRAWINGS

- A. Discrepancies
 - 1. Prior to submitting bid, Contractor shall refer any apparent discrepancies or omissions to Engineer for clarification.
 - 2. The Architect, Engineer or Owner will not be responsible for any oral instructions or modifications to the contract documents prior to opening of bids.
 - 3. Written interpretation or clarification will be made by Addenda.
- B. Construction Conflicts
 - 1. Conflicts discovered during construction shall be immediately called to the attention of the Engineer for decision.
 - 2. Do not proceed with installation in area of question until conflict has been fully resolved.

3. When so directed by Engineer, Contractor shall make minor adjustment to avoid interferences with other trades. Such minor adjustments shall be performed at no additional cost to the Architect, Engineer or Owner.
- C. Drawings
1. Drawings indicate extent and general layout of plumbing systems for project. Due to small scale, it is not possible to indicate all fittings and accessories that may be required. Provide such fittings and accessories as required to form a complete and operating system in general conformance with Specifications and Drawings.
 2. Exact locations, distances, levels and other conditions will be governed by the structure. Field measurements shall take precedence over the Drawings. Use the Drawings and these Specifications for guidance. Secure the Architect's approval for all changes in locations.
 3. Verify all measurements at site. No compensation will be made because of difference between locations shown on the Drawings and measurements at the building.
 4. Refer to the architectural drawings for dimensions and locations of walls, partitions, doors, windows, ceiling heights, door swings and other details of construction.

3.6 UNDERGROUND UTILITIES

- A. Locations of existing underground utilities are based on available site information and are shown approximately. Contractor shall determine exact utility locations before commencing work and shall be responsible for repair of damages resulting from his construction activities to pre-construction condition.
- B. Trench and backfill for installation of underground piping to depth shown or required. Remove any accumulated water in excavation by pumping. Shore and brace excavation as required by safety regulations. Provide temporary bridges to maintain normal traffic flow. Excavation and backfill required by mechanical installations shall be accomplished in accordance with Division 31 Specifications by this Contractor.

3.7 REMOVAL AND/OR REUSE OF EXISTING MATERIALS AND EQUIPMENT

- A. Existing equipment, which is indicated as being removed and not indicated for reuse, shall remain the property of the Owner, stored as directed. Any material the Owner does not wish to retain shall be removed and disposed by the Contractor.
- B. Contractor shall assume in his Bid that existing equipment and materials shown to be reused are in good working condition and can be installed without any repairs. If certain items are found to be in need of repair or in unusable condition, Contractor shall notify the Engineer for decision, however, Contractor shall be responsible for any damage by his personnel to equipment in removal or handling.
- C. Material and other equipment removed and to be reused shall be cleaned before reinstallation.

3.8 OFFSETS

- A. Where required to allow clearance of ducts, electrical conduit and outlet boxes, beams, etc., to avoid interference with work of other trades, to increase head room under pipes or to improve the appearance of pipe work, this Contractor shall offset his pipes as directed by the Architect/Engineer.

3.9 CUTTING AND PATCHING

- A. Refer to General Conditions. Unless specifically called out to be performed by other Contractors, the Plumbing Contractor shall perform all cutting and patching required for the installation of material and equipment furnished under his Contract.

B. Fire-Barrier Penetrations

1. Pipe penetrations through fire rated walls and floors shall be sealed with a UL classified Fire Stop System. Fire Stops shall be provided in accordance with the appropriate System No. as it relates to pipe size/Material and wall or floor rating/material.
 2. See Specification Section 220510 for other Fire-Barrier Penetration requirements.
 3. See Section 2 article "Materials" of this Specification for approved fire stop system material.
- C. Restore damaged surfaces to their original condition by skilled mechanics of the trade involved. Contractor at fault shall assume all cost.**
- D. Use only rotary type drilling tools to cut concrete.**
- E. Do not endanger the stability of the structure. Do not at any time cut or alter work of any other Contractor without Architect's consent.**

3.10 FIELD QUALITY CONTROL

- A. Perform field tests and inspections. Test new piping and parts of existing piping that have been altered, extended, or repaired.**
- B. Piping Inspections:**
1. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - b. Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
- C. Domestic Water, Sanitary, and Vent Piping Tests: Test domestic water, sanitary, and vent piping as required by the Authority Having Jurisdiction or the Plumbing Code, or, in absence of published procedures, as follows:**
1. Domestic Water Piping:
 - a. Pressure: Minimum of 125 psig.
 - b. Duration: Two (2) hours.
 2. Sewer, Soil, Waste, Drain and Vent Piping:
 - a. Procedure: Close all openings and pressurize with air.
 - b. Pressure: Minimum of 5 psig.
 - c. Duration: 15 minutes.
 - d. System may be tested in its entirety or in sections.
- D. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained. Piping will be considered defective if it does not pass tests and inspections.**

3.11 ADJUSTING

- A. Perform the following domestic water adjustments before operation:**
1. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 2. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.12 DISINFECTION OF POTABLE WATER SYSTEM

- A. Clean interior of domestic water, septic, and vent piping systems. Remove dirt and debris as work progresses.**

- B. New potable water systems shall be disinfected prior to use whenever required by the Authority having jurisdiction. The method to be followed shall be that prescribed by the Health Authority or, in case no method is prescribed by the Health Authority, the following: Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 1. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - i. Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - ii. Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - 2. The procedure shall be repeated if it is shown by a bacteriological examination, made by the Authority, that contamination still persists in the system.
- C. After all tests have been made and the plumbing systems are operating properly, this Contractor shall go over the entire system and remove labels from all plumbing fixtures.

3.13 INSTRUCTIONS

- A. Provide written and oral operating and maintenance instructions to Owner's representatives. The oral instructions shall be given before the Owner occupies the buildings. Instructions to include **all** building's plumbing systems and equipment.
- B. Division 22 Contractor shall coordinate with Owner at Owner's convenience, formal instruction time for contractor personnel to instruct Owner's Representatives on all equipment. Provide similar equipment supplier's instructions where specified thus.
- C. Formal instructions shall be video recorded when required by other Sections of this Specification by this Contractor. Format shall be DVD. Formal instruction to be included with each Record Manual, being referenced to and a part of the Manual.

3.14 CLEAN UP

- A. Each Contractor shall be responsible for cleaning up after his work, including the removal of all scrap material left on the job by his men or Subcontractors. This will include the removal of all pipe cuttings, pieces of pipe and insulation and other debris.
- B. After all tests have been made and the plumbing systems are operating properly, this Contractor shall go over the entire system and remove labels from all plumbing fixtures and other plumbing equipment.
- C. All equipment having finished paint surfaces shall be examined upon completion for scratches and other damage. Touch up all surfaces as required with paint of color to match factory finish.

END OF SECTION

SECTION 22 05 10
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Ball valves.
 - 2. Check valves.
 - 3. Gauges (temperature, pressure)
 - 4. Hangers.
 - 5. Sleeves.
 - 6. Sleeve-seal systems.
 - 7. Escutcheons.
 - 8. Thermowells.
 - 9. Gage attachments.
 - 10. Equipment and Warning labels.
 - 11. Pipe labels.
 - 12. Equipment supports.
 - 13. Fire-Barrier Penetrations.
 - 14. Water Meter.
 - 15. Steel nail plates.
- B. Nomenclature:
 - 1. SWP: Steam working pressure.
 - 2. CWP: Cold working pressure.

1.2 SUBMITTALS

- A. Shop Drawings: For equipment covered under this section as per Section 220500.
 - 1. Product Data: Each type of valve, gauge, strainer, sleeve, and sleeve-seal system.
 - 2. Fire-Barrier Penetrations: UL Classified System, System Number.
- B. Operation and Maintenance Manual: Per section 220500.

PART 2 - PRODUCTS

2.1 VALVE MANUFACTURERS

- A. Except in other Part 2 articles where noted, the following manufacturers are acceptable:
 - 1. Anvil International.
 - 2. Conbraco Industries, Inc.; Apollo Valves.
 - 3. Milwaukee Valve Company.
 - 4. NIBCO INC.
 - 5. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 6. Viega, LLC.
- B. All manufacturers are subject to compliance with requirements
- C. Provide products by one of the manufacturers specified or by prior approval.

2.2 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Standard and Rating: Comply with NSF-61-G.

2.3 BALL VALVES

- A. Two-Piece, Full-Port, Metal, Ball Valves:
 - 1. Standard and Rating: 250 psi CWP at maximum 250°F.
 - 2. Body Design: Two piece
 - 3. Body Material: Forged brass or Bronze.
 - 4. Seats: PTFE or TFE.
 - 5. Stem: Brass or Bronze, blowout-proof, packing nut.
 - 6. Ball: Chrome-plated brass.
 - 7. Port: Full or Regular.
 - 8. Operator: Lever; separate lever nut.

2.4 CHECK VALVES

- A. Check Valve – Bronze Swing:
 - 1. Standard and Rating: 200 psig CWP at 100°F.
 - 2. Body Design: Y-pattern.
 - 3. Body Material: Bronze.
 - 4. Disc: Bronze or PTFE.

2.5 STRAINERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. Watts International.
- B. Body: Brass with threaded screen retainer cap.
- C. Strainer Screen: 20-mesh brass or stainless steel.

2.6 GAUGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. Miljoco Corporation.
 - 2. Terice, H. O. Co.
 - 3. Weiss Instruments, Inc.
 - 4. WIKA Instrument Corporation - USA.
 - 5. Winters Instruments - U.S.
- B. Thermometers – Digital:
 - 1. Basis of Design: Weiss Instruments DVU series.
 - 2. Case: Hi-impact plastic or cast aluminum.
 - 3. Case form: Adjustable angle.
 - 4. Display: 1/2" LCD digits, wide ambient formula
 - 5. Power Source: Integral solar cell.
- C. Pressure Gages – Dial Type:
 - 1. Basis of Design: Weiss Instruments 4UG series.
 - 2. Standard: Conform to ASME B40.100.
 - 3. Case: Cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
 - 4. Pressure-Element Assembly: Bourdon tube
 - 5. Movement: Mechanical, with link to pressure element and connection to pointer.
 - 6. Dial: White aluminum with scale markings graduated in psi.
 - 7. Scale: Select so expected pressure reading is in center of range.

2.7 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: Clevis type with locknut to threaded extension rod, factory-fabricated components; MSS SP-58 types 1 through 58.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized or cadmium plated steel.

B. Copper Pipe Hangers:

1. Description: Clevis type with locknut to threaded extension rod, copper-coated-steel, factory-fabricated components; MSS SP-58 types 1 through 58.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.

C. Trapeze Pipe Hangers:

1. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

D. Plastic Pipe Support Channel

1. Description: 18 Ga. steel v-channel; standard finish.

2.8 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier for cold piping.
- B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.9 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.10 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

2.11 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

2.12 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. Metraflex Company (The).
 - 2. Link-Seal; Pipeline Seal & Insulator, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Glass reinforced plastic.
 - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.13 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

2.14 EQUIPMENT AND WARNING LABELS

- A. General Requirements
 - 1. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 2. Minimum Letter Size: 1/2 inch for name of units. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 3. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 4. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Metal Labels for Equipment:
 - 1. Material and Thickness: Non-corroding metal, 20 gauge minimum thickness, and having predrilled or stamped holes for attachment hardware.
- C. Plastic Labels for Equipment and Warning:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 2. Equipment Label Color: Black letters on white background.
 - 3. Warning Label Color: White letters on red background.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- D. Warning Label Content: Include caution and warning information, plus emergency notification instructions.
- E. Equipment Label Content: Include equipment's Drawing designation or unique equipment number.
- F. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing plan numbers where equipment is indicated, plus the Specification Section number and title where equipment is specified. Equipment schedule shall be provided to the Controls Contractor and included in operation and maintenance data.

2.15 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.16 FIRE-BARRIER PENETRATIONS

- A. Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with Approved firestop materials. See Section 220500 for further details.

2.17 WATER METER

- A. Furnish and install a 1 1/2" meter of the type approved by the Water Department.
 - 1. Meter shall have a self-generating remote readout.

2.18 STEEL NAIL PLATES

- A. In concealed locations where piping, other than cast-iron or galvanized steel, is installed through holes or notches in studs, joists, rafters, or similar members less than 1-1/2" from the nearest edge of the member, the pipe shall be protected by steel shield plates.
- B. Plates shall have a thickness not less than 0.0575" (16-gauge mild steel).
- C. Plates shall cover the area of the pipe where the member is notched or bored, shall extend not less than 1-1/2" beyond the outside diameter of the pipe, and shall extend not less than 2" above sole plates and below top plates.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.
- B. Install calibrated-orifice, balancing valves where shown on drawings.
- C. Install valves in horizontal piping with stem at or above center of pipe in position to allow full stem movement.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, or butterfly valves.
 - 2. Pump-Discharge Check Valves:
 - a. 2" and Smaller: Bronze swing check valves with bronze disc.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

3.3 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

- B. Metal Trapeze Pipe-Hanger Installation: Arrange for grouping of parallel runs of horizontal piping, and support together on trapeze pipe hangers.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- G. Install lateral bracing with pipe hangers and supports to prevent swaying.
- H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- I. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe 4" and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe 4" and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. 4" and smaller: 12 inches long and 0.06 inch thick.
 - b. 5" and larger: 18 inches long and 0.06 inch thick.
 - 5. Pipes 8" and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
- J. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- K. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- L. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- M. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- N. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- O. Use thermal-hanger shield inserts for insulated piping and tubing.

- P. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 °F piping installations.
- Q. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20 or 25): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod.
- R. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- S. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
- T. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

3.4 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.5 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 1 inches above finished floor level.
 2. Using grout, seal the space outside of sleeves in slabs and walls.

3.6 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in below grade exterior concrete walls.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.7 GAUGE INSTALLATION

- A. Install thermowells with extension on insulated piping.
- B. Fill thermowells with heat-transfer medium.
- C. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- D. Install thermometers in the following locations:
 - 1. Outlet of each water heater.
 - 2. Inlet of each water heater after recirculation connection.

3.8 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.9 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run.

3.10 ESCUTCHEON AND FLOOR PLATE INSTALLATION

- A. Install escutcheons for exposed piping penetrations of walls, ceilings, and floors of finished areas.
- B. Install escutcheons for piping penetrations of walls within concealed cabinet spaces.
- C. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
- D. Replace broken and damaged escutcheons using new materials.

3.11 FIRE-BARRIER PENETRATION PROTECTION

- A. Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.
- B. Provide intumescent collars, wraps, fire bands, sealants, and other firestopping materials as required to maintain the fire ratings for the piping and insulation materials used.

- C. Install Fire Stop Systems per the manufacturers' guidelines.

3.12 WATER METER INSTALLATION

- A. Install a ball valve on each side of the meter. Construct a steel angle frame or pour a concrete pad under meter to support weight. Paint support frame black.
- B. Where required by local authority: Install a bypass line with valve parallel to the meter.

3.13 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

- A. Pipe 2" and Smaller:
 - 1. Ball Valves: Two piece, full or regular port.
 - 2. Check Valve – Bronze Swing

3.14 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe 2" and Smaller:
 - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Ball Valves: Two piece, full or regular port, brass or bronze.
 - 3. Check Valve – Bronze Swing.
- B. Pipe 2-1/2" and Larger:
 - 1. Butterfly Valves.
 - 2. Check Valves: Bronze Swing.

3.15 GAUGE SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping Thermometer: 0 to 100°F.
- B. Scale Range for Domestic Hot-Water Piping Thermometer: 30 to 240°F.

3.16 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - a. Galvanized-steel sleeve.
 - 2. Interior Concrete Walls above Grade:
 - a. PVC sleeve.
 - b. Cast iron sleeve.
 - 3. Exterior Concrete Walls below Grade:
 - a. Galvanized-steel wall sleeves with sleeve-seal system.
 - b. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3.17 STEEL NAIL PLATE INSTALLATION

- A. Install nail plates to protect all vulnerable piping routed in concealed locations within 1-1/2" from the nearest edge of the member the piping is routed through.
- B. Fasten plates to the member per the manufacturer's instructions.

END OF SECTION

SECTION 22 05 20
GENERAL MOTOR REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Common motor requirements for Plumbing equipment.
 - a. General requirements for motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.
 - 2. Common requirements for variable frequency drives (VFD) for Plumbing equipment.
 - a. Section includes VFDs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.

1.2 VFD QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

1.3 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace VFDs that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Motor Characteristics:
 - 1. Duty: Continuous duty at ambient temperature of 105 °F and at altitude of 3500 feet above sea level.
 - 2. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.2 SINGLE PHASE MOTORS

- A. Description: Single phase motor, T-Frame, 1.25 service factor, minimum class B insulation for 105°F ambient.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. ABB Automation Company.
 - 2. Reliance.
 - 3. General Electric.
 - 4. Marathon.
 - 5. Century.

- C. Motors 1/20 HP and Smaller: Shaded-pole type.
- D. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- E. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- F. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- G. Minimum Efficiency: 75 percent.
- H. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.3 THREE-PHASE MOTORS

- A. Description: NEMA MG-1, T-frame, Design B, induction-type motor, minimum class F insulation for 105°F ambient.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. ABB Automation Company.
 - 2. General Electric.
 - 3. Marathon.
 - 4. WEG.
 - 5. TECO.
 - 6. NIDEC.
- C. Materials:
 - 1. Windings: Copper.
 - 2. Frame: Steel or cast iron.
 - 3. Rotor: Random-wound, squirrel cage.
 - 4. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading, L-10 life of 200,000 hours.
- D. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.
- E. Service Factor:
 - 1. 1 HP and Smaller: 1.25
 - 2. Above 1 HP: 1.15
- F. Full-load Electrical Efficiency: Based on motor size as indicated below, and shall comply with ASHRAE 90.1-2013, whichever is greater:
 - 1. 1 HP and Smaller: 81.5%
 - 2. Above 1 HP to 5 HP: 86.5%
 - 3. Above 5 HP: 91%
- G. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.

2.4 THREE-PHASE MOTORS USED WITH VFD

- A. Description: Additional requirements for three-phase motors used with variable frequency controllers (VFD).
- B. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- C. Motors Used with Variable Frequency Controllers:
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

2.5 ELECTRONICALLY COMMUTATED MOTORS

- A. Description: Brushless DC motor with built in speed and torque controls.
- B. Rotor: Permanent magnet.
- C. Circuitry: Programmable, manage commutation of stator to be always synchronous with rotor.
- D. Multispeed Motors: Minimum turndown of 80%.
- E. Efficiency: Minimum of 65%.
- F. Bearings: Permanently lubricated, heavy duty ball bearings.
- G. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install motors and accessories according to manufacturer's instructions.
- B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

END OF SECTION

**SECTION 22 07 00
PLUMBING INSULATION**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic water piping.
 - 2. Roof drains and rainwater leaders.
- B. The work covered by this Specification consists in furnishing all labor, equipment, accessories and materials and in performing all operations necessary for the installation of all insulation for the plumbing systems, in strict accordance with Section 220700 of this Specification and applicable Drawings and subject to the terms and conditions of the Contract.

1.2 REFERENCE

- A. Related work in Section 230700 "HVAC Insulation."

1.3 SUBMITTALS

- A. Shop Drawings: For materials covered under this section as per Section 220500.
- B. Operation and Maintenance Manual: Per section 220500.
 - 1. Product Data: Each type of insulation.

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- B. All insulation shall be installed in a workmanlike manner by skilled workmen regularly engaged in this type of work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Except in other Part 2 articles where noted, the following manufacturers are acceptable:
 - 1. Owens-Corning Fiberglass.
 - 2. Johns Manville.
 - 3. Knauf Insulation.
- B. All manufacturers are subject to compliance with requirements.
- C. Provide products by one of the manufacturers specified or by prior approval.

2.2 COMMON INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

2.3 INSULATION

- A. Fiberglass Wrap: Glass fibers bonded with a thermosetting resin; FSK or ASJ Max jacket. Comply with ASTM C 553, Type II and ASTM C 1290, Type I and Type III.

2.4 INSULATION JACKETS

- A. ASJ Max Jacket: Poly-encapsulated paper jacket; Factory applied shall comply with ASTM C1136, Type I, II, III, IV.
- B. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; Factory applied shall comply with ASTM C 1136, Type II.

2.5 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.6 SEALANTS

- A. Joint Sealants: Permanently flexible, elastomeric sealant, compatible with insulation materials, jackets, and substrates.

2.7 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

2.8 TAPES

- A. Tapes: Match jacket with compatible adhesive as recommended by jacket manufacturer.
- B. ASJ Max Tape: Foil-face, vapor-retarder tape; complying with ASTM C 1136, 3 inches wide.
- C. FSK Tape: Foil-face, vapor-retarder tape; complying with ASTM C 1136, 3 inches wide.

2.9 SECUREMENTS

- A. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - 1. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - 2. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - 3. Adhesive-backed base with a peel-off protective cover.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 12 gauge nickel-copper alloy or 14 gauge soft-annealed, stainless steel or 14 gauge soft-annealed, galvanized steel.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of pipes and fittings.
- C. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- D. Install insulation with jackets as follows:
 - 1. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip.
 - 2. Overlap jacket longitudinal seams at least 1-1/2 inches. Staple laps with outward clinching staples along edge.
 - 3. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
- E. Insulation Installation on Fittings, Valves, and Unions:
 - 1. Install with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate fittings and specialties using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive.
 - 3. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic and reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 - 4. Stencil or label the outside insulation jacket of each union with the word "union."
- F. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

- A. Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire-rated wall and partition penetrations.
 - 1. See Specification Section 220510 for further Fire-Barrier Penetration requirements.
- C. Floor Penetrations: Install insulation continuously through floor penetrations. Seal penetrations through fire-rated assemblies.
 - 1. See Specification Section 220510 for further Fire-Barrier Penetration requirements.

3.4 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.5 PIPING INSULATION SCHEDULE

- A. Indoor, Aboveground:
 - 1. Domestic Cold Water:
 - a. 1-1/4" diameter pipe and smaller: Fiberglass, 1" thick, R-4 minimum.
 - b. 1-1/2" diameter pipe and larger: Fiberglass, 1-1/2" thick, R-6 minimum.
 - 2. Domestic Hot and Recirculating Hot Water: 140°F and Below.
 - a. 1-1/4" diameter pipe and smaller: Fiberglass, 1" thick, R-4 minimum.
 - b. 1-1/2" diameter pipe and larger: Fiberglass, 1-1/2" thick, R-6 minimum.
 - 3. Domestic Hot and Recirculating Hot Water: 141°F to 200°F.
 - a. 1-1/4" diameter pipe and smaller: Fiberglass, 1-1/2" thick, R-6 minimum.
 - b. 1-1/2" diameter pipe and larger: Fiberglass, 2" thick, R-8 minimum.
 - 4. Rainleader: Fiberglass insulation, 1" thick, R-4 minimum.
 - a. Metal Piping: Completely insulated
 - b. Plastic Piping: 8' back from each roof drain.
 - c. Where noted on Drawings.
 - 5. Roof Drain Sumps: 1" premolded or job-fabricated fiberglass. Over insulation, apply 6 ounce canvas neatly pasted in place and apply two coats of sealant over the entire surface.
- B. Indoor, Aboveground, Return Air Plenums:
 - 1. PVC, PP: Combustible piping materials located in air plenums shall be completely insulated with approved materials for flame spread and smoke-development.

END OF SECTION

**SECTION 22 11 00
PLUMBING PIPING**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Pipe and fitting materials, and joining methods for the following:
 - a. Domestic water distribution piping.
 - b. Sanitary waste and vent.
 - c. Facility storm drainage.
 - d. Low pressure compressed air piping (150 psig or less).
 - 2. Sacrificial anode for fire riser.

1.2 REFERENCE

- A. Refer to Section 220510 "Common Work Results for Plumbing" for requirements of hangers, sleeves, sleeve seals, and escutcheons.

1.3 SUBMITTALS

- A. Shop Drawings: For equipment covered under this section as per Section 220500.
 - 1. Product Data: Provide a separate shop drawing for each of the following piping systems showing the material and fastening method chosen by the contractor:
 - a. Aboveground domestic water.
 - b. Aboveground sanitary waste and vent.
 - c. Underground sanitary waste and vent.
 - d. Aboveground facility storm drainage.
 - e. Underground facility storm drainage.
 - f. Low pressure compressed air.
- B. Operation and Maintenance Data: Equipment listed under Product Data article above as per Section 220500.

1.4 QUALITY ASSURANCE

- A. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."
- B. Non-potable water piping materials shall bear stamp or other markings of testing agency.

PART 2 - PRODUCTS

2.1 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B, black with ends threaded according to ASME B1.20.1.
- B. Steel Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized seamless steel pipe. Include ends matching joining method.
- C. Malleable-Iron Fittings: ASME B16.3, Class 150 or 300, threaded.
- D. Malleable-Iron Unions: ASME B16.39, Class 150 or 300, threaded.
- E. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel, threaded.
- F. Wrought-Steel Butt-Welding Fittings: ASME B16.9, Schedule 40.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K, annealed temper.
- C. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 - 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- D. Grooved-End Copper Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - a. Anvil International, Inc.
 - b. Victaulic Company.
 - 2. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting.
 - 3. Grooved-End-Tube Couplings: Rigid pattern, unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, EPDM gasket rated for minimum 230 °F for use with housing, and steel bolts and nuts.
- E. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- F. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- G. Copper Pressure-Seal-Joint Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - a. Apollo Valves.
 - b. NIBCO, Inc.
 - c. Viega, LLC.
 - 2. Fittings for 2" and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
 - 3. Fittings for 2-1/2" to 4": Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

2.3 MECHANICAL-JOINT, DUCTILE-IRON PIPE

- A. AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
- B. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
- C. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and stainless steel bolts.

2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
 - 1. Standards: ASTM C 1277 and CISPI 310.
 - 2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Heavy-Duty, Hubless-Piping Couplings:
 - 1. Standards: ASTM C 1277 and ASTM C 1540.

2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.5 PVC, AWWA PIPE

- A. AWWA C900, Class 150, with bell end with gasket, and with spigot end.
- B. Comply with UL 1285 for fire-service mains if indicated.
- C. PVC Fabricated Fittings: AWWA C900, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
- D. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
- E. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.6 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.
- C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

2.7 FIBERGLASS REINFORCED PLASTIC (FRP)

- A. Filament-Wound Pipe: ASTM D2996, rated at 225 psig at 210 °F for mild chemical and water services.
- B. Fittings: ASTM D5685; material same as piping.

2.8 HIGH DENSITY POLYETHYLENE (HDPE) POTABLE PIPING

- A. All pipe and heat-fused materials shall be manufactured from a virgin polyethylene extrusion compound material in accordance with ASTM D2513, sections 4.1 and 4.2. Pipe shall be manufactured to outside diameters, wall thickness, and respective tolerances as specified in ASTM D3035 or D2447.
- B. The material shall have a Hydrostatic Design Basis of 1600 psi at 73°F per ASTM D2837. The material shall be a high-density polyethylene compound having a minimum cell classification of PE345464C per ASTM D3350.
- C. Dimensions
 1. Smaller than 3" shall be manufactured in accordance with ASTM D3035 with a minimum dimension ratio of 11.
 2. 3" and larger shall be manufactured in accordance with ASTM F714 with a minimum dimension ratio of 17.
- D. Heat fused fittings in accordance with pipe manufacturer's procedures.
- E. Fusion transition fittings with reinforced threads shall be used to adapt to metal or reinforced hose connection fittings. Barbed fittings are not an acceptable transition to polyethylene pipe.

2.9 HIGH DENSITY POLYETHYLENE (HDPE) COMPRESSED AIR PIPING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. Air-Pro, ASAHI-AMERICA.
 - 2. AgruAir, Chemline Plastics.
- B. All pipe and heat-fused materials shall be manufactured from a virgin polyethylene extrusion compound material in accordance with ASTM D2513, sections 4.1 and 4.2. Pipe shall be manufactured to outside diameters, wall thickness, and respective tolerances as specified in ASTM D3035 or D2447.
- C. The material shall have a Hydrostatic Design Basis of 1600 psi at 73°F and 50-year continuous service life at 68°F per ASTM D2837. The material shall be a high-density polyethylene compound having a minimum cell classification of PE346544C per ASTM D3350 and have a grade of PE100 with temperature range of -22°F to 140°F.
- D. Dimensions and Ratings:
 - 1. Up to 4" pipe and fittings shall be manufactured in accordance with ISO 1549 with a minimum dimension ratio of 7 for pressures up to 230psig (PN16).
 - 2. 6" and larger pipe and fittings shall be manufactured in accordance with ASTM F714 with a minimum dimension ratio of 11 for pressures up to 150psig (PN10).
- E. Heat fused fittings in accordance with pipe manufacturer's procedures.
- F. Fusion transition fittings with reinforced threads shall be used to adapt to metal or reinforced hose connection fittings. Barbed fittings are not an acceptable transition to polyethylene pipe.

2.10 PIPING JOINING MATERIALS

- A. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.
- B. Joining system for FRP as recommended by manufacturer.

2.11 TRANSITION FITTINGS

- A. Plastic-to-Metal Transition Fittings shall be CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions, and one end with threaded brass or stainless steel insert and one solvent-cement-socket end.
- B. Plastic-to-Metal Transition Unions shall be CPVC four-part union with brass threaded end, solvent-cement-joint plastic end, rubber O-ring gasket, and union nut.

2.12 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 - 1. Standard: ASSE 1079.
 - 2. Pressure Rating: 125 psig minimum at 180 °F.
 - 3. End Connections: Solder-joint copper alloy and threaded ferrous.

2.13 FLEXIBLE PIPE CONNECTORS

- A. Bronze-Hose Flexible Pipe Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - 1. Working-Pressure Rating: 200 psig minimum.
 - 2. End Connections: Threaded or plain-end copper, or flanged copper alloy to match equipment connected.
- B. Stainless-Steel-Hose Flexible Pipe Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: 200 psig minimum.
 - 2. End Connections: Threaded or flanged to match equipment connected.

2.14 SACRIFICIAL ANODE

- A. Description: Magnesium sacrificial anode for fire riser.
 - 1. Standard: Fabricated per ASTM B843 for AZ63B(H-1A) standard potential anodes.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or prior approved:
 - 1. Farwest Corrosion Control Company.
- C. Basis of Design: ProMag H-1 Standard Potential, Model 17D3.
- D. Length: 25" long.
- E. Accessories:
 - 1. 10 foot of #12 THHN insulated solid core copper lead wire.
 - 2. Anode shall be pre-packaged in cloth bag containing 75% hydrated gypsum, 20% bentonite and 5% silicon Sulfate backfill material to maintain moisture around the anode to reduce earth resistance.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in Division 31 for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping.
- B. In general, it is intended that piping be installed parallel to building lines, unless otherwise shown on the Drawings, and that equipment be located symmetrical with the architectural elements of the building.
- C. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal. Exposed piping shall be run as high as possible except where noted otherwise.
- D. Piping shall be fabricated from Contractor's Shop Drawings or field measurements and not from Contract Drawings.
- E. Extend plumbing piping to 5 feet from outside face of building wall for connection to building services, including water, fire, waste, and storm piping.
- F. This Contractor shall verify all inverts of existing mains and elevations with reference to existing and finish grades. Minimum depth of bury for water lines is 8'0".

- G. On water-supply and fire-service lines 4" and larger, install poured concrete thrust blocks at tees, elbows and at base elbow on domestic and fire water service risers in building. Blocks shall be poured against undisturbed earth of trench wall.
- H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- I. Install waste piping 3" and smaller at 1/4" slope, and 4" and larger at 1/8" slope. Vent and storm piping shall be 1/8" slope, unless otherwise noted.
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Section 221300 "Sanitary Waste Piping Specialties."
- L. Install piping to permit valve servicing.
- M. Install piping free of sags and bends.
- N. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- P. Install sleeves for piping penetrations of walls, ceilings, and floors.
- Q. Install sleeve seals for piping penetrations of below grade concrete walls and slabs.
- R. Install escutcheons (chrome plates) for exposed piping penetrations of finished walls, ceilings, and floors.

3.3 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Aboveground Domestic Water Piping **2"** and Smaller: Plastic-to-metal transition fittings.

3.4 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for 2" and Smaller: Use dielectric unions.

3.5 FIRE SERVICE INSTALLATION

- A. Flange on fire sprinkler line shall be installed level with bolt pattern on flange set so valve stems connected to line can be installed parallel or perpendicular to wall.
- B. Fire sprinkler line flanges shall be secured to floor/wall with threaded rod that has been securely fastened to concrete floor or wall.
- C. Cad weld magnesium sacrificial anode to the ductile iron fire riser per detail noted on the drawings.
- D. Install anti-seize compound to ease installation of fittings.

- E. Install retainer glands on elbow at riser.
 - 1. Retainer glands and restraint rings shall be Ebaa 'Megalug' type with wedge style design.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 50 feet long.
 - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 50 feet or longer.
 - 3. Install trapeze hanger for multiple parallel piping 50 feet or longer.
 - 4. Spring hangers to support vertical runs.
 - 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
 - 6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- B. Install hangers for steel piping as follows:
 - 1. 1" and smaller: 8 feet with 3/8-inch rod.
 - 2. 1-1/4" to 3": 10 feet with 3/8-inch rod.
 - 3. 4" to 6": 12 feet with 1/2-inch rod.
 - 4. 8" and larger: 12 feet with 5/8-inch rod.
- C. Install hangers for drawn-temper copper piping as follows:
 - 1. 1-1/2" and smaller: 6 feet with 3/8-inch rod.
 - 2. 2" to 4": 10 feet with 3/8-inch rod.
 - 3. 6" and larger: 10 feet with 1/2-inch rod.
- D. Install hangers for CPVC, PVC, and PP as follows:
 - 1. 1" and smaller: 3 feet with 3/8-inch rod; 8 feet with pipe support channel and 3/8" rod.
 - 2. 1-1/4" to 3": 4 feet with 3/8-inch rod; 8 feet with pipe support channel and 3/8" rod.
 - 3. 4" to 6": 4 feet with 1/2-inch rod; 10 feet with pipe support channel and 1/2" rod.
 - 4. 8" and larger: 4 feet with 5/8-inch rod; 10 feet with pipe support channel and 5/8" rod.
- E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.
- F. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

3.7 FIELD QUALITY CONTROL, ADJUSTING, CLEANING

- A. Comply with requirements in Section 220500 "Plumbing General Provisions".

3.8 PIPING SCHEDULE

- A. Do not use flanges or unions for underground piping.
- B. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- C. Piping materials are identified below. If more than one material is listed for an application, selection from materials listed is Contractor's option.
- D. Underground water-service piping 4" and 6":
 - 1. Soft copper tube, Type K, Type L; wrought-copper, solder-joint fittings; and brazed joints.
 - 2. Ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.

3. PVC, AWWA Class 150 pipe; PVC, AWWA Class 150 molded fittings; and gasketed joints.
- E. Aboveground water-service piping 4" and 6":
1. Hard copper tube, Type K, Type L; wrought-copper, solder-joint fittings; and brazed joints.
 2. Ductile-iron, grooved-end pipe; ductile-iron, grooved-end appurtenances; and grooved joints.
- F. Under-building-slab, domestic water, building-service piping:
1. 3" and smaller:
 - a. HDPE; heat fused fittings in accordance with pipe manufacturer's procedures.
 - b. Soft copper tube, Type K, Type L; wrought-copper, solder-joint fittings; and brazed joints.
 2. 3" and larger: Bell and spigot, ductile-iron pipe.
- G. Under-building-slab, domestic water piping:
1. 1" and smaller: PEX and PE-RT tube, no joints; Soft copper tube, Type K, Type L, no joints; PP Potable Piping, heat-fused fittings; PE-RT tube, no joints or heat-fused fittings.
 2. 3" and smaller: HDPE, heat fused fittings; PP Potable Piping, heat-fused fittings.
- H. Aboveground domestic water piping:
1. All sizes: Hard copper tube, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
 2. 2-1/2" and larger: Hard copper tube, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.
 3. 4" and smaller: Hard copper tube, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
- I. Underground Fire-Service-Main Piping 4" to 8":
1. Ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.
 2. Beyond 5 feet from outside face of building wall: PVC, AWWA Class 200 pipe listed for fire-protection service; PVC Class 200 fabricated fittings; and gasketed joints.
- J. Aboveground Fire-Service-Main Piping 4" to 8": Ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.
- K. Change of direction fittings for vent, soil, and waste pipe:
1. Soil and waste piping: Long-sweep bends.
 2. Vertical stacks change of direction from horizontal to vertical: Sanitary tees and short-sweep 1/4 bends acceptable.
 3. Back to back or side by side fixtures with common drain pipe: Long turn, double Y-branch and 1/8-bend fittings.
- L. Aboveground, vent, soil, and waste piping:
1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
 2. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - a. Exception: PVC shall not be used for 20 feet from waste receptacle where waste stream is 140°F or greater, such as from commercial dishwashers.

- b. Note: Combustible piping materials located in air plenums shall be completely insulated with approved materials to prevent flame spread and smoke-development.
- 4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- 5. Additional option for piping 4" and smaller: Copper DWV tube, copper drainage fittings, and soldered joints.
- M. Underground, vent, soil, and waste piping:
 - 1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
 - 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - a. Exception: PVC shall not be used for 20 feet from waste receptacle where waste stream may exceed 140 °F, such as from commercial dishwashers.
 - 3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- N. Underground, waste piping from oil interceptor to oil storage tank:
 - 1. Fiberglass reinforced plastic (FRP) and fittings.
- O. Aboveground storm drainage piping:
 - 1. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.
 - 2. Copper DWV tube, copper drainage fittings, and soldered joints.
 - 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - a. Note: Combustible piping materials located in air plenums shall be completely insulated with approved materials to prevent flame spread and smoke-development.
 - 4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- P. Underground storm drainage piping:
 - 1. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and coupled joints.
 - 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- Q. Low-pressure compressed-air distribution piping:
 - 1. 2" and smaller: Steel pipe; threaded, malleable-iron fittings; and threaded joints.
 - 2. 2" and smaller: Type K or L, copper tube; wrought-copper fittings; and brazed or soldered joints.
 - 3. All sizes: HDPE, heat fused fittings.

END OF SECTION

**SECTION 22 12 00
PLUMBING SPECIALTIES**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Vacuum breakers.
 - 2. Water tempering valves.
 - 3. Tempering Valve – Emergency
 - 4. Hose bibbs.
 - 5. Drain valves.
 - 6. Water-hammer arresters.
 - 7. Potable Water Expansion Tanks.
 - 8. Compressed air specialties
 - a. Fittings
 - b. Pressure regulators.
 - c. Lubricators.

1.2 SUBMITTALS

- A. Shop Drawings: For equipment covered under this section as per Section 220500.
- B. Operation and Maintenance Manuals: For equipment covered under this section as per Section 220500.

1.3 QUALITY ASSURANCE

- A. Comply with NSF 61, "Drinking Water System Components - Health Effects," for potable-water storage tanks. Include appropriate NSF marking.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig minimum unless otherwise indicated.
- B. For products where a list of pre-approved manufacturers is not provided, the submitted product must be equivalent to the indicated basis of design.

2.2 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
 - 1. Basis of Design: Watts Regulator Co. LF288A.
 - 2. Standard: ASSE 1001.
 - 3. Size: 1/4" to 3", as required to match connected piping.
 - 4. Body: Bronze.
 - 5. Finish: Rough bronze.
- B. Hose-Connection Vacuum Breakers:
 - 1. Basis of Design: Watts Regulator Co. NF8
 - 2. Standard: ASSE 1011.
 - 3. Body: Bronze, nonremovable, with manual drain.
 - 4. Outlet Connection: Garden-hose threaded.
 - 5. Finish: Chrome or nickel plated.

2.3 WATER TEMPERING VALVES

- A. Description: Water-temperature limiting devices for public lavatories:
 - 1. Basis of Design: Watts Regulator Co. LFUSG-B, LFMMV.
 - 2. Standard: ASSE 1070.
 - 3. Type: Thermostatically controlled, water mixing valve.
 - 4. Material: Bronze body with corrosion-resistant interior components.
 - 5. Wetted surface shall be less than 0.25% of lead by weight.
 - 6. Cross Flow Protection: Integral check valves and integral screens.
 - 7. Minimum Flow: 0.5 gpm.
 - 8. Tempered-Water Setting: 120°F.

2.4 TEMPERING VALVE - EMERGENCY

- A. Description: Emergency shower/eyewash thermostatic mixing valve.
- B. Manufactures: subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. Acorn Engineering Company.
 - 2. Armstrong International, Inc.
 - 3. Lawler Manufacturing Co., Inc.
 - 4. Leonard Valve Company.
 - 5. Powers; Watts Water Technologies, Inc.
 - 6. Symmons.
- C. Basis of Design: Lawler 911E
 - 1. Standard: ANSI Z358.1, ASSE 1071.
- D. Valve:
 - 1. Material: Corrosion resistant metal, rough bronze finish.
 - 2. Operation: Thermostatic.
 - 3. Failure:
 - a. In case of unit failure to continue cold-water flow.
 - b. In the event of cold water interruption, the control mechanism shall shut off the hot water port.
 - c. In the event of hot water interruption, the control mechanism shall allow cold water flow through both the fixed and variable cold water bypass.
 - d. In the event the liquid motor fails, the control mechanism shall close off hot water and fully open the variable cold water bypass to allow for cold water flow.
 - 4. Outlet Temperature Control: Adjustable between 70 – 90°F.
 - 5. 911 output: 25 to 60 gpm at 30 PSI; 85°F water, plus or minus 5°F.
 - 6. 911E output: 9 to 25 gpm at 30 PSI; 85°F water, plus or minus 5°F.
 - 7. 911 E/F output: 2 to 7 gpm at 30 PSI; 85°F water, plus or minus 5°F.
 - 8. Temperature Adjustment: Vandal Resistant.
- E. Temperature Gauges: Dial type, provided and installed by manufacturer.
 - 1. 911: On each inlet and outlet.
 - 2. 911 E: On outlet.
 - 3. 911 E/F: On outlet.
- F. Accessories:
 - 1. Factory fabricated cabinet, stainless steel, for surface mounting and with lockable hinged door.
 - 2. Include check valves on both hot and cold-water inlets, provided, installed and tested by manufacturer.

3. Include lockable ball valves on both hot and cold-water inlets, provided, installed and tested by manufacturer.

2.5 HOSE BIBBS

A. Hose Bibbs:

1. Basis of Design: Watts Regulator Co. SC8.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Outlet Connection: Garden-hose thread.
5. Vacuum Breaker: Nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
6. Equipment Rooms: Rough bronze finish, wheel handle operation.
7. Finish for Service Areas: Rough bronze finish, wheel handle operation.
8. Finish for Finished Rooms: Chrome or nickel plated finish, wheel handle operation.
9. Include operating key with each operating-key hose bibb.
10. Include integral wall flange with each chrome- or nickel-plated hose bibb.
11. Include backflow preventer for hose bibbs connected to chemical dispensers.

2.6 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Equivalent to Watts Regulator Co. Series BD-QT.
2. Pressure Rating: 150-psig minimum CWP.
3. Size: 3/4".
4. Body: Forged Brass.
5. Ball: Chrome-plated brass.
6. Stem Packing: Teflon.
7. Handle: Aluminum or Vinyl-covered steel.
8. Outlet: Threaded, short nipple with garden-hose thread and cap with brass chain.

2.7 WATER-HAMMER ARRESTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:

1. AMTROL, Inc.
2. Josam Company.
3. Sioux Chief Manufacturing Company, Inc.
4. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
5. Tyler Pipe; Wade Div.
6. Watts Drainage Products.
7. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.

B. Water-Hammer Arresters: Comply with ASSE 1010 or PDI-WH 201.

1. Type: Copper tube with piston.
2. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.8 POTABLE WATER EXPANSION TANKS

A. Description: Steel, bladder-type, pressure-rated tank with cylindrical sidewalls.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:

1. Amtrol, Inc.
2. Taco

3. Armstrong Pumps, Inc.
 4. Bell & Gossett Domestic Pump; a division of ITT Industries.
 5. Wilkins
 6. Watts
 7. American Wheatley
- C. Welded steel, rated for 125-psig working pressure and 375°F maximum operating temperature, with taps in bottom of tank. Tanks shall be factory tested.
 - D. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig working pressure and 240 °F maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.

2.9 QUICK COUPLINGS

- A. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.
 1. Coordinate with owner for style of coupling.
- B. Valveless Quick Couplings: Straight-through brass body with stainless-steel or nickel-plated-steel operating parts.
 1. Socket End: With O-ring or gasket seal, without valve, and with barbed inlet for attaching hose.
 2. Plug End: With barbed outlet for attaching hose.

2.10 HOSE ASSEMBLIES

- A. Description: Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for 300-psig minimum working pressure, unless otherwise indicated.
 1. Hose: Reinforced single- or double-wire-braid hose for compressed-air service.
 2. Hose Clamps: Stainless-steel clamps or bands.
 3. Hose Couplings: Two-piece, straight-through, threaded brass or stainless-steel O-ring or gasket-seal swivel coupling with barbed ends for connecting two sections of hose.
 4. Hose Splicers: One-piece, straight-through brass or stainless-steel fitting with barbed ends for connecting two sections of hose.

2.11 COMPRESSED AIR SPECIALTIES

- A. Air-Line Pressure Regulator: Diaphragm or piston operated, bronze or zinc body, non-rising adjustment knob, spring-loaded manual pressure-setting adjustment, push to lock, 0-125 psi adjustment range, and rated for 200-psig minimum inlet pressure, unless otherwise indicated.
- B. General Purpose Air Line Filter/Regulator: Diaphragm or piston operated, bronze or zinc body, non-rising adjustment knob, spring-loaded manual pressure-setting adjustment, push to lock, 0-125 psi adjustment range, and rated for 200-psig minimum inlet pressure, unless otherwise indicated; bronze or zinc bowl with automatic pulse drain, filter rated for 5 microns, integral pressure gauge, and rated for 150 psi.
- C. Air Pressure Gauge: 0-160 range, 2-1/2" round steel case with enamel coating, white background, black lettering and indicator, mechanical operation, psi markings, acrylic or glass window, copper alloy tube and socket.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install water temperature-limiting devices on all public lavatories.

- B. Install water temperature-limiting devices on all sinks.
- C. Install water hammer arresters in piping branches with fast-closing valves, such as flush valves. Locate upstream of last fixture in pipe branch.
- D. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- E. Install piping adjacent to potable-water storage tanks to allow service and maintenance.
- F. Connect water piping to water heaters and storage tanks with unions or flanges and with shutoff valves. Connect tank drains with shutoff valves and discharge over closest floor drains.
- G. Drain Valves: 3/4" ball valve. Include outlet with, or nipple in outlet with, ASME B1.20.7, 3/4-11.5NH thread for garden-hose service, threaded cap, and chain.
- H. If any device, fixture, or panel is required to be wall mounted by this contractor, provide AC Plywood, 3/4" or 5/8" thickness, painted both sides with fireproof paint, color to be determined and coordinated with owner. Paint is required even if installed on a non-fire rated wall.

3.2 EMERGENCY AND MASTER MIXING VALVE INSTALLATION

- A. Install check valves on inlets and outlets of tempering valves.
- B. See Specification Section 224000 Emergency Plumbing Fixture Installation for other emergency mixing valve installation requirements.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
- B. Test each pressure vacuum breaker, backflow preventer according to authorities having jurisdiction and the device's reference standard.

3.4 CLEANING

- A. Clean and disinfect potable-water storage tanks.
- B. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed, use procedure described in section 220500 "Plumbing General Provisions."

3.5 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

SECTION 22 13 00
SANITARY WASTE SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:
 - 1. Cleanouts.
 - 2. Floor drains.
 - 3. Floor sinks.
 - 4. Sand/oil interceptors.
 - 5. Solids interceptors.
 - 6. Trench drains.
 - 7. Sewage ejectors.

1.2 SUBMITTALS

- A. Shop Drawings: For equipment covered under this section as per Section 220500.
- B. Operation and Maintenance Data: For equipment covered in this section as per Section 220500.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Except in other Part 2 articles where noted, the following manufacturers are acceptable
 - 1. Josam Company; Josam Div.
 - 2. MIFAB, Inc.
 - 3. Sioux Chief Manufacturing Company, Inc.
 - 4. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - 5. Tyler Pipe; Wade Div.
 - 6. Watts Drainage Products Inc.
 - 7. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. All manufacturers are subject to compliance with requirements
- C. Provide products by one of the manufacturers specified or by prior approval.

2.2 CLEANOUTS

- A. Standard: ASME A112.36.2M.
- B. Cleanouts – Exposed:
 - 1. Body Material: As required to match connected piping.
 - 2. Size: Same as connected drain line as indicated on drawings.
 - 3. Closure: Countersunk or raised-head threaded plug.
 - 4. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- C. Cleanout –Floor:
 - 1. Basis of Design: Wade 6000 Series.
 - 2. Cover – Finished Floor: Nickel bronze; scoriated; "C.O." cast into cover.
 - 3. Cover – Unfinished Floor: Cast iron; "C.O." cast into cover.
 - 4. Cover – Carpeted Floor: Same as finished floor cover with carpet clamping flange.
 - 5. Cover Shape: Round, except where noted otherwise on drawings.
 - 6. Type: Adjustable housing.

7. Size: Same as connected drain line as indicated on drawings.
8. Closure: Brass plug.
9. Body or Ferrule: Cast iron in areas subjected to wheel traffic; Plastic permitted light duty areas.
10. Top Loading Classification: Heavy duty in areas subjected to wheel traffic; Light duty otherwise.
11. Riser: Long radius bends.

D. Cleanouts – Wall:

1. Body: Soil pipe test tee, material as required to match connected piping.
2. Size: Same as connected drain line as indicated on drawings.
3. Closure: Raised-head, threaded plug.
4. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
5. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

2.3 FLOOR DRAINS

A. Floor Drains:

1. Basis of Design: Watts FD-100
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain. Provide funnels where shown on drawings.
4. Body: Cast iron; provide seepage flange and clamping device.
5. Size: Same as connected drain line as indicated on drawings.
6. Strainer: Nickel bronze; adjustable; round, except as otherwise indicated on drawings.
7. Raised Flange: Provide for drains in mechanical rooms.
8. Loading Classification: Heavy duty in areas subjected to wheel traffic; Light duty otherwise.
9. Trap Features: Cleanout and trap-seal primer valve drain connection where shown on drawings.

B. General Requirements for Above Grade Drain Bodies:

1. Flashing Materials: Required.
2. Exception: Shower drains where flashing materials are furnished and installed by the General Contractor.
3. Dimensions: Minimum of 8" wider in all directions from drain body.

2.4 FLOOR SINK

A. Cast-iron Floor Sink:

1. Basis of Design: Watts FS-740.
2. Body Material: Cast iron with white acid resisting porcelain enamel interior lining.
3. Receptor Size: 12" square, 8" deep.
4. Top or Strainer Material: Nickel bronze.
5. Top or Strainer: Square, anti-tilting, loose set; Slotted pattern, full grate except as otherwise noted on drawings; Light duty loading.
6. Bottom Strainer: Aluminum; dome shaped.
7. Pipe Size: As indicated on drawings.

B. Kettle Drain Floor Sink:

1. Basis of Design: Zurn Z1762.
2. Body Material: Stainless steel.
3. Receptor Size: 24"x12" top, 8" deep.
4. Top or Strainer Material: Stainless steel.

5. Top or Strainer: Square, anti-tilting, loose set; Slotted pattern, full grate except as otherwise noted on drawings; Light duty loading.
6. Bottom Strainer: Solids retaining baffle.
7. Pipe Size: As indicated on drawings.

2.5 SAND/OIL INTERCEPTORS - POLYMER

- A. Description: Polyethylene or fiberglass reinforced plastic oil and solids separator furnished for above or below grade installation with field adjustable riser system. Cover shall provide water/gas-tight seal and have a maximum load capacity appropriate for the install location.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 1. Striem: OS Series.
 2. Zurn: Proceptor.
- C. Standard Features:
 1. Risers: field adjusted for piping inverts.
 2. Inlet and outlet diffusers: removable.
- D. Accessories:
 1. Oil level monitoring system.
 - a. NEMA 4X weatherproof enclosure.
 - b. 120v power connection.
 - c. Audible-visual indicator.
 - d. Dry contact for BAS hookup.
 2. Removable coalescing media.
 3. Cover Capacity: H2O bolted composite cover.
 4. High water anchor kit.

2.6 SOLIDS INTERCEPTOR

- A. Description: Fixture trap type solids interceptor for on-floor installation.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 1. Jay R Smith: Model 8710.
- C. Body: Cast iron, steel, or cast aluminum with corrosion resistant coating; or PVC.
- D. Access Cover: Top or side, gasketed.
- E. Basket: Stainless steel, or perforated polycarbonate; Removable.

2.7 TRENCH DRAINS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 1. Manufacturers listed in paragraph 2.1.
 2. Dura Trench; Eric'sons.
 3. Sioux Chief Manufacturing Company, Inc.
- B. Trench Drains – Shop:
 1. Body Material: Cast iron or HDPE.
 2. Flange: Anchor with weep holes.
 3. Grate Material: Ductile iron or gray iron, epoxy or powder coated.
 4. Top-Loading Classification: Heavy duty.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to 4". Use 4" CO for drainage piping up to 6" in size. Use 6" CO in larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each aggregate change in direction of piping greater than 135 degrees.
 - 3. Locate at minimum intervals of 75.
 - 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Set grates of floor drains flush with finished floor, unless otherwise indicated.
 - 1. Size same as drainage piping.
 - 2. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
- E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

3.2 GENERAL INTERCEPTOR INSTALLATION

- A. Sand/Oil Interceptor shall be furnished by this Contractor and turned over to the General Contractor for installation. This Contractor shall provide all piping and accessories.
- B. It is this Contractor's responsibility to field verify all piping inverts into and out of the interceptors to provide the correct extension/riser lengths to maintain the scheduled minimum solid and liquid capacities. Extension/riser lengths shall not result in reduced interceptor capacity.
- C. Unless otherwise noted, install cleanouts at the inlets and outlets of all interceptors.
- D. Install all interceptors with clear space for servicing.

3.3 TRENCH DRAIN INSTALLATION

- A. Trench drains shall be furnished by this Contractor and turned over to the General Contractor for installation. This Contractor shall provide all piping.

3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

END OF SECTION

SECTION 22 14 00
STORM DRAINAGE SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Roof Drains
 - 2. Downspouts

1.2 REFERENCE

- A. Refer to 221300 "Sanitary Waste Specialties" for Cleanouts.

1.3 SUBMITTALS

- A. Shop Drawings: For equipment covered under this section as per Section 220500.
- B. Operation and Maintenance Data: For equipment covered in this section as per Section 220500.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Except in other Part 2 articles where noted, the following manufacturers are acceptable:
 - 1. Josam Company; Josam Div.
 - 2. MIFAB, Inc.
 - 3. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - 4. Tyler Pipe; Wade Div.
 - 5. Watts Drainage Products Inc.
 - 6. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 7. Sioux Chief Manufacturing Company, Inc.
- B. All manufacturers are subject to compliance with requirements.
- C. Provide products by one of the manufacturers specified or by prior approval.

2.2 ROOF DRAINS

- A. General-Purpose Roof Drains, Domed:
 - 1. Standard: ASME A112.6.4, for general-purpose roof drains.
 - 2. Body Material: Epoxy coated cast iron.
 - 3. Dimension of Large-Sump Body: Nominal 20-inch diameter.
 - 4. Dimension of Standard-Sump Body: Nominal 12-inch diameter.
 - 5. Dimension of Small-Sump Body: Nominal 8-inch diameter.
 - 6. Roof Sump Receiver: Required.
 - 7. Outlet: Bottom.
 - 8. Adjustable Collars: Required.
 - 9. Underdeck Clamp: Required.
 - 10. Dome Material: Aluminum or Cast iron.
 - 11. Perforated Gravel Guard: Not required.
 - 12. Vandal-Proof Dome: Not required.
 - 13. Water Dam: 2 inches high on overflow roof drains only (RD-2).

2.3 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Downspout Nozzles:

1. Basis of Design: Zurn model Z199.
2. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
3. Size: Same as connected conductor.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
 - 1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
 - 2. Install expansion joints, if indicated, in roof drain outlets.
 - 3. Position roof drains for easy access and maintenance.
- B. Install downspout adapters on outlet of back-outlet parapet roof drains and connect to sheet metal downspouts.
- C. Install downspout nozzles to discharge at 12" above grade.

3.2 ROOF DRAIN SCHEDULE

- A. Domed Roof Drains: Limited access roofs.
 - 1. Small-Sump Body: 4" conductor size and smaller.
 - 2. Standard-Sump Body: 8" conductor size and smaller.
 - 3. Large-Sump Body: 10" up to 16" conductor size.

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. lead sheets, 0.0938-inch thickness or thicker. Solder joints of 4.0-lb/sq. ft. lead sheets, 0.0625-inch thickness or thinner.
 - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches and with skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

END OF SECTION

**SECTION 22 30 00
PLUMBING EQUIPMENT**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Water heaters.
 - 2. Domestic hot water circulation pumps (Recirculation pumps).
 - 3. Sump pumps.

1.2 SUBMITTALS

- A. Shop Drawings: For equipment covered under this section as per Section 220500.
 - 1. Water Softeners Requirements:
 - a. Include wiring diagrams, rated capacities, operating characteristics, electrical characteristics, furnished specialties and accessories, plans, elevations, sections, details and connections to piping systems
- B. Operation and Maintenance Data: For equipment covered in this section as per Section 220500.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended use.
- B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.4 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified period.
 - 1. Warranty Period: Not less than one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 WATER HEATERS, STORAGE TYPE

- A. Description: Commercial, closed combustion, minimum 95% efficient, condensing, storage water heater.
 - 1. Standard: ANSI Z21.10.3/CSA 4.3.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. Bradford White Corporation.
 - 2. Hubbell Heaters.
 - 3. Rheem Manufacturing Company.
 - 4. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
 - 5. State Water Heaters
 - 6. Lochinvar
- C. Storage-Tank Construction: Steel with 150-psig working-pressure rating.
 - 1. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing. Threaded ends according to ASME B1.20.1.

2. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
- D. Factory-Installed Storage-Tank Appurtenances:
1. Anode Rod: Replaceable magnesium.
 2. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 3. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 4. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 5. Jacket: Steel with enameled finish or high impact plastic.
 6. Heat Exchanger: Spiral type, cupronickel.
 7. Burner: UL 795 for power-burner, gas-fired, water heaters and natural gas fuel.
 8. Automatic Ignition: Electric, automatic, gas-ignition system.
 9. Temperature Control: Adjustable thermostat.
 10. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 11. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
- E. Venting: PVC.

2.2 WATER HEATER ACCESSORIES

- A. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater and include drain outlet not less than 3/4" with pipe threads or with garden-hose threads.
- B. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1
- C. Gas Shutoff Valves: Refer to Section 220510 "Common Work Results for Plumbing". Furnish for installation in piping.

2.3 CIRCULATOR PUMPS, WET ROTOR

- A. Description: Factory-assembled and -tested, wet rotor, seal less, self-lubricating, cartridge pump designed for installation with pump mounted horizontally or vertically.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
1. Armstrong Pumps Inc
 2. Bell & Gossett; Div. of ITT Industries
 3. Grundfos Pumps Corp.
 4. Taco Comfort Solutions.
 5. Thrush Company Inc.
 6. Wilo USA LLC
- C. Pump Construction:
1. Casing: Bronze with NPT, union, or flanged connections.
 2. Impeller: Non-metallic.
 3. Pump Shaft: Ceramic.
 4. Pump Bearings: Carbon.
- D. Motor: Single or multi-speed stainless steel replaceable cartridge design.

E. Accessories:

1. Thermostats: Electric; adjustable for control of hot-water circulation pump.
 - a. Type: Water temperature sensor, minimum 65 to 200°F range.
 - b. Operation of Pump: On or off.
 - c. Settings: Start pump at 110 °F and stop pump at 120 °F.
2. Electrical: 120/1/60; Pre-wired power cord, 6' in length, provide transformer if required.

2.4 SUBMERSIBLE SUMP PUMPS

- A. Description: Submersible, fixed-position, single-seal sump pumps; factory-assembled and -tested sump-pump unit.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 1. Bell & Gossett Domestic Pump; ITT Corporation.
 2. Goulds Pumps; ITT Corporation.
 3. Grundfos Pumps Corp.
 4. Pentair Pump Group; Hydromatic Pumps.
 5. Little Giant Pump Co.
 6. Weil Pump Company, Inc.
 7. Zoeller Company.
- C. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump.
- D. Pump Construction:
 1. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
 2. Impeller: Statically and dynamically balanced, cast iron or bronze design for clear wastewater handling, and keyed and secured to shaft.
 3. Pump and Motor Shaft: Stainless steel or steel, with factory-sealed, grease-lubricated ball bearings.
 4. Seal: Mechanical.
- E. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
- F. Controls:
 1. Enclosure: NEMA 250, Type 1.
 2. Switch Type: Mechanical float type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
 3. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load.
 4. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, or mercury-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
- G. Control-Interface Features:
 1. Remote Alarm Contacts: For remote alarm interface.

2.5 SUMP-PUMP BASINS AND BASIN COVERS

- A. Basins: Factory-fabricated, watertight, cylindrical, basin sump with top flange and sidewall openings for pipe connections.
 - 1. Material: Polyethylene or fiberglass.
 - a. Polyethylene Wall Thickness: Basin size 24" or less: 0.20"; Basin size 36" or less: 0.230".
 - b. Fiberglass Wall Thickness: Basin size 36" or less: 0.188"; Basin size 48": 0.250".
 - 2. Sump Depth: Field measured to match application invert with an additional 24" minimum for storage.
 - 3. Anchor Flange: Same material as or compatible with basin sump, cast in or attached to sump, in location and of size required to anchor basin in concrete slab.
- B. Basin Covers: Fabricate metal cover with openings having gaskets, seals, and bushings; for access to pumps, pump shafts, control rods, discharge piping, vent connections, and power cables.
 - 1. Reinforcement: Steel or cast iron, capable of supporting foot traffic.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- A. If any device, fixture, or panel is required to be wall mounted by this contractor, provide AC Plywood, 3/4" or 5/8" thickness, painted both sides with fireproof paint, color to be determined and coordinated with owner. Paint is required even if installed on a non-fire rated wall.

3.2 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base.
 - 1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
- B. Residential, Water Heater Mounting: Install residential, water heaters on floor, or on water-heater stand on floor if required to be elevated 18".
- C. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances.
 - 1. Install shutoff valves on water-supply piping to water heaters and on hot-water outlet piping.
- D. Install gas-fired, domestic-water heaters according to NFPA 54.
 - 1. Install gas shutoff valves on gas supply piping to gas-fired water heaters.
- E. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- F. Install condensate drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- G. Install combination temperature-and-pressure relief valves in water piping for water heaters without storage. Extend water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

- H. Install thermometers on outlet piping of commercial water heaters.
- I. Install pressure-reducing valve with integral bypass relief valve in electric, domestic-water booster-heater inlet piping and water hammer arrester in booster-heater outlet piping. Set pressure-reducing valve for outlet pressure of 25 psig.
- J. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

3.3 INSTALLATION OF HOT WATER RECIRCULATION PUMPS

- A. Install thermostats in hot-water return piping.
- B. Adjust domestic water pumps to function smoothly and lubricate as recommended by manufacturer.
- C. Adjust initial temperature set points.

3.4 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221100 "Plumbing Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of water heaters.
- C. Install piping adjacent to potable-water storage tanks to allow service and maintenance.
- D. Connect water piping to water storage tanks with unions or flanges and with shutoff valves. Connect tank drains with shutoff valves and discharge over closest floor drains.
 - 1. Isolation valves: Ball.
 - 2. Drain Valves: 3/4" ball valve. Include outlet with, or nipple in outlet with threads for garden-hose service, threaded cap, and chain.

3.5 CLEANING

- A. Clean and disinfect potable-water storage tanks.
- B. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed, use procedure described in section 220500 "Plumbing General Provisions."

END OF SECTION

**SECTION 22 40 00
PLUMBING FIXTURES**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Water closets.
 - 2. Toilet seats.
 - 3. Urinals
 - 4. Flush valves.
 - 5. Lavatories.
 - 6. Lavatory faucets.
 - 7. Lavatory station.
 - 8. Sinks.
 - 9. Wall faucets.
 - 10. Freeze-proof hydrants.
 - 11. Emergency shower/eye wash.
 - 12. Supply fittings.
 - 13. Protective shielding pipe covers.
- B. See Drawings for basis of design manufacturers and models.

1.2 SUBMITTALS

- A. Shop Drawings: For equipment covered under this section as per Section 220500.
 - 1. Additional Shop Drawing requirements for Hard Wired flush valves and faucet fixtures:
 - a. Product data for transformers to be used to power devices.
 - b. Quantity of transformers to be used in each restroom group.
 - c. Termination devices used to terminate multiple devices to a single transformer, and quantities of devices to be used.
 - d. Length of interconnection cable (maximum cable length should be provided)
- B. Operation and Maintenance Data: For equipment covered in this section as per Section 220500.

1.3 QUALITY ASSURANCE

- A. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.
- B. Regulatory Requirements: Comply with requirements in ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities for plumbing fixtures for people with disabilities.
- C. General Battery Requirements: Batteries are intended to be standard sizes only. Proprietary or non-standard battery sizes are not allowed. Provide fresh batteries at project completion.

PART 2 - PRODUCTS

2.1 WATER CLOSETS – FLUSH TANK

- A. Water Closets: Floor mounted, floor outlet, two-piece, close coupled (gravity tank).
 - 1. ADA Water Closets: Comply with ICC/ANSI A117.1
- B. Bowl:
 - 1. Material: Vitreous china, white, conforming to ASME A112.19.2/CSA B45.1.

2. Bowl Type: Siphon jet.
 3. Rim Contour: Elongated.
- C. Tank:
1. Material: Vitreous china, white, conforming to ASME A112.19.2/CSA B45.1.
 2. Flushing: Gravity flush.
 3. Trip Lever: Polished Chrome.
- D. Toilet Seat: Required.
- E. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
1. American Standard.
 2. Crane.
 3. Kohler.
 4. Mansfield.
 5. Sloan.
 6. Toto.
 7. Zurn.

2.2 WATER CLOSETS – FLOOR MOUNTED

- A. Water Closets: Floor mounted, bottom outlet, flush valve.
1. ADA Water Closets: Comply with ICC/ANSI A117.1
- B. Bowl:
1. Material: Vitreous china, white, conforming to ASME A112.19.2/CSA B45.1.
 2. Bowl Type: Siphon jet.
 3. Rim Contour: Elongated.
 4. Spud Location: Top.
- C. Toilet Seat: Required.
- D. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
1. American Standard.
 2. Crane.
 3. Kohler.
 4. Mansfield.
 5. Sloan.
 6. Toto.
 7. Zurn.

2.3 TOILET SEATS

- A. Provide on all water closets:
1. Standard: IAPMO/ANSI Z124.5.
 2. Material: Plastic, white.
 3. Type: Commercial (Standard).
 4. Shape: Elongated rim, open front.
 5. Hinge: Check, non-corroding metal.
 6. Seat Cover: Not required.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
1. Bemis Manufacturing Company.

2. Centoco Manufacturing Corporation.
3. Church Seats.
4. Kohler.
5. Zurn.

2.4 URINALS – WALL-HUNG

- A. Urinals: Wall hung, back outlet, siphon jet.
 1. ADA Mounting Height: Complying with ICC/ANSI A117.1
- B. Fixture:
 1. Material: Vitreous china, white, conforming to ASME A112.19.2/CSA B45.1.
 2. Type: Siphon jet.
 3. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
 4. Spud Location: Top .
 5. Outlet Location: Back.
- C. Support Carrier: See specification below.
- D. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 1. American Standard.
 2. Crane.
 3. Kohler.
 4. Mansfield.
 5. Sloan.
 6. Toto.
 7. Zurn.

2.5 FLUSH VALVES – MANUAL

- A. Description: Lever-handle, diaphragm or piston flushometer valves.
 1. Pressure Rating: 125 psig.
 2. Standard: ASSE 1037.
- B. Features: Include integral stop and backflow-prevention device.
 1. Body Material: Brass with corrosion-resistant components.
 2. Diaphragm Material: Chloramine resistant.
 3. Stop Cap: Vandal resistant.
 4. Finish: Chrome plated.
 5. Handle: Non-hold open.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 1. American Standard.
 2. Delany Products.
 3. Delta Faucet Company.
 4. Sloan.
 5. Zurn.

2.6 LAVATORIES – UNDER COUNTER-MOUNTED

- A. Description: Rectangular, vitreous china, under counter mounted, ADA compliant.
 1. Material: Vitreous china, white, conforming to ASME A112.19.2/CSA B45.1.
 2. Type: Under-counter mounting.

3. Faucet-Hole Location: Top.
 4. Soap Dispenser Hole: None.
 5. Mounting Material: Sealant.
 6. ADA Standard: Comply with ICC/ANSI A117.1
- B. Accessories: Supplies, p-trap.
1. Supplies: 3/8" angle with stops.
 2. P-trap: 1-1/4", 17 gauge, chrome plated.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
1. American Standard.
 2. Crane.
 3. Kohler.
 4. Mansfield.
 5. Sloan.
 6. Toto.
 7. Zurn.

2.7 LAVATORY FAUCETS – SENSOR

- A. Description: Automatic, sensor activated, commercial, battery-powered.
1. Standard: ASME A112.18.1/CSA B125.1.
 2. General: Vandal resistant; coordinate faucet inlet with fixture hole punching.
 3. Body Material: Solid brass.
 - a. Finish: Polished chrome plate.
 4. Spout: Fixed.
 5. Spout Outlet: Vandal resistant aerator.
 6. Valve: Filtered solenoid.
 7. Control Module: Splash proof.
 8. Lavatory Outlet: Grid strainer with tailpiece.
- B. Accessories:
1. Batteries:
 - a. Standard sizes only. Proprietary batteries are not allowed.
 - b. Provide fresh batteries at project completion.
 2. Thermostatic Mixing Valve: Comply with ASSE 1070.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
1. American Standard.
 2. Cambridge Brass, Inc.
 3. Chicago Faucets.
 4. Component Hardware Group, Inc.
 5. Delta Faucet Company.
 6. Elkay.
 7. Grohe America, Inc.
 8. Just Manufacturing.
 9. Kohler.
 10. Moen Incorporated.
 11. Sloan.
 12. T & S Brass and Bronze Works, Inc.
 13. Zurn.

2.8 SINKS – GENERAL PURPOSE

- A. Description: Counter mounted, back ledge.
 - 1. Standard: ASME A112.19.3/CSA B45.4.
 - 2. Material: 18 gauge, type 302 stainless steel.
 - 3. Each Drain: Grid with 1-1/2" tailpiece and p-trap; removable conical basket strainer with metal stem and rubber stopper, equivalent to Elkay model LK35.
 - 4. Drain Location: Centered in compartment.
 - 5. Bowl Depth: Standard depth
 - 6. Mounting: On counter with sealant.
- B. Faucets: Manual-type, single-control mixing valve, commercial general-duty, solid-brass valve.
 - 1. Basis of Design: Elkay
 - 2. Standard: ASME A112.18.1/CSA B125.1.
 - 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
 - 4. Body Material: Commercial, solid brass.
 - a. Finish: Polished chrome plate.
 - 5. Number Required: One.
 - 6. Faucet Mounting: On ledge.
 - 7. Mounting Type: Deck, exposed.
 - 8. Valve Handle(s), Spout: Per Drawing schedules.
 - a. Spout Outlet: Aerator.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. Fixture:
 - a. Elkay Manufacturing Co.
 - b. Just Manufacturing.
 - c. Franke Kindred Canada.
 - 2. Faucet:
 - a. American Standard.
 - b. Cambridge Brass, Inc.
 - c. Chicago Faucets.
 - d. Component Hardware Group, Inc.
 - e. Delta Faucet Company.
 - f. Elkay.
 - g. Grohe America, Inc.
 - h. Just Manufacturing.
 - i. Kohler.
 - j. Moen Incorporated.
 - k. Sloan.
 - l. T & S Brass and Bronze Works, Inc.
 - m. Zurn.

2.9 SINKS – SCULLERY

- A. Description: Free-standing floor mount, scullery sink.
 - 1. Standard: ASME A112.19.3/CSA B45.4.
 - 2. Material: 14 gauge, type 304 stainless steel, buffed satin finish.
 - 3. Drain: Grid with 1-1/2" tailpiece and p-trap; removable conical basket strainer with metal stem and rubber stopper, equivalent to Elkay model LK35.
 - 4. Drain Location: Center rear in compartment.
 - 5. Mounting: Floor set on tubular legs.

6. Drainboard: No drain boards.
- B. Faucets: Manual-type, commercial general-duty, solid-brass valve.
 1. Basis of Design: Chicago Faucet.
 2. Standard: ASME A112.18.1/CSA B125.1.
 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
 4. Body Material: Commercial, solid brass.
 - a. Finish: Polished chrome plate.
 5. Number Required: One.
 6. Faucet Mounting: On back.
 7. Mounting Type: Back/wall, exposed.
 8. Spout: Arc tube swing spout with pre-rinse spray.
 9. Valve Handle(s), Spout: Per Drawing schedules.
 - a. Spout Outlet: Aerator.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 1. Fixture:
 - a. Elkay Manufacturing Co.
 - b. Just Manufacturing.
 - c. Franke Kindred Canada.
 - d. Regency.
 - e. Advanced Tabco.
 - f. Eagle Group.
 2. Faucet:
 - a. American Standard.
 - b. Cambridge Brass, Inc.
 - c. Chicago Faucets.
 - d. Component Hardware Group, Inc.
 - e. Delta Faucet Company.
 - f. Elkay.
 - g. Grohe America, Inc.
 - h. Just Manufacturing.
 - i. Kohler.
 - j. Moen Incorporated.
 - k. Sloan.
 - l. T & S Brass and Bronze Works, Inc.
 - m. Zurn.

2.10 WALL FAUCET

- A. Description: Wall mounted, hot and cold faucet with wall brace and pail-hook.
 1. Standard: ASME A112.18.1/CSA B125.1.
 2. General: Include hot- and cold-water indicators.
 - a. Material: Commercial, solid brass.
 - b. Finish: Polished chrome plate.
 - c. Check Stops: Provide on hot and cold water.
 3. Mounting Type: Back/wall, exposed.
 4. Valve Handle(s):
 - a. Non-ADA: 2-inch lever.
 - b. ADA Compliant: 6-inch elbow blades.

5. Spout: Rigid.
 - a. Vacuum Breaker: Required for hose outlet.
 - b. Spout Outlet: 3/4" hose thread.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 1. American Standard.
 2. Cambridge Brass, Inc.
 3. Chicago Faucets.
 4. Component Hardware Group, Inc.
 5. Delta Faucet Company.
 6. Elkay.
 7. Grohe America, Inc.
 8. Just Manufacturing.
 9. Kohler.
 10. Moen Incorporated.
 11. Sloan.
 12. T & S Brass and Bronze Works, Inc.
 13. Zurn.

2.11 FREEZE-PROOF HYDRANTS

- A. Description: Concealed, self-draining, non-freeze wall hydrants.
 1. Operation: Loose key, include one with each hydrant.
 2. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
 3. Outlet: Concealed, garden-hose thread.
 4. Box: Flush mounted with cover, with rough bronze finish.
 5. Mounting Height: 2 feet above finished grade unless otherwise noted.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 1. Josam Company.
 2. Wade Specification Drainage Products.
 3. Watts Water Technologies.
 4. Woodford Manufacturing Company.
 5. Zurn Industries, LLC.

2.12 EMERGENCY SHOWER/EYEWASH

- A. Description: Plumbed emergency showers and eyewash combination unit.
- B. Standards: ANSI Z358.1, ASSE 1071.
- C. Piping: Powder or epoxy coated galvanized steel.
- D. Emergency shower: 8-inch-minimum diameter head.
 1. Capacity: Not less than 20 gpm at 20 psi for at least 15 minutes.
 2. Supply Piping: 1" with stay-open control valve.
 3. Control-Valve Actuator: Triangular pull rod.
- E. Emergency eye/face wash:
 1. Capacity: Not less than 3 gpm for at least 15 minutes.
 2. Supply Piping: 1/2" with stay-open control valve.
 3. Control-Valve Actuator: Paddle.
 4. Spray-Head Assembly: Two receptor-mounted spray heads with flip covers.

- 5. Receptor: Stainless-steel or ABS bowl.
- 6. Drain Piping: Chrome-plated, receptor drain, P-trap, waste to wall, and wall flange.
- F. Include: Universal emergency sign.
- G. Tempering valve: Emergency shower and eyewash thermostatic mixing valve.
 - 1. Basis of Design: Lawler 911E.
 - 2. See Specification Section 221200 "Plumbing Specialties" for mixing valve requirements.
- H. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. Acorn Engineering Company.
 - 2. Bradley Corporation.
 - 3. Chicago Faucets.
 - 4. Encon Safety Products.
 - 5. Guardian Equipment Co.
 - 6. Haws Corporation.
 - 7. Speakman Company.
 - 8. Stingray Systems.

2.13 SUPPLY FITTINGS

- A. Article applies to tank type water-closets, sinks, and lavatories.
- B. Manufacturers: Subject to compliance with requirements, provide supply stops by one of the following or other prior approved:
 - 1. Dahl Valve Limited.
 - 2. Sioux Chief Manufacturing Company, Inc.
- C. Exposed Supply Piping: Chrome-plated-brass pipe or chrome-plated-copper tube matching water-supply piping size. Include chrome-plated wall flange.
- D. Stop: Chrome-plated-brass, one-quarter-turn, ball-type or compression stop.
 - 1. Operation: Wheel handle.
- E. Riser Material: 1/2" braided-stainless-steel flexible hose riser.

2.14 PROTECTIVE SHIELDING PIPE COVERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following or prior approved:
 - 1. Engineered Brass Company.
 - 2. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
 - 3. McGuire Manufacturing.
 - 4. Plumberex.
 - 5. Truebro; a brand of IPS Corporation.
 - 6. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
- B. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.15 FIXTURE CARRIERS

- A. Description: Manufactured adjustable fixture carrier for the fixture type specified and capable of the static load specified. Contractor fabricated supports are not approved.

- B. Standards:
 - 1. ASME A112.6.1M.
- C. Manufacturers: Subject to compliance with requirements, provide products by the following or prior approved:
 - 1. Jay R. Smith MFG. Co., Inc.
 - 2. Josam Company.
 - 3. Wade Specification Drainage Products.
 - 4. Watts Water Technologies.
 - 5. Zurn Industries, LLC.
 - 6. Sioux Chief Manufacturing Company, Inc.
- D. Urinals:
 - 1. Urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture.
 - a. Basis of Design: Wade 404 series.
 - b. Static Load: Tested to 200lbs.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General Installation:
 - 1. Install fixture supports firmly attached to building structure.
 - 2. Install fixtures level, plumb, and in accordance with manufacturer's rough-in and installation instructions and height requirements of authorities having jurisdiction.
- B. Wall Flange and Escutcheon Installation:
 - 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
 - 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
- C. Joint Sealing:
 - 1. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
 - 2. Match sealant color to fixture color.
- D. Flush Valve Installation:
 - 1. Install lever-handle flush valves for accessible water closets and urinals with handle mounted on open side of water closet.
 - 2. Install actuators in locations that are easy for people with disabilities to reach.
- E. Install toilet seats on water closets.
- F. Lavatory Installation:
 - 1. Install water temperature limiting devices on all public lavatories.
 - 2. Install supports, affixed to building substrate, for wall-mounted lavatories.
- G. Sink Installation:
 - 1. Install supports, affixed to building substrate, for wall-hung sinks.
 - 2. Install water-supply piping with stop on each supply to each sink faucet in locations where they can be easily reached for operation.

H. Shielding Installation:

1. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks and lavatories.

I. Emergency Plumbing Fixture Installation

1. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
2. Install shutoff ball valves in water-supply piping to fixtures. Install valves in locations where they can easily be reached for operation.
 - a. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.
3. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals.
4. Install thermometers in supply and outlet piping connections to water-tempering equipment.

3.2 CONNECTION SCHEDULE

- A. See Plan.

3.3 ADJUSTING

- A. Operate and adjust fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at bubblers, faucets and flushometer valves to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.
- D. Set field-adjustable temperature set points of temperature-actuated water mixing valves. Adjust set point within allowable temperature range.

3.4 CLEANING AND PROTECTION

- A. Clean fixtures and fittings with manufacturers' recommended cleaning methods and materials.
- B. Do not allow use of fixtures after final cleaning for temporary facilities unless approved by Owner.

END OF SECTION

SECTION 23 05 00
HVAC GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Specification Format

1. These Specifications are written in imperative and abbreviated form. This imperative language of the technical sections is directed at the Contractors, unless specifically noted otherwise. Incomplete sentences shall be completed by inserting "shall", "the Contractor shall", and "shall be", and similar mandatory phrases by inference in the same manner as they are applied to notes on the Drawings. The words "shall be" shall be supplied by inference where a colon (:) is used within sentences or phrases. Except as worded to the contrary, perform all indicated requirements whether stated imperatively or otherwise.
2. Three Part Format
 - a. "Part 1 - General": Covers those areas which relate to the Work, and which define the general administrative and technical requirements specific to a particular section.
 - b. "Part 2 - Products": Defines, in detail, the acceptance equipment and materials to be incorporated into the Work.
 - c. "Part 3 - Execution": Describes, in detail, the manner in which items covered by Part 2 are to be incorporated into the Work.
3. Where Codes, Specifications and Drawings are in conflict, the Contractor will be deemed to have bid the more expensive method. Refer all such discrepancies immediately to the Engineer prior to commencing related work.

B. Definitions:

1. Furnish: Supply equipment as required by these Drawings and Specifications, delivered to the job site for installation or use by others.
2. Install: Fix in position for total operational use all apparatus as shown, specified or required. Provide all miscellaneous fittings and wiring supplies.
3. Or Approved Equal: Equipment or materials selected by Contractor subject to Engineer's acceptance.
4. Or Equivalent: Equipment or materials selected by Contractor matching the function and performance of equipment or materials listed.
5. Provide: Furnish and install in place, total and operational.
6. Complete/Completely: All pipes, fittings, ducts, wiring supplies, and accessories provided for the noted equipment from the equipment to the mains or noted termination points.

1.2 SCOPE OF WORK

- A. The work covered by this Division consists in furnishing all labor, equipment, accessories and materials and in performing all operations necessary for the installation of the HVAC systems, in strict accordance with Division 23 of this Specification and applicable Drawings and subject to the terms and conditions of the Contract.
- B. Work of this Division is subject to requirements of Instructions to Bidders, General Conditions, Supplementary Conditions, Division One, and all other sections of this Specification.

- C. Examine site and all Contract documents prior to submittal of bid.
 - 1. Submittal of a Bid shall indicate the Contractor has examined the Site and Drawings and has included all required allowances in this Bid. No allowance shall be made for errors resulting from the Contractor's failure to visit job sites and to review Drawings.
- D. Division 23 Work: Includes, but is not limited to, providing the following:
 - 1. Hydronic Heating System: Piping, plant equipment, fuel supply, heating equipment.
 - 2. Hydronic Cooling System: Piping, plant equipment, cooling equipment.
 - 3. Direct Expansion (DX) System: Piping and equipment.
 - 4. Air Distribution System: Equipment and ductwork.
 - 5. Ventilation and Exhaust System: Equipment and ductwork.
 - 6. Building Automation System.
 - 7. Insulation System: Ductwork and piping.
 - 8. Geothermal System: Equipment and piping.

1.3 ALTERNATES

- A. Refer to Division 01 for alternates.
- B. General
 - 1. The work of this Section is affected by the Alternates described in Division 1.
- C. Alternate M-1
 - 1. The Owner wishes to know in advance the possible cost to remodel the restrooms in the Joachim museum.
 - 2. Base Bid: No work
 - 3. Under Alternate Bid M-1 on the Bid Form, state the Contract Sum to remodel the restrooms as shown on drawing sheet M801.

1.4 SUBMITTALS

- A. General:
 - 1. Preferred Submittal Format: PDF, unless otherwise noted.
 - 2. Preferred Submittal Nomenclature: Unless otherwise noted, PDF submittals are to be named according to the following:
 - a. [Specification Section Number] – [Specification Name or Equipment Included]
 - 3. Distribution: Unless otherwise noted, direct all correspondence concerning Division 23 submittals to:

STEVE BUTTERFIELD
PRAIRIE ENGINEERING, P.C.
619 RIVERWOOD DRIVE, SUITE 205
BISMARCK, ND 58504
sbutterfield@prairieengineeringpc.com

- B. Substitution and Prior Approval to Quote:
 - 1. Format and Content: Complete descriptive technical data on the proposed item consisting of model numbers, type, size and performance characteristics.
 - 2. Submission Timing: Minimum of 192 hours (eight days) prior to bid opening.
 - a. Substitutions will not be permitted after bid opening except where such substitution is considered by the Engineer to be in the best interest of the Owner.
 - 3. Bidder Notification: Prior to bid opening via Addenda, sent to all planholders.

4. Contractor Responsibility: This contractor will be responsible for all coordination, construction costs, and Architectural/Engineering design fees required to substitute equipment that has different characteristics than designed including weights, physical dimensions, clearances, mechanical characteristics, electrical characteristics, and other characteristics deemed important to the design by the Architect/Engineer.
5. Alternative Format: Printed paper, two copies; Self-addressed, stamped envelope required for return reply.

C. Schedule of Values

1. Distribution: One copy to Engineer.
2. Format and Content: When included with the Bid, at minimum the following categories shall be indicated:
 - a. "Project mobilization"
 - b. "Start-up and Commissioning"
 - c. "Demolition"
 - d. "Excavation and Backfill"
 - e. "Insulation"
 - f. "Test and Balance"
 - g. "Building Automation System"
 - h. "Fire Sprinkler System"
 - i. "Geothermal Wellfield"
 - j. "Piping Systems" (all hot/chilled/geothermal piping, valves, fittings, hangers, installed in place)
 - k. "Sheet Metal" (all ductwork, lining, dampers, hangers, installed in place)
 - l. "Terminal Units" (unit heaters, grilles, diffusers, radiation, installed in place)
 - m. "Hydronic Distribution Equipment" (all pumps, boilers, chillers, heating/cooling coils, installed in place)
 - n. "Air Distribution Equipment" (all fans, air handlers, heat pumps, VAVs, installed in place)
3. Submission Timing: Prior to first payment application.

D. Shop Drawings

1. Distribution: Engineer via the Prime Contractor for each item indicated.
2. Format and Content: Include catalog numbers, performance data, dimensions and other descriptive information.
 - a. Contractor Review: Dated and signed cover sheet or review stamp for each Shop Drawing file to indicate thorough review. **Email message text not acceptable.**
 - b. Submit a separate shop drawing file for each Specification Section including only the items within that Section.
 - c. Non-Conforming: Returned to Contractor without review.
3. Submission Timing: Prior to delivery of materials to job site.

E. Record Drawings

1. Format and Content: Paper copy of Drawings project site.
 - a. As work progresses, Contractor's field supervisor shall mark Record Drawings in red pencil to indicate actual conditions of installation.
 - b. Give particular attention to marking actual locations of underground piping.
 - c. Affix all addendum and change order descriptions to appropriate record drawing sheet, utilizing spray adhesive.
 - d. Make Record Drawings available to Engineer during project visitation.
2. Submission Timing: Close of project with Record Manuals.

F. Spare Equipment and Devices

1. Distribution: Owner.
2. Format and Content: List quantities on contractor letterhead or invoice, obtain signature of Owner's representative acknowledging receipt, and include with each Record Manual.
3. Submission Timing: Close of project with Record Manuals.

G. Operation and Maintenance Manuals

1. Submission Timing: Close of project, as condition of its acceptance.
2. Record Manual information shall be included for all equipment/material where Shop Drawings are required.
3. Format and Content: Two copies, Loose-leaf hardcover binders, **and** in PDF format on CDs or USB drive.
 - a. List project name, date, Contractor's name, address and telephone number on exterior label of each Record Manual and CD.
 - b. Include an index sheet indicating subcontractor and subcontractor's phone number and each major piece of equipment, supplier and supplier's telephone number. Provide tabbed dividers indicating major groupings of equipment.
 - c. Include a copy of the Shop Drawings.
 - d. Include all installation, operation and maintenance data packaged with any equipment.
 - e. Include all signed and dated final punch lists from walkthroughs performed by the Engineer.

1.5 APPLICATIONS FOR PAYMENT

- A. Refer to Division 1 "Applications for Payment".
- B. Provide one additional copy, sent directly to the Engineer.
- C. Schedule of Values: At minimum, include items in Submittal article.

1.6 CHANGES TO CONTRACT

- A. Any required changes to the contract after bid date shall be in accordance with General Conditions/Division 1 and this section. Where any discrepancies between the sections are encountered, the more restrictive section shall apply.
- B. Proposed changes shall be accompanied with complete substantiating documentation.
 1. Provide an itemized list of quantities for materials, equipment, and supplies.
 - a. Include unit costs for each item and extended price.
 - b. Include unit labor for each item and extended time.
 2. Provide subcontractor proposals that include the same substantiating documentation.
 3. Provide quotations from suppliers for any specially ordered equipment.
- C. Material costs shall be actual costs to the contractor, obtaining the materials through normal supply channels, including trade and quantity discounts. Utilizing "suggested pricing" from national pricing organizations for unit costs shall not be accepted. Upon request, the contractor or subcontractor shall submit evidence to substantiate the costs.
- D. Labor units shall be industry accepted standard labor hours to perform one unit of work. If the work is being performed in a location that is not considered to be standard working conditions for that specific task, additional labor shall be itemized.

- E. Labor rates shall be the actual rate paid for the workman category along with associated labor burden. Labor burden shall consist only of the mandatory fringe benefits, labor taxes, and labor insurances as affected by payroll. The owner reserves the right to reject any labor burden which is inconsistent with other similar contractors or where the fringe benefit cost is in excess of established labor agreements.
- F. Subcontractors shall compute their costs in the same manner as the contractor. Subcontractors are subject to the same markup constraints as described herein.
- G. For changes resulting in credit to the costs, no restocking fees for materials shall be applied by the contractor or subcontractors.

1.7 QUALITY ASSURANCE

- A. Qualifications of Installers
 - 1. For installation and testing, use only trained licensed and experienced workmen familiar with items required and manufacturer's recommended methods.
 - 2. In acceptance or rejection of installed work, no allowance will be made for lack of skill on the part of the workmen.

1.8 AUTHORITIES AND AGENCIES

- A. Materials, workmanship and installation: comply with the latest editions of all applicable codes, local ordinances, industry standards, utility company regulations, insurance carrier requirements and these Specifications.
- B. Obtain and pay all permits, inspections, licenses and other charges pertaining to the Work. Upon completion of the Work, furnish proof of acceptance by proper agency having jurisdiction.
- C. Codes and standards shall include, but not necessarily be limited to, the following:
 - 1. International Energy Conservation Code (IECC);
 - 2. Uniform Plumbing Code;
 - 3. North Dakota State Building Code;
 - 4. International Building Code (IBC);
 - 5. International Mechanical Code (IMC);
 - 6. International Fuel Gas Code (IFC);
 - 7. National Fire Protection Association (NFPA) – Sections as adopted by authority having jurisdiction.
- D. The more stringent provisions shall govern where provisions of pertinent codes and standards conflict with these Specifications or Drawings. Where Codes, Specifications or Drawings differ with one another, the Contractor will be deemed to have bid the more expensive method. Refer all such discrepancies to the Engineer immediately.
 - 1. Pertinent codes and standards shall not be cited to furnish less than specifically shown or specified.
 - 2. Meeting the minimum standards of the above Codes does not permit a lower grade of construction where Plans or Specifications call for workmanship or materials in excess of Code Requirements.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.9 GUARANTEE AND WARRANTY

- A. Except where otherwise noted, contractor shall guarantee materials, workmanship and the proper operation of equipment for a period of one year after Owner's beneficial use of the building or mechanical system. Contractor shall correct all equipment, material and workmanship found to be defective or non-conforming to the contract documents without cost to Owner during that one year period.
- B. Guarantee shall include trips to the project site by Contractor to adjust mechanical equipment as required, ensuring it is operating as intended.
- C. Specified guarantee shall not relieve Contractor from liability arising from improper installation or non-compliance with applicable codes.

1.10 TEMPORARY FACILITIES

- A. Refer to Special Conditions and/or Division 1 for details of temporary facilities.

1.11 NOMENCLATURE

- A. Pipe sizes listed are nominal pipe sizes throughout this Division except where otherwise noted.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Material and equipment shall be as shown or specified. Provide material not specifically described but required for a complete and proper installation of the Work, subject to the acceptance of the Engineer.
- B. Owner will not be liable for material installed in non-compliance with codes, standards, and these Contract Documents.
- C. Fire Stop System material shall be by 3M "Fire Barrier", Metacaulk, Hilti, Nelson Firestop Products, or AD Fire. See Division 07 for further details on approved materials.

2.2 ELECTRIC WIRING

- A. The Division 23 Contractor shall furnish all motors, special controls and electrical devices as specified herein for proper operation of the equipment furnished.
- B. Division 26 Contractor shall furnish and install, as required, disconnects, starters, switches, etc., and do all necessary power and control wiring including the installation of electrical devices such as thermostats, humidistats, remote control panels, etc., furnished separately by Division 23 Contractor, unless otherwise noted in Equipment Specifications or noted in Section 230900.

PART 3 - EXECUTION

3.1 GENERAL

- A. Engineer, Architect, or Owner shall not be responsible for the means, methods, techniques, sequences or procedures of construction selected by Contractor.
- B. Engineer, Architect, or Owner shall not be responsible for safety precautions and programs incidental to work of Contractor.
- C. It is the sole responsibility of Contractor to initiate, maintain, and supervise all safety precautions and programs in connection with the Work.

- D. In general, it is intended that ductwork and piping be installed parallel to building lines, unless otherwise shown on the Drawings, and that equipment be located symmetrical with the architectural elements of the building.
- E. Division 23 Contractor is to notify the Owners Staff of any work that may involve temporary disabling of the Fire Alarm System at least 1 week prior to the work occurring.

3.2 SURFACE CONDITIONS

- A. Prior to work of each Section of Division 23, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- B. Verify that work of this Division may be installed in accordance with all pertinent codes, regulations and standards.

3.3 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect the materials of this Division before, during and after installation and to protect the installed work and materials of all other trades.
- B. Plugs: Install in ends of uncompleted piping at end of each day or when work stops.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

3.4 COORDINATION

- A. Order equipment and material in a timely fashion to assure it is on the job site when required.
- B. Coordinate installation of material with schedule of other trades to prevent unnecessary delay in construction schedule.
- C. Division 23 piping, duct and equipment installations shall comply with National Electrical Code requirements 110.26 "working spaces" and "dedicated spaces". Mechanical ducts and pipes shall not be installed in the space near electrical panels/equipment defined as "working spaces" or "dedicated spaces".

3.5 DISCREPANCIES, CONSTRUCTION CONFLICTS AND DRAWINGS

- A. Discrepancies
 - 1. Prior to submitting bid, Contractor shall refer any apparent discrepancies or omissions to Engineer for clarification.
 - 2. The Architect, Engineer or Owner will not be responsible for any oral instructions or modifications to the contract documents prior to opening of bids.
 - 3. Written interpretation or clarification will be made by Addenda.
- B. Construction Conflicts
 - 1. Conflicts discovered during construction shall be immediately called to the attention of the Engineer for decision.
 - 2. Do not proceed with installation in area of question until conflict has been fully resolved.
 - 3. When so directed by Engineer, Contractor shall make minor adjustment to avoid interferences with other trades. Such minor adjustments shall be performed at no additional cost to the Architect, Engineer or Owner.

C. Drawings

1. Drawings indicate extent and general layout of mechanical systems for project. Due to small scale, it is not possible to indicate all fittings and accessories that may be required. Provide such fittings and accessories as required to form a complete and operating system in general conformance with Specifications and Drawings.
2. Exact locations, distances, levels and other conditions will be governed by the structure. Field measurements shall take precedence over the Drawings. Use the Drawings and these Specifications for guidance. Secure the Architect's approval for all changes in locations.
3. Verify all measurements at site. No compensation will be made because of difference between locations shown on the Drawings and measurements at the building.
4. Refer to the architectural drawings for dimensions and locations of walls, partitions, doors, windows, ceiling heights, door swings and other details of construction.

3.6 UNDERGROUND UTILITIES

- A. Locations of existing underground utilities are based on available site information and are shown approximately. Contractor shall determine exact utility locations before commencing work and shall be responsible for repair of damages resulting from his construction activities to pre-construction condition.
- B. Trench and backfill for installation of underground piping to depth shown or required. Remove any accumulated water in excavation by pumping. Shore and brace excavation as required by safety regulations. Provide temporary bridges to maintain normal traffic flow. Excavation and backfill required by mechanical installations shall be accomplished in accordance with Division 31 Specifications by this Contractor.

3.7 REMOVAL AND/OR REUSE OF EXISTING MATERIALS AND EQUIPMENT

- A. Existing equipment, which is indicated as being removed and not indicated for reuse, shall remain the property of the Owner, stored as directed. Any material the Owner does not wish to retain shall be removed and disposed by the Contractor.
- B. Contractor shall assume in his Bid that existing equipment and materials shown to be reused are in good working condition and can be installed without any repairs. If certain items are found to be in need of repair or in unusable condition, Contractor shall notify the Engineer for decision, however, Contractor shall be responsible for any damage by his personnel to equipment in removal or handling.
- C. All refrigeration equipment and piping to be removed or relocated shall have the refrigerant removed prior to removal or demolition. Removal and reclamation of refrigerant shall be done by qualified, trained and certified refrigeration technicians. Certification shall meet all requirements as set forth by Section 608 of the Clean Air Act Amendments. Contractor shall use approved recovery and reclaiming equipment and approved containers for refrigerant storage. Flashing refrigerant gas to atmosphere is strictly prohibited.
- D. Material and other equipment removed and to be reused shall be cleaned before reinstallation.

3.8 OFFSETS

- A. Where required to allow clearance of electrical conduit and outlet boxes, beams, etc., to avoid interference with work of other trades, to increase head room under mechanical systems or to improve the appearance of mechanical systems work, this Contractor shall offset his mechanical system as directed by the Architect/Engineer.

3.9 CUTTING AND PATCHING

- A. Refer to General Conditions. Unless specifically called out to be performed by other Contractors, the Division 23 Contractor shall perform all cutting and patching required for the installation of material and equipment furnished under his Contract.
- B. Opening/holes cut to allow passage of ducts and pipes through concrete floor shall be patched by the Contractor doing the cutting unless indicated otherwise on the Drawings.
- C. Fire-Barrier Penetrations
 - 1. Pipe penetrations through fire rated walls and floors shall be sealed with a UL classified Fire Stop System. Fire Stops shall be provided in accordance with the appropriate System No. as it relates to pipe size/Material and wall or floor rating/material.
 - 2. See Specification Section 230510 for other Fire-Barrier Penetration requirements.
 - 3. See Section 2 article "Materials" of this Specification for approved fire stop system material.
- D. Openings between ductwork and fire rated walls and floors shall be sealed with fire rated caulking or steel collars on both sides of wall or floor.
- E. Restore damaged surfaces to their original condition by skilled mechanics of the trade involved. Contractor at fault shall assume all cost.
- F. Use only rotary type drilling tools to cut concrete.
- G. Do not endanger the stability of the structure. Do not at any time cut or alter work of any other Contractor without Architect's consent.

3.10 FIELD QUALITY CONTROL

- A. Perform field tests and inspections. Test new piping and parts of existing piping that have been altered, extended, or repaired.
- B. Gas Piping Tests:
 - 1. Test gas piping as required by the Authority Having Jurisdiction or the Utility Company.
 - 2. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
- C. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained. Piping will be considered defective if it does not pass tests and inspections.

3.11 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.12 CLEANING

- A. Clean interior of duct and piping systems. Remove dirt and debris as work progresses.

3.13 INSTRUCTIONS

- A. Provide written and oral operating and maintenance instructions to Owner's representatives. The oral instructions shall be given before the Owner occupies the buildings. Instructions to include **all** building's mechanical systems and equipment.
- B. Copies of written operating and maintenance instructions shall be included with each Record Manual.
- C. Division 23 Contractor shall coordinate with Owner at Owner's convenience, formal instruction time for contractor personnel to instruct Owner's Representatives on all equipment. Provide similar equipment supplier's instructions where specified thus.
- D. Formal instructions shall be video recorded when required by other Sections of this Specification by this Contractor. Format shall be DVD. Formal instruction to be included with each Record Manual, being referenced to and a part of the Manual.

3.14 CLEAN UP

- A. Each Contractor shall be responsible for cleaning up after his work, including the removal of all scrap material left on the job by his men or Subcontractors. This will include the removal of all pipe and sheet metal cuttings, pieces of sheet metal, pipe, and insulation and other debris.
- B. Clean all heating units, clean and straighten fins on all coils, clean scale, dirt or debris off piping, motors, etc., oil or grease all motors, fan bearings, pump gear boxes, etc., and leave in a clean best possible working condition. Install clean filters in ventilation system prior to turning job over to Owner.
- C. After all tests have been made and the mechanical systems are operating properly, this Contractor shall go over the entire system and remove labels from all mechanical equipment.
- D. All equipment having finished paint surfaces shall be examined upon completion for scratches and other damage. Touch up all surfaces as required with paint of color to match factory finish.
- E. Perform all cleaning as required by other Sections of Division 23.

END OF SECTION

SECTION 23 05 10
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Ball valves.
 - 2. Hangers.
 - 3. Escutcheons.
 - 4. Equipment and Warning labels.
 - 5. Rooftop piping and duct supports.
 - 6. Roof curbs.
 - 7. Pipe labels.
 - 8. Thermostats.
 - 9. Fire-Barrier Penetrations.
 - 10. Steel nail plates.
- B. Nomenclature:
 - 1. SWP: Steam working pressure.
 - 2. CWP: Cold working pressure.

1.2 SUBMITTALS

- A. Shop Drawings: For equipment covered under this section as per Section 230500.
 - 1. Product Data: Each type of valve, gauge, strainer, sleeve, and sleeve-seal system.
 - 2. Fire-Barrier Penetrations: UL Classified System, System Number.
- B. Operation and Maintenance Data: To include in operation and maintenance manuals as per Section 230500.

PART 2 - PRODUCTS

2.1 VALVE MANUFACTURERS

- A. Except in other Part 2 articles where noted, the following manufacturers are acceptable:
 - 1. Anvil International.
 - 2. Conbraco Industries, Inc.; Apollo Valves.
 - 3. Milwaukee Valve Company.
 - 4. Nexus Valve.
 - 5. NIBCO INC.
 - 6. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 7. Victaulic Company.
 - 8. Viega, LLC.
- B. All manufacturers are subject to compliance with requirements
- C. Provide products by one of the manufacturers specified or by prior approval.

2.2 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Gate Valves: With rising stem.

2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

2.3 BALL VALVES

A. Two-Piece, Metal, Ball Valves:

1. Basis of Design: Apollo Valves 70-100 Series.
2. Standard and Rating: MSS SP-110; 150 psi SWP, 600 psi CWP at 500°F.
3. Body Design: Two piece, forged brass or bronze; PTFE or TFE seats.
4. Stem: Brass or Bronze, blowout-proof, packing nut.
5. Ball: Chrome-plated brass, full or regular port.
6. Operator: Lever; separate lever nut.

2.4 PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: Clevis type with locknut to threaded extension rod, factory-fabricated components; MSS SP-58 types 1 through 58.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized or cadmium plated steel.

B. Copper Pipe Hangers:

1. Description: Clevis type with locknut to threaded extension rod, copper-coated-steel, factory-fabricated components; MSS SP-58 types 1 through 58.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.

2.5 DUCT HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Strap and Rod Sizes: 1", 16 gauge straps; 3/8" rod.
- C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- D. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

2.8 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

2.9 EQUIPMENT AND WARNING LABELS

- A. General Requirements
 - 1. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 1-1/4 inch.
 - 2. Minimum Letter Size: 1 inch for name of units. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 3. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 4. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Metal Labels for Equipment:
 - 1. Material and Thickness: Non-corroding metal, 20 gauge minimum thickness, and having predrilled or stamped holes for attachment hardware.
- C. Plastic Labels for Equipment and Warning:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 2. Equipment Label Color: Black letters on white background.
 - 3. Warning Label Color: White letters on red background.
 - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- D. Warning Label Content: Include caution and warning information, plus emergency notification instructions.
- E. Equipment Label Content: Include equipment's Drawing designation or unique equipment number.
- F. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing plan numbers where equipment is indicated, plus the Specification Section number and title where equipment is specified. Equipment schedule shall be provided to the Controls Contractor and included in operation and maintenance data.

2.10 ROOFTOP PIPING AND DUCT SUPPORTS

- A. Description: Weatherproof, factory assembled support with base suitable for any type roofing material.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. Cooper B-Line.
 - 2. C-Port; Clearline Technologies.
 - 3. C-Port; MIFAB.
 - 4. Erico.
- C. Material:
 - 1. Channel: Galvanized steel.
 - 2. Base: U.V. resistant, non-damaging to roofing material; polymer or rubber.
- D. Capacity: 1,500 lbs.

2.11 ROOF CURBS

- A. Description: Galvanized-steel sheet; with mitered and welded corners; and 1-1/2-inch wood nailer. Size as required to fit roof opening and equipment base.
 - 1. Configuration: Self-flashing without a cant strip, with mounting flange, or custom-fabricated matching metal roof profile as required for roof construction.
 - 2. Height: Minimum 18 inches above the finished top of the roof, unless otherwise indicated.
 - 3. Insulation: 1-1/2-inch-thick, rigid fiberglass, adhered to inside walls.
 - 4. Coordination:
 - a. The Mechanical Contractor shall furnish and install the roof curbs and coordinate with the insulation thickness on roofs where the insulation is above the roof deck and provide pressure treated wood blocking to bring the curb above the insulation and membrane. In lieu of wood blocking, a full height prefabricated curb with a raised cant is acceptable if the height of the raised cant is the same height of the insulation thickness and the minimum height above the top of the finished roof is maintained.
 - b. For metal buildings, the Mechanical Contractor shall provide roof curbs suitable for metal roof system. Coordinate with the metal building supplier as required to provide compatible products.
 - i. Manufacturers: Provide curb manufacturer approved by the metal building manufacturer and as required for the metal building warranty.
 - 1) Basis of Design:
 - a. R&S Roof Products.
 - b. AES Industries Inc.
 - c. The Pate Company.
 - d. LMCurbs.
 - e. MKT Metal Manufacturing.
 - 5. Finish: Provide color selection chips to Architect for color selection during shop drawings.

2.12 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.13 THERMOSTATS

- A. Solid-State Thermostat:
 - 1. Type: Wall-mounting, programmable, microprocessor-based unit.
 - 2. Heat/Cool Switching: Automatic.
 - 3. Exposed set point.
 - 4. Exposed indication.
 - 5. Deg F indication.
 - 6. Battery backup protection against power failure for program settings.

7. Programmability: Seven-day with minimum of four temperature presets per day.
- B. Two-Stage, Heating-Cooling Thermostat:
1. Heat-Off-Cool switch.
 2. Fan on-auto switch.
 3. Exposed set point.
 4. Exposed indication.
 5. Deg F indication.
- C. Single-Stage, Heating-Only Thermostat:
1. Heat-Off switch.
 2. Fan on-Auto switch.
 3. Exposed set point.
 4. Exposed indication.
 5. Deg F indication.
- D. Single-Stage, Line voltage, Heating-Only Thermostat:
1. Heat-Off switch.
 2. Fan On switch.
 3. Exposed set point.
 4. Exposed indication.
 5. Deg F indication.
- E. Control Wiring: Unshielded twisted-pair cabling.

2.14 FIRE-BARRIER PENETRATIONS

- A. Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with Approved firestop materials. See Section 230500 for further details.

2.15 STEEL NAIL PLATES

- A. In concealed locations where piping, other than cast-iron or galvanized steel, is installed through holes or notches in studs, joists, rafters, or similar members less than 1-1/2" from the nearest edge of the member, the pipe shall be protected by steel shield plates.
- B. Plates shall have a thickness not less than 0.0575" (16-gauge mild steel).
- C. Plates shall cover the area of the pipe where the member is notched or bored, shall extend not less than 1-1/2" beyond the outside diameter of the pipe, and shall extend not less than 2" above sole plates and below top plates.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. All valves shall be installed in accessible locations. If any valve is found to be installed in a location deemed inappropriate by the Owner and/or Engineer, the contractor shall relocate the valve at no additional cost to the owner.
- B. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.
- C. Install valves in horizontal piping with stem at or above center of pipe in position to allow full stem movement.
- D. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.

- E. Install natural gas regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, or butterfly valves.
 - 2. Throttling Service: Ball or butterfly valves.
 - 3. Pump-Discharge Check Valves:
 - a. 2" and Smaller: Bronze swing check valves with bronze disc.
 - b. 2-1/2" and Larger: Iron silent check valves with rubber seats.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing and Steel Piping, 2" and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Copper Tubing and Steel Piping, 2-1/2" and Larger: Flanged ends.
- D. In general, ball valves are preferred over butterfly, gate, and globe valves on piping 2" and smaller. Butterfly are preferred on piping larger than 2".

3.3 PIPE HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Arrange for grouping of parallel runs of horizontal piping, and support together on trapeze pipe hangers.
- C. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- E. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- F. Install lateral bracing with pipe hangers and supports to prevent swaying.
- G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
 - 1. Pipes 8" and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 2. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.
- H. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- I. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- J. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- K. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

- L. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- M. Use thermal-hanger shield inserts for insulated piping and tubing.
- N. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 °F piping installations.
- O. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 - 3. Side-Beam or Channel Clamps (MSS Type 20 or 25): For attaching to bottom flange of beams, channels, or angles.
 - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 - 6. C-Clamps (MSS Type 23): For structural shapes.
 - 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod.
- P. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 - 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- Q. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
- R. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

3.4 DUCT HANGER AND SUPPORT INSTALLATION

- A. Hanger Spacing: Maximum of 10 feet apart:
 - 1. Rectangular Duct: Pair of straps or rods.
 - 2. Round Duct, up to 36" diameter: Single rod.
 - 3. Round Duct, greater than 36" diameter: Double rods or straps.
- B. Install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

3.5 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.6 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.7 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run.

3.8 FIRE-BARRIER PENETRATION PROTECTION

- A. Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.
- B. Provide intumescent collars, wraps, fire bands, sealants, and other firestopping materials as required to maintain the fire ratings for the piping and insulation materials used.
- C. Install Fire Stop Systems per the manufacturers' guidelines.

3.9 VALVE SCHEDULE

- A. Gas Valves:
 - 1. Ball Valves.

3.10 ESCUTCHEON AND FLOOR PLATE INSTALLATION

- A. Install escutcheons for exposed piping penetrations of walls, ceilings, and floors of finished areas.
- B. Install escutcheons for piping penetrations of walls within concealed cabinet spaces.
- C. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
- D. Replace broken and damaged escutcheons using new materials.

3.11 STEEL NAIL PLATE INSTALLATION

- A. Install nail plates to protect all vulnerable piping routed in concealed locations within 1-1/2" from the nearest edge of the member the piping is routed through.

- B. Fasten plates to the member per the manufacturer's instructions.

3.12 THERMOSTAT SCHEDULE

- A. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.
- B. Install thermostats at mounting height of 48 inches above floor to center of device.
 - 1. Line voltage thermostats installed by Electrical Contractor.
 - 2. Mount on interior walls wherever possible. Provide insulation backing when mounting on exterior walls.
- C. Solid-State Thermostat:
 - 1. Offices
- D. Two-Stage, Heating-Cooling Thermostat:
 - 1. Lobby
- E. Single-Stage, Heating-Only Thermostat:
 - 1. Vestibules
- F. Single-Stage, Line voltage, Heating-Only Thermostat:
 - 1. Shop

END OF SECTION

SECTION 23 05 20
GENERAL MOTOR REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Common motor requirements for HVAC equipment.
 - a. General requirements for motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.
 - 2. Single-phase motors.
 - 3. Three-phase motors.
 - 4. Electrically commuted motors.
 - 5. VFDs.
 - 6. Shaft grounding rings.

1.2 VFD QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

1.3 SUBMITTALS

- A. Product Data: Submit catalog data for each motor furnished loose. Indicate nameplate data, standard compliance, electrical ratings and characteristics, and physical dimensions, weights, mechanical performance data, and support points.

1.4 WARRANTY

- A. Motor performance shall be warranted against material and workmanship defects by manufacturer's warranty and service policy for the period of at least 18 months from the day of shipment from the factory or the manufacturer's warehouse.
 - 1. Premium efficiency motors shall be warranted for 36 months.
 - 2. Severe duty motors (as applicable) shall be warranted for 60 months.
- B. VFDs: Manufacturer's standard form in which manufacturer agrees to repair or replace VFDs that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Motor Characteristics:
 - 1. Duty: Continuous duty at ambient temperature of 105 °F and at altitude of 1800 feet above sea level.
 - 2. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.2 SINGLE PHASE MOTORS

- A. Description: Single phase motor, T-Frame, 1.25 service factor, minimum class B insulation for 105°F ambient.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. ABB Automation Company.
 - 2. General Electric.
 - 3. Marathon.
 - 4. Century.
- C. Motors 1/20 HP and Smaller: Shaded-pole type.
- D. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- E. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- F. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- G. Minimum Efficiency: 75 percent.
- H. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.3 THREE-PHASE MOTORS

- A. Description: NEMA MG-1, T-frame, Design B, induction-type motor, minimum class F insulation for 105°F ambient.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. ABB Automation Company.
 - 2. General Electric.
 - 3. Marathon.
 - 4. WEG.
 - 5. TECO.
 - 6. NIDEC.
- C. Materials:
 - 1. Windings: Copper.
 - 2. Frame: Steel or cast iron.
 - 3. Rotor: Random-wound, squirrel cage.
 - 4. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading, L-10 life of 200,000 hours.
- D. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.
- E. Service Factor:
 - 1. 1 HP and Smaller: 1.25

2. Above 1 HP: 1.15
- F. Full-load Electrical Efficiency: Based on motor size as indicated below, and shall comply with ASHRAE 90.1-2013, whichever is greater:
 1. 1 HP and Smaller: 81.5%
 2. Above 1 HP to 5 HP: 86.5%
 3. Above 5 HP: 91%
- G. Multispeed Motors: Variable torque.
 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 2. For motors with other than 2:1 speed ratio, separate winding for each speed.

2.4 THREE-PHASE MOTORS USED WITH VFD

- A. Description: Additional requirements for three-phase motors used with variable frequency controllers (VFD).
- B. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- C. Motors Used with Variable Frequency Controllers:
 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 2. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

2.5 SHAFT GROUNDING RINGS

- A. Description: Conductive microfiber shaft grounding ring.
 1. Meet NEMA MG-1 requirements.
 2. Factory installed whenever possible.
- B. Basis of Design: AEGIS, model SGR.
- C. Type: Minimum of two rows of circumferential fibers on solid ring or split ring.
- D. Application Note: Provide on motors greater than 1 HP.
 1. Motors less than 100 HP: Mount ring on either the drive end or non-drive end.
 2. Motors 100 HP and above: Two shaft grounding rings, mounted on the drive end and the non-drive end.

2.6 ELECTRONICALLY COMMUTATED MOTORS

- A. Description: Brushless DC motor with built in speed and torque controls.
- B. Rotor: Permanent magnet.
- C. Circuitry: Programmable, manage commutation of stator to be always synchronous with rotor.
- D. Multispeed Motors: Minimum turndown of 80%.
- E. Efficiency: Minimum of 65%.
- F. Bearings: Permanently lubricated, heavy duty ball bearings.
- G. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.7 VARIABLE FREQUENCY DRIVES

- A. Description: Variable-frequency power converter (rectifier, dc bus, and IGBT, PWM inverter).
 - 1. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. ABB Automation Company.
 - 2. Cerus Industrial.
 - 3. Danfoss Inc.; Danfoss Drives Div.
 - 4. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 5. General Electric Company.
 - 6. Rockwell Automation, Inc.; Allen-Bradley Brand.
 - 7. Square D; a brand of Schneider Electric.
 - 8. Toshiba International Corporation.
- C. VFD General Requirements: Comply with NEMA ICS 7, NEMA ICS 61800-2.
 - 1. Integral Disconnect: Disconnect shall remove all power from unit.
- D. Application: Variable torque.
- E. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
- F. Unit Operating Requirements:
 - 1. Input AC Voltage Tolerance: Plus 10% and minus 15% of VFD input voltage range rating; +/- 5% of VFD frequency rating.
 - 2. Output Rating: 3-phase; 10 to 120 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.
 - 3. Environmental Operating Conditions: 32°F to 104°F, 0 to 3,300 feet above sea level, less than 95% (non-condensing).
 - 4. Minimum Efficiency: 96% at 60 Hz, full load.
 - 5. Overload Capability: 1.1 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
 - 6. Starting Torque: Minimum 100% of rated torque from 3 to 60 Hz.
 - 7. Speed Regulation: Plus or minus 5%.
 - 8. Output Carrier Frequency: Selectable; 0.5 to 8 kHz.
- G. Inverter Logic: Microprocessor based, isolated from all power circuits.
- H. Isolated Control Interface: Allows VFDs to follow remote-control electrical signal over a minimum 40:1 speed range.
- I. Internal Adjustability Capabilities:
 - 1. Minimum Speed: 5 to 25 percent of maximum rpm.
 - 2. Maximum Speed: 80 to 100 percent of maximum rpm.
 - 3. Acceleration and Deceleration: 0.1 to 900 seconds.
 - 4. Current Limit: 30 to minimum of 150 percent of maximum rating.
- J. Self-Protection and Reliability Features:
 - 1. Input transient protection by means of surge suppressors to provide three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
 - 2. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.

3. Under- and overvoltage trips.
 4. Inverter overcurrent trips.
 5. VFD and Motor Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFDs and motor thermal characteristics, and for providing VFD overtemperature and motor overload alarm and trip; settings selectable via the keypad; NRTL approved.
 6. Critical frequency rejection, with three selectable, adjustable deadbands.
 7. Instantaneous line-to-line and line-to-ground overcurrent trips.
 8. Loss-of-phase protection.
 9. Reverse-phase protection.
 10. Short-circuit protection.
- K. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.
- L. Bidirectional Autospeed Search: Capable of starting VFD into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.
- M. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
- N. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
- O. Input Line Reactance: Provide a minimum of 5% impedance on the input to the drive. If the standard drive design does not meet the specification of 5%, additional inductors shall be provided to bring the drive up to the specified level.
1. Line reactors: Furnished and installed by the drive manufacturer in the VFD enclosure from the factory. Field installed line reactors shall not be allowed.
- P. Harmonic Mitigation:
1. DC bus reactors or Input AC line reactors.
 2. Total Harmonic Distortion: Not exceed 10%.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install motors and accessories according to manufacturer's instructions.
- B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

3.2 SHAFT GROUNDING RINGS

- A. Shaft grounding rings (SGR) shall be factory installed inside the motors by the manufacturer wherever possible. SGR's may be field installed by installing contractor subject to Engineer's approval. Provide AEGIS SGR Colloidal Silver Shaft Coating, or approved equal, on shafts prior to rings installation, per SGR manufacturer's recommendations, after first cleaning shafts.
- B. Install and test SGR's in accordance with manufacturer's recommendations. Install the SGR so that the aluminum frame maintains an even clearance around the shaft. Conductive microfibers shall be in full circumferential contact with conductive metal surface of the shaft. Do not use thread lock to secure the mounting screws as it may compromise the conductive path to ground. If thread lock is required, use a small amount of EP2400 AEGIS Conductive Epoxy, or approved equal, to secure the screws in place.

- C. Shafts shall be clean and free of any coatings, paint, or other nonconductive material (clean to bare metal). Depending upon the condition of the shaft, it may require using emery cloth or Scotch-Brite. If the shaft is visibly clean, a non-petroleum based solvent may be used to remove any residue. Check the conductivity of the shaft using an ohm meter. Ohms test: Place the positive and negative meter leads on the shaft at a place where the microfibers will contact the shaft. Each motor will have a different reading but in general one should have a maximum reading of less than 2 ohms. If the reading is higher, clean the shaft again and retest.
- D. After motors with SGR are fully installed in the field (in equipment, assemblies, or individually), for both factory-installed-SGR and field-installed-SGR cases, test for a conductive path to ground using an Ohm meter. Place one probe on metal frame of SGR and one probe on motor frame. Motor must be grounded to common earth ground with variable frequency drive according to applicable standards. Verify that SGR installations and test readings comply with SGR manufacturer's requirements.

END OF SECTION

SECTION 23 05 90
TESTING ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Balancing air systems.
- B. The work covered by this Specification consists in furnishing all labor, engineering and test equipment required to adjust and balance the following:
 - 1. New air distribution systems.
 - 2. Measuring electrical performance of new HVAC equipment.
 - 3. Domestic water recirculation systems.
- C. The TAB Contractor shall be subcontractor of Division 23 Contractor.

1.2 DEFINITIONS

- A. Acronyms used in the specification are as follows:
 - 1. AABC: Associated Air Balance Council.
 - 2. NEBB: National Environmental Balancing Bureau.
 - 3. TAB: Testing, adjusting, and balancing.
 - 4. TABB: Testing, Adjusting, and Balancing Bureau.
 - 5. TAB Specialist: An entity engaged to perform TAB Work.

1.3 SUBMITTALS

- A. Shop Drawings shall be submitted on the work covered under this Section, as shown on the Drawings, as per Section 230500, and per instruction below:
 - 1. Submittals shall include PDF drawings and lists indicating equipment and CFM/GPM tally's done by the TAB Contractor. The submitted documents shall be similar to the final submittal documents required (refer to part 3 of this Section), less actual TAB results.
 - 2. Inform the Engineer of any discrepancies on the plans.
- B. Submit Certified TAB reports to the Engineer.
 - 1. Format: PDF preferred.
 - 2. Certification: By AABC or NEBB.

1.4 PROJECT CONDITIONS

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before completion of test and balance. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Much of the work will need to occur after occupied hours. All costs to perform the work at night or weekends shall be included in bidding this work.

1.5 QUALITY ASSURANCE

- A. Division 23 Contractor shall employ an independent TAB Contractor specializing in total system air and hydronic testing and balancing.
 - 1. All personnel involved in the execution of the work under the TAB Contract shall be experienced and factory-trained specifically in the total balancing of mechanical systems, as well as being regular employees of the TAB Contractor.
- B. The following contractors have been pre-approved to bid the TAB work:
 - 1. Air Dynamics; Granville, ND.
 - 2. Balancing Professionals; Fargo, ND.
 - 3. Design Control, Inc.; Fargo, ND.
- C. Calibrate all instruments and provide verification of calibration provided with submittal data.

1.6 WARRANTY

- A. The TAB agency shall provide an extended 90-day warranty after the completion of the TAB work, during which time the Owner or Engineer can request a rebalancing and retesting of any component listed in the report. The TAB agency shall provide a technician to assist the Owner and/or Engineer in making any tests they may require during this time period.

PART 2 - PRODUCTS (N/A)

PART 3 - EXECUTION

3.1 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts. Rubber or metal snap-in plugs are also acceptable.
 - 2. Install and join new insulation that matches removed materials.
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Verify interlocked systems are operating in conjunction.
- E. Take and report testing and balancing measurements in inch-pound (IP) units.
- F. Report deficiencies discovered before and during performance of testing, adjusting and balancing procedures.
- G. Provide assistance to mechanical contractor to troubleshoot systems with deficiencies outside the allowable limits set in this Specification.
- H. If initial TAB is not performed during near peak summer and winter conditions, perform additional TAB during peak summer and winter conditions.

3.2 REQUIREMENTS FOR AIR SYSTEMS

- A. System Diagrams: Include schematic layouts of air distribution systems. Present each system with minimum single-line diagram.
- B. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer. Record RPM and full load amperes.
 - 1. Measure total airflow in main supply ducts. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
- C. Adjust all supply and exhaust zones to design CFM.
- D. All main supply, return, exhaust and outside air ducts shall have a pitot tube traverse performed for accurate airflow performance. Identify the best locations in ducts for accurate duct airflow measurements.
- E. Test and adjust each diffuser, grille and register to within tolerance requirements and also adjust so as to minimize drafts in all areas.
- F. Installed exhaust hood fans shall be adjusted to CFM requirements as shown on Plans and as specified. Tests of fume hood enclosures shall be made to determine that velocities across openings are in accordance with Safety Codes.
- G. Test and adjust all fresh air quantities to individual heat pumps.
- H. Verify that thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and heat generating appliances.

3.3 REQUIREMENTS FOR DOMESTIC WATER RECIRCULATION SYSTEMS

- A. Measure and record flow at all balancing devices to design flow tolerance.

3.4 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform an inspection of existing equipment that is to remain and be reused.
 - 1. Measure and record the operating speed, airflow, and static pressure of each fan.
 - 2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 - 3. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
 - 1. Compare the indicated airflow of the renovated work to the measured fan airflows.
 - 2. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
 - 3. Balance each air outlet.

3.5 VARIABLE FREQUENCY DRIVES

- A. VFD's on Belt-drive Fans: Sheave fan as required to attain the design airflow with the VFD set at 60 Hz. Fan VFD shall not be used to balance the airflow.
- B. VFD's on Hydronic Pumps: Use VFD to balance the waterflow.

3.6 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans: +5% to -5%
2. Air Outlets and Inlets: +10% to -10%
3. Heating/Cooling Water Flow Rate: +10% to -10%

3.7 FINAL REPORT GENERAL

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Deviation of final performance from design as percentage.
 - c. Notable characteristics of systems.
 - d. Description of system operation sequence if it varies from the Contract Documents.
12. Notes to explain why certain final data in the body of reports vary from indicated values.

3.8 FINAL REPORT RECORDED DATA

A. Motors:

1. Manufacturer.
2. Model or Serial Number.
3. Rated and measured Amperage and Voltage.
4. Rated Horsepower.
5. Rated and measured RPM.
6. Sheave Size, Type and Manufacturer.

B. Fans:

1. Manufacturer.
2. Model or Serial Number.
3. Design and measured CFM.
4. Design and measured RPM.
5. Design and measured Pressures.
6. Pulley Sheave Size, Type and Manufacturer.
7. Belt Size and Quantity.

C. Pumps:

1. Manufacturer.
2. Model or Serial Number.
3. Design and measured GPM.
4. Design and operating Head.
5. Suction and discharge pressure.

D. Expansion Tanks:

1. Static water pressure.

E. Air Systems:

1. For each air inlet and outlet.
 - a. Reference Number/Mark and Location.
 - b. Design and measured CFM.

END OF SECTION

**SECTION 23 07 00
HVAC INSULATION**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Duct Insulation.
 - 2. Fire-rated Insulation Systems.
- B. The work covered by this Specification consists in furnishing all labor, equipment, accessories and materials and in performing all operations necessary for the installation of all insulation for the HVAC systems, in strict accordance with Section 230700 of this Specification and applicable Drawings and subject to the terms and conditions of the Contract.

1.2 REFERENCE

- A. Related work in Section 220700 "Plumbing Insulation."

1.3 SUBMITTALS

- A. Shop Drawings: For materials covered under this section as per Section 230500.
 - 1. Product Data: Each type of insulation.
- B. Operation and Maintenance Data: Per section 230500.
 - 1. Product Data: Each type of thermal and fire-rated insulation systems.

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- B. All insulation shall be installed in a workmanlike manner by skilled workmen regularly engaged in this type of work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Except in other Part 2 articles where noted, the following manufacturers are acceptable:
 - 1. Owens-Corning Fiberglass.
 - 2. Johns Manville.
 - 3. Knauf Insulation.
- B. All manufacturers are subject to compliance with requirements.
- C. Provide products by one of the manufacturers specified or by prior approval.

2.2 COMMON INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

2.3 INSULATION

- A. Fiberglass Wrap: Glass fibers bonded with a thermosetting resin; FSK or ASJ Max jacket. Comply with ASTM C 553, Type II and ASTM C 1290, Type I and Type III.
- B. Flexible Elastomeric Insulation: Product shall be closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - 2. UV Resistant: Required on outdoor installations.
 - 3. Adhesive and protective finish shall be as recommended by manufacturer for sealing all joints and mitered fittings.
- C. Polyolefin Insulation
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - a. Armacell LLC; Tubolit.
 - b. Nomaco Insulation; IMCOLOCK, IMCOSHEET, NOMALOCK, and NOMAPLY
 - 2. Product shall be unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials.
 - 3. Adhesive and protective finish shall be as recommended by manufacturer for sealing all joints and mitered fittings.

2.4 INSULATION JACKETS

- A. ASJ Max Jacket: Poly-encapsulated paper jacket; Factory applied shall comply with ASTM C1136, Type I, II, III, IV.
- B. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; Factory applied shall comply with ASTM C1136, Type II.

2.5 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.6 SEALANTS

- A. Joint Sealants: Permanently flexible, elastomeric sealant, compatible with insulation materials, jackets, and substrates.

2.7 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

2.8 TAPES

- A. Tapes: Match jacket with compatible adhesive as recommended by jacket manufacturer.
- B. ASJ Max Tape: Foil-face, vapor-retarder tape; complying with ASTM C 1136, 3 inches wide.
- C. FSK Tape: Foil-face, vapor-retarder tape; complying with ASTM C 1136, 3 inches wide.
- D. Aluminum-Foil Tape: Vapor-retarder tape, 2 inches wide.
- E. PVC Tape: White vapor-retarder PVC tape, 2 inches wide.

2.9 SECUREMENTS

- A. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - 1. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - 2. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - 3. Adhesive-backed base with a peel-off protective cover.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 12 gauge nickel-copper alloy or 14 gauge soft-annealed, stainless steel or 14 gauge soft-annealed, galvanized steel.

2.10 FIRE-RATED INSULATION SYSTEMS

- A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. CertainTeed Corp.; FlameChek.
 - 2. Johns Manville; Firetemp Wrap.
 - 3. 3M; Fire Barrier Wrap Products.
 - 4. Unifrax Corporation; FyreWrap.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install multiple layers of insulation with longitudinal and end seams staggered.
- C. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- D. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic. Install insulation continuously through hangers and around anchor attachments.

- E. Install insulation with jackets as follows:
1. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip.
 2. Overlap jacket longitudinal seams at least 1-1/2 inches. Staple laps with outward clinching staples along edge.
 3. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 4. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- F. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

- A. Roof/Wall Penetrations: Install insulation continuously through roof/wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof/wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside flashing at least 2 inches.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Fire-Rated Wall and Partition Penetrations:
1. Duct: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
 2. Pipe: Terminate insulation at fire-rated wall and partition penetrations.
 3. See Specification Section 230510 for further Fire-Barrier Penetration requirements.
- D. Floor Penetrations:
1. Duct: For penetrations through fire-rated assemblies, insulate with same procedure as with Fire-Rated Walls.
 2. Pipe: Install insulation continuously through floor penetrations. Seal penetrations through fire-rated assemblies. Install insulation per UL Fire Stop System guidelines for pipe material and size.
 3. See Specification Section 230510 for further Fire-Barrier Penetration requirements.

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate fittings and specialties using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic and reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 4. Stencil or label the outside insulation jacket of each union with the word "union."
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.5 FIBERGLASS INSTALLATION

- A. General Procedures:
1. Apply adhesives according to manufacturer's recommended coverage rates of duct and plenum surfaces.
- B. Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 2. Install pins on sides and bottom of horizontal ducts and sides of vertical ducts wider than 12 inches. Cover exposed pins and washers with tape matching insulation facing.
 3. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier.
- C. Insulation Installation for Tanks and Vessels: Secure with adhesive and anchor pins.
1. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
 2. Do not weld anchor pins to ASME-labeled pressure vessels.
 3. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. Secure each layer of insulation with stainless-steel or aluminum bands.
 5. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
 6. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
 7. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

3.6 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07.

3.7 FLEXIBLE ELASTOMERIC AND POLYOLEFIN FOR PIPE INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive.
- C. Insulation Installation on Valves and Pipe Specialties:
 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
- D. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

3.8 INDOOR DUCT AND PLENUM SCHEDULE

- A. Fiberglass wrap, with FSK jacket:
 1. Supply-Air Ducts and Plenums in attics, concealed spaces and unconditioned spaces.
 2. Tempered-Fresh-Air Ducts in attic spaces.
 3. Exhaust-Air Ducts and Plenums between isolation damper and penetration of building exterior.
 - a. Exception: Lined Exhaust-Air Duct from power roof ventilators.
 4. Mixed-Air Ducts and Plenums.
 5. Dishwasher Exhaust-Air Duct back 10' from roof exhaust fan.
 6. Return-Air Duct and Plenums in attic spaces.
 7. Tempered-Fresh-Air Duct and Plenums in spaces other than attic.
 8. Un-tempered Fresh-Air Duct from air-to-air heat exchangers.
- B. Fiberglass board, welded board pins, with FSK facing and matching label-less FSK tape:
 1. Outdoor-Air Duct and Plenums.
 2. Ducts and Plenums in Mechanical Rooms.
 - a. Provide one of the following additional means of sealing and cladding:
 - i. Mastic-canvas-mastic.
 - ii. Mastic-fiberglass scrim cloth-mastic.
 - iii. Self-adhering, peel and stick, rubberized bitumen jacket.
- C. Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating:
 1. Concealed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenums.
- D. Fire-rated board; thickness as required to achieve 2-hour fire rating:
 1. Exposed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenums.
- E. Insulation not required:
 1. Exhaust-Air Duct except as otherwise
 2. Return-Air Duct and Plenums in indirectly conditioned spaces.
 3. Supply-Air Ducts and Plenums in exposed, conditioned spaces.
 4. Tempered-Fresh-Air Ducts.
 5. Fibrous-glass ducts.
 6. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 7. Factory-insulated flexible ducts.
 8. Factory-insulated plenums and casings.
 9. Flexible connectors.
 10. Vibration-control devices.
 11. Factory-insulated access panels and doors.
 12. Listed grease ducts.

F. Minimum Duct Insulation R-Values

1. Supply ducts, installed in unheated attics and exterior: R-12.
2. Supply ducts, installed in unconditioned spaces, ceiling plenums, and crawl spaces: R-6.
 - a. Exception: Cooling only supply ducts: R-2.
3. Supply ducts, installed in attic with roof insulation: R-2.
4. Return ducts, installed in unheated attics: R-4.
5. Outside air ducts: R-12.
6. Un-tempered Fresh-Air Ducts: R-4.

3.9 EXTERIOR DUCT AND PLENUM INSULATION SCHEDULE

A. Fiberglass board, with self-adhesive outdoor jacket or aluminum jacket.

1. Supply, Return Ducts and Plenums: 2" thick and 3-lb/cu. ft. nominal density, R-8 minimum.

3.10 PIPING INSULATION SCHEDULE

A. Indoor, Aboveground:

1. Refrigerant Suction and Hot-Gas Piping and Tubing: Flexible elastomeric or Polyolefin, 1 inch thick.

B. Outdoor, Aboveground:

1. Refrigerant Suction and Hot-Gas Flexible Tubing:
 - a. Flexible Elastomeric: UV resistant, 1-1/2 inches thick.
 - b. Polyolefin: 1-1/2 inches thick.

END OF SECTION

SECTION 23 20 00
HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes:
 - 1. Pipe and fitting materials, and joining methods for the following:
 - a. Refrigeration piping.
 - b. Natural gas piping.
 - c. Condensate.

1.2 REFERENCE

- A. Refer to Section 230510 "Common Work Results For HVAC" for requirements of hangers, sleeves, sleeve seals, and escutcheons.
- B. ASME B16.51 – Copper and Copper Alloy Press-Connect Pressure Fittings
- C. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
- D. ASTM B75 – Standard Specification for Seamless Copper Tube
- E. ASTM F3226 – Standard Specification for Metallic Press-Connect Fittings for Piping and Tubing Systems
- F. IAPMO PS 117 – Press and Nail Connections
- G. CSA 6.32 / ANSI LC-4 – Metallic Press-Connect Fittings for Fuel Gas Distribution Systems

1.3 SUBMITTALS

- A. Shop Drawings: For equipment covered under this section as per Section 230500.
 - 1. Product Data: Provide a separate shop drawing for each of the following piping systems showing the material and fastening method chosen by the contractor:
 - a. Refrigeration.
 - b. Aboveground natural gas.
 - c. Underground natural gas.
- B. Refrigeration Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.
- C. Operation and Maintenance Manuals: For equipment covered under this section as per Section 230500.

1.4 QUALITY ASSURANCE

- A. All piping shall be installed in a workmanlike manner by skilled workmen regularly engaged in this type of work.
- B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

- C. Installers of press-connect bronze, copper, carbon steel or stainless steel fittings:
 - 1. Installers shall attend a manufacturer's installation training class as having been trained and qualified to join piping with press-connect fittings. On-site training and credentialing by manufacturer's representative is acceptable.
 - 2. Installer shall be a qualified installer, licensed within the jurisdiction, and familiar with the installation of press-connect bronze, copper, carbon steel or stainless steel fittings.
 - 3. Press-connect bronze, copper, carbon steel or stainless steel fittings shall be installed using proper tool, actuator, jaws, and rings as instructed by the manufacturer.

1.5 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified period.
 - 1. Standard Warranty Period: Not less than one year from the date of Substantial Completion.
 - 2. Cold Press Warranty:
 - a. Copper Pressure Seal: Not less than 50 years from the date of installation.
 - b. Steel Pressure Seal: Not less than 15 years from the date of installation.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 - 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

2.2 STEEL PIPE AND FITTINGS

- A. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 "Piping Applications" Article.
- B. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article.
- C. Cold Press Mechanical-Joint Fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - a. Viega, LLC.
 - 2. Fittings: Cold Press Mechanical Joint Fitting shall conform to material requirements of ASTM A420 or ASME B16.3 and performance criteria of ANSI/CSA LC4. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer.
 - a. Gas Fittings: Conform to material requirements of ASME B31.9 and performance criteria of ANSI/CSA LC4a/CSA 6.32a.

2.3 CORRUGATED, STAINLESS-STEEL TUBING

- A. Comply with ANSI/IAS LC 1.
- B. Manufacturers: Subject to compliance with requirements, provide piping by one of the following or other prior approved:
 - 1. OmegaFlex, Inc.
 - 2. Parker Hannifin Corporation; Parflex Division.

3. Titeflex.
 4. Tru-Flex Metal Hose Corp.
- C. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
- D. Coating: PE with flame retardant.
1. Surface-Burning Characteristics: As determined by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.
- E. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends.
- F. Striker Plates: Steel, designed to protect tubing from penetrations.
- G. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections for pipe inlet and corrugated tubing outlets.
- H. Operating-Pressure Rating: 5 psig.

2.4 TRANSITION FITTINGS

- A. Plastic-to-Metal Transition Fittings shall be CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions, and one end with threaded brass or stainless steel insert and one solvent-cement-socket end.
- B. Plastic-to-Metal Transition Unions shall be CPVC four-part union with brass threaded end, solvent-cement-joint plastic end, rubber O-ring gasket, and union nut.

2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Nipple:
 1. Comply with ASTM F1545.
 2. Pressure Rating: 425 psi at 225°F.
 3. Materials: Carbon steel body with crosslinked polyethylene (PEX) plastic insert.
- C. Dielectric Unions:
 1. Standard: ASSE 1079.
 2. Pressure Rating: 125 psig minimum at 180 °F.
 3. End Connections: Solder-joint copper alloy and threaded ferrous.

2.6 GAS PIPING SPECIALTIES

- A. Line Pressure Regulators: Soft valve seat to permit bubble tight lock up under no-flow conditions.
1. Comply with ANSI Z21.18.
 2. Body and Diaphragm Case: Die-cast aluminum or cast iron.
 3. Springs: Zinc-plated steel; interchangeable.
 4. Diaphragm Plate: Zinc-plated steel.
 5. Seat Disc: Nitrile rubber.
 6. Orifice: Aluminum; interchangeable.
 7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.

8. Pressure regulator shall maintain discharge pressure setting downstream and not exceed 150% of design discharge pressure at shutoff.
 9. Overpressure Protection Device: Factory mounted on pressure regulator.
 10. Inlet Emergency Exposure Limits: 65psig with overpressure protection device.
- B. Appliance Flexible Connectors:
1. Indoor, Appliance Flexible Connectors: Comply with ANSI Z21.24 (fixed appliance) or with ANSI Z21.69 (moveable appliance).
 2. Corrugated stainless-steel tubing with polymer coating.
 3. Operating-Pressure Rating: 0.5 psig.
 4. End Fittings: Zinc-coated steel, threaded ends.
 5. Maximum Length: 72 inches.
- C. Gas Filters:
1. Basis of Design: Maxitrol Company, GF1000 Series and HF2000 Series.
 2. Housing: Die-cast aluminum with threaded or flange connections.
 3. Filter Media: Polypropylene fleece mat; 50 microns.
 4. Operating-Pressure Rating: Max 60psi threaded, 87psi flanged.
 5. Operating-Temperature Range: -4°F to 175°F.
 6. Maximum Pressure Drop: 10mbar (4 in-wc).

2.7 REFRIGERATION PIPING FITTINGS

- A. Packed-Angle Valves:
1. Body and Bonnet: Forged brass or cast bronze.
 2. Packing: Molded stem, back seating, and replaceable under pressure.
 3. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
 4. Seal Cap: Forged-brass or valox hex cap.
 5. Rating: 500 psig and 275 °F.
- B. Service Valves:
1. Body: Forged brass with brass cap including key end to remove core.
 2. Core: Removable ball-type check valve with stainless-steel spring.
 3. Seat: Polytetrafluoroethylene.
 4. Rating: 500 psig.
- C. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.
1. Body and Bonnet: Plated steel.
 2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 3. Seat: Polytetrafluoroethylene.
 4. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with conduit adapter, and coil.
 5. Rating: 400 psig and 240 °F.
- D. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
 2. Piston, Closing Spring, and Seat Insert: Stainless steel.
 3. Seat Disc: Polytetrafluoroethylene.
 4. Rating: 400 psig and 240 °F.
- E. Thermostatic Expansion Valves: Comply with ARI 750.
1. Body, Bonnet, and Seal Cap: Forged brass or steel.
 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 3. Packing and Gaskets: Non-asbestos.

4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
 5. Suction Temperature: 40 °F.
 6. Reverse-flow option (for heat-pump applications).
 7. Rating: 450 psig.
- F. Straight-Type Strainers:
1. Body: Welded steel with corrosion-resistant coating.
 2. Screen: 100-mesh stainless steel.
 3. Rating: 500 psig and 275 °F.
- G. Angle-Type Strainers:
1. Body: Forged brass or cast bronze.
 2. Drain Plug: Brass hex plug.
 3. Screen: 100-mesh monel.
 4. Rating: 500 psig and 275 °F.
- H. Moisture/Liquid Indicators:
1. Body: Forged brass.
 2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
 3. Indicator: Color coded to show moisture content in ppm.
 4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
 5. Rating: 500 psig and 240 °F.
- I. Replaceable-Core Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 3. Desiccant Media: Activated alumina or charcoal.
 4. Designed for reverse flow (for heat-pump applications).
 5. Rating: 500 psig and 240 °F.
- J. Permanent Filter Dryers: Comply with ARI 730.
1. Body and Cover: Painted-steel shell.
 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 3. Desiccant Media: Activated alumina or charcoal.
 4. Designed for reverse flow (for heat-pump applications).
 5. Rating: 500 psig and 240 °F.
- K. Liquid Accumulators: Comply with ARI 495.
1. Body: Welded steel with corrosion-resistant coating.
 2. Rating: 500 psig and 275 °F.

2.8 REFRIGERATION PIPING FITTINGS

- A. Refrigerant Flame Free Fittings
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - a. ZoomLock
 2. Material:
 - a. The installer shall confirm the copper tubing conforms to ASTM B280, ASTM B88, or EN 12735-1.
 - b. Fitting Body: Conform to ASTM-B75 or ASTM-B743.

- c. Fitting Sealing O-Rings: Factory installed only, material shall be HNBR or Neoprene (R-22 application only.)
 - d. Threaded Schraeder Valve Access Fittings: Schraeder style valve material and threads conform to SAE J513.
 - e. SAE Threaded Fittings: Flare nuts conform to SAE J513 and SAE J533.
- 3. Fittings to be UL Listed.
- B. Packed-Angle Valves:
 - 1. Body and Bonnet: Forged brass or cast bronze.
 - 2. Packing: Molded stem, back seating, and replaceable under pressure.
 - 3. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
 - 4. Seal Cap: Forged-brass or valox hex cap.
 - 5. Rating: 500 psig and 275 °F.
- C. Service Valves:
 - 1. Body: Forged brass with brass cap including key end to remove core.
 - 2. Core: Removable ball-type check valve with stainless-steel spring.
 - 3. Seat: Polytetrafluoroethylene.
 - 4. Rating: 500 psig.
- D. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.
 - 1. Body and Bonnet: Plated steel.
 - 2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 - 3. Seat: Polytetrafluoroethylene.
 - 4. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with conduit adapter, and coil.
 - 5. Rating: 400 psig and 240 °F.
- E. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
 - 1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
 - 2. Piston, Closing Spring, and Seat Insert: Stainless steel.
 - 3. Seat Disc: Polytetrafluoroethylene.
 - 4. Rating: 400 psig and 240 °F.
- F. Thermostatic Expansion Valves: Comply with ARI 750.
 - 1. Body, Bonnet, and Seal Cap: Forged brass or steel.
 - 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 - 3. Packing and Gaskets: Non-asbestos.
 - 4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
 - 5. Suction Temperature: 40 °F.
 - 6. Reverse-flow option (for heat-pump applications).
 - 7. Rating: 450 psig.
- G. Straight-Type Strainers:
 - 1. Body: Welded steel with corrosion-resistant coating.
 - 2. Screen: 100-mesh stainless steel.
 - 3. Rating: 500 psig and 275 °F.
- H. Angle-Type Strainers:
 - 1. Body: Forged brass or cast bronze.
 - 2. Drain Plug: Brass hex plug.
 - 3. Screen: 100-mesh monel.
 - 4. Rating: 500 psig and 275 °F.

- I. Moisture/Liquid Indicators:
 - 1. Body: Forged brass.
 - 2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
 - 3. Indicator: Color coded to show moisture content in ppm.
 - 4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
 - 5. Rating: 500 psig and 240 °F.
- J. Replaceable-Core Filter Dryers: Comply with ARI 730.
 - 1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
 - 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 - 3. Desiccant Media: Activated alumina or charcoal.
 - 4. Designed for reverse flow (for heat-pump applications).
 - 5. Rating: 500 psig and 240 °F.
- K. Permanent Filter Dryers: Comply with ARI 730.
 - 1. Body and Cover: Painted-steel shell.
 - 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 - 3. Desiccant Media: Activated alumina or charcoal.
 - 4. Designed for reverse flow (for heat-pump applications).
 - 5. Rating: 500 psig and 240 °F.
- L. Liquid Accumulators: Comply with ARI 495.
 - 1. Body: Welded steel with corrosion-resistant coating.
 - 2. Rating: 500 psig and 275 °F.

PART 3 - EXECUTION

3.1 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
- B. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- C. Install radiant heating piping continuous from the manifold through the heated panel and back to the manifold without piping joints in heated panels.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal. Exposed piping shall be run as high as possible except where noted otherwise.
- E. Install piping to permit valve servicing and free of sags and bends.
- F. Install press fittings with a minimum spacing of 1" between fittings.
- G. Select system components with pressure rating equal to or greater than system operating pressure.
- H. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- I. Install drains, consisting of a tee fitting, 3/4" ball valve, and short 3/4" threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- J. Install unions or flanges in piping, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

- K. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- L. Install 3/4" nipple and ball valve in blowdown connection of strainers 2" and larger. Match size of strainer blowoff connection for strainers smaller than 2".
- M. Install sleeves for piping penetrations of walls, ceilings, and floors.
- N. Install sleeve seals for piping penetrations of below grade concrete walls and slabs.
- O. Install escutcheons (chrome plates) for exposed piping penetrations of finished walls, ceilings, and floors.

3.2 REFRIGERANT PIPING INSTALLATION

- A. Install refrigerant piping according to ASHRAE Standard 15.
- B. Install refrigerant piping in protective conduit where installed belowground.
- C. Slope refrigerant piping as follows:
 - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 - 2. Install horizontal suction lines with a uniform slope downward to compressor.
 - 3. Install traps and double risers to entrain oil in vertical runs.
 - 4. Liquid lines may be installed level.
- D. Provide Schrader connection at each isolation valve.
- E. Brazing Procedure: An inert gas (such as nitrogen) shall be continuously passed through the system at a rate sufficient to maintain an oxygen free environment to prevent the formation of copper oxide scale. After piping has been completed, the refrigerant piping system shall be pressure tested at a pressure of 300 psi on the high side and 150 psi on the low side. The pressure shall be maintained on the system for a minimum of 12 hours. The system shall be evacuated when the surrounding ambient air is not less than 60 F. If the temperature is less, auxiliary heat must be provided to insure proper evacuating conditions. A minimum vacuum of 500 Microns of Hg. shall be pulled on the system and maintained for 12 hours. The vacuum pump displacement shall be not less than 2 cfm for up to 15 tons. The system shall be charged as recommended by the equipment manufacturer.
- F. Flame Free Fitting Installation:
 - 1. Follow manufacturer guidelines, instructions and training for examination, preparation, and installation.
 - 2. If any brazing is required, follow manufacturer guidelines and instruction as no allowance shall be made for damaged O-rings.
 - 3. Installer shall cut out tubing with deep incise marks
 - 4. Do not crimp fittings over flared style tubing (ODF).
 - 5. Installer shall ensure piping is spaced such that the crimp gauge can be fit around the piping for crimp checking and the crimp tool and jaws has clearance to fit around the fittings.
 - 6. Place fittings no closer than 1/4" apart.
 - 7. Test for joint tightness per the manufacturer installation instructions.
 - 8. System leak checks shall be performed per the VRF manufacturers' instruction.

3.3 GENERAL GAS PIPING INSTALLATION

- A. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.
 - 1. Construct sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 6 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

- B. Gas filter: Install gas filter of size equivalent to pipe shown on the drawings. Locate the filter after sediment trap and before the regulator. Install per the manufacturer's instructions and per NFPA requirements.
- C. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- D. Connect branch piping from top or side of horizontal piping.
- E. Install unions in pipes 2" and smaller, adjacent to each valve, at final connection to each piece of equipment.
- F. Do not use natural-gas piping as grounding electrode.
- G. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping adjacent to appliances to allow service and maintenance of appliances.
- J. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment. Provide restraining cable from moveable appliances to wall.

3.4 NATURAL GAS PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Connect to regulator at gas meter. Prime and paint all exterior metal piping to protect from corrosion.
 - 1. Clean piping to remove loose dirt and debris prior to applying primer. Sand any rust spots with 220-grit sandpaper; rinse pipe with water and allow to dry.
 - 2. Apply metal primer paint to clean exterior piping.
 - 3. Apply two coats of enamel-based metal topcoat paint. Allow the first coat to thoroughly dry before applying second coat.
- C. All underground service piping to building and all meters and exterior regulators will be furnished and installed by the Utility Company and costs related to this service and meter installation are to be billed directly to the Owner by the Utility Company. It is the Division 23 Contractor's responsibility to coordinate with utility, so the underground gas line is installed at the appropriate time during construction.
- D. Install natural-gas piping electrically continuous and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
 - 1. Corrugated stainless steel tubing (CSST) shall be bonded to the electrical service grounding electrode system. The bonding jumper shall connect to a metallic pipe or fitting between the point of delivery and the first downstream CSST fitting. The bonding jumper shall not be smaller than 6 AWG copper wire or equivalent.

3.5 UNDERGROUND FUEL PIPING INSTALLATION

- A. Installation: By factory certified installers and in accordance with factory published installation instructions.
- B. Protect piping from UV exposure.
- C. Take care to observe manufacturer recommended bend radius. Do not use kinked piping.
- D. Install with 1/8" slope per foot piping back toward tank.

- E. Install piping with factory approved fittings only. Seal all NPT threads with gas and oil resistant pipe sealant.
- F. Use factory approved tools for cutting pipe.
- G. Installation temperature range: 25°F to 135°F.
- H. Backfill materials: Clean, compacted sand, pea gravel, or $\frac{1}{8}$ to $\frac{3}{4}$ " (3.2 to 19 mm) or smaller crushed rock (without sharp edges). Minimum of 6" of fill on all sides, with 4" between pipes.

3.6 REFRIGERANT PIPING FIELD QUALITY CONTROL

- A. This work shall be accomplished by trained refrigeration mechanics whose normal activity is installation and service of refrigeration systems.
- B. Cleaning:
 - 1. Before installation of copper tubing, clean the tubing and fittings using the following cleaning method and procedure:
 - a. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through the tubing.
 - b. Draw a clean, lintless cloth saturated with trichloroethylene through the tube repeatedly until the cloth is not discolored by dirt.
 - c. Draw a clean lintless cloth, saturated with compressor oil, squeezed dry, through the tube to remove remaining lint.
 - d. Finally, draw a clean, dry, lintless cloth through the tube.
- C. Tests and Inspections:
 - 1. Comply with ASME B31.5, Chapter VI.
 - 2. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 - 3. Test high- and low-pressure side piping of each system separately.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.

3.7 REFRIGERATION SYSTEM CHARGING

- A. Charge system using the following procedures:
 - 1. Install core in filter dryers after leak test but before evacuation.
 - 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
 - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
 - 4. Charge system with a new filter-dryer core in charging line.

3.8 HANGERS AND SUPPORTS

- A. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 50 feet long.
 - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 50 feet or longer.
 - 3. Install trapeze hanger for multiple parallel piping 50 feet or longer.
 - 4. Spring hangers to support vertical runs.
 - 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
 7. Install hanger 12" from elbow joint.
- B. Install hangers for steel piping as follows:
1. 1" and smaller: 8 feet with 3/8-inch rod.
 2. 1-1/4" to 3": 10 feet with 3/8-inch rod.
 3. 4" to 6": 12 feet with 1/2-inch rod.
 4. 8" and larger: 12 feet with 5/8-inch rod.
- C. Install hangers for drawn-temper copper piping as follows:
1. 1-1/2" and smaller: 6 feet with 3/8-inch rod.
 2. 2" to 4": 10 feet with 3/8-inch rod.
 3. 6" and larger: 10 feet with 1/2-inch rod.
- D. Install hangers for CPVC and PVC as follows:
1. 1" and smaller: 3 feet with 3/8-inch rod; 8 feet with pipe support channel and 3/8" rod.
 2. 1-1/4" to 3": 4 feet with 3/8-inch rod; 8 feet with pipe support channel and 3/8" rod.
 3. 4" to 6": 4 feet with 1/2-inch rod; 10 feet with pipe support channel and 1/2" rod.
 4. 8" and larger: 4 feet with 5/8-inch rod; 10 feet with pipe support channel and 5/8" rod.
- E. PEX:
1. 1" and Smaller: 3 feet with 3/8-inch rod; 8 feet with pipe support channel and 3/8" rod.
- F. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.
- G. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

3.9 PIPING APPLICATIONS

- A. Piping materials are identified below. If more than one material is listed for an application, selection from materials listed is Contractor's option.
- B. Condensate-Drain Piping:
1. Type M, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
 2. Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.
 - a. Exception: Combustible piping materials located in air plenums shall be completely insulated with approved materials for flame spread and smoke-development.
- C. Refrigeration Piping: Copper, Type ACR L, annealed-temper tubing and wrought-copper fittings with brazed joints. Flame free fittings are acceptable.
- D. Natural Gas Piping:
1. Aboveground: Black steel, Schedule 40, Type E or S, Grade B.
 - a. Paint all steel piping installed on exterior of building to prevent corrosion.
 - b. Malleable-iron threaded fittings or wrought-steel welding fittings: 2-1/2" or smaller.
 - c. Cold Press Mechanical-Joint Fittings:
 - i. 1/2" to 2-1/2".
 - ii. Systems with gas pressure under 5 psi.
 - d. Welded Fittings:
 - i. Systems with gas pressure 5 psi and higher.
 - ii. Piping larger than 2-1/2".
 - iii. Piping in inaccessible areas.
 - e. Unions: Malleable iron with brass-to-iron seat, ground joint, and threaded ends.

- f. Corrugated stainless-steel tubing may be used at following locations:
 - i. From drip leg tee to equipment, 1" or smaller.
 - ii. Inaccessible locations, 1-1/2" or smaller, 75' maximum length.
 - iii. Where noted on drawings.
- 2. Underground:
 - a. Copper, Type ACR L, with factory-applied PE protective coating.
 - b. HDPE piping, approved fittings.
 - c. Stainless steel tubing, ASTM A268 or A269.
 - i. Corrugated stainless steel tubing shall not be used underground.

END OF SECTION

**SECTION 23 30 00
AIR DISTRIBUTION**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Ducts and fittings.
 2. Sheet metal materials.
 3. Sealants and gaskets.
 4. Duct Liners.
 5. Hangers and supports.
 6. Dampers.
 7. Life safety dampers.
 8. Access doors.
 9. Turning vanes.
 10. Duct-mounted access doors.
 11. Flexible connectors.
 12. Flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
1. Procedure: As described per latest edition of the SMACNA manual "HVAC Air Duct Leakage Test Manual."
 2. Coordination: Division 23 contractor shall coordinate and schedule duct installation and the associated pressure testing.
 3. Progress Reports: Submit at intervals of 25%, 50%, 75% and 100% of work completed.
 4. Related Sections: See Section 230590 'Testing Adjusting & Balancing' for additional information.

1.3 SUBMITTALS

- A. Shop Drawings: For equipment covered under this section as per Section 230500.
1. Round ducts and fittings: Materials, drawings of fittings with method of assembly.
 2. Duct Liners: Make and model, performance, materials.
 3. Dampers: Make and model, components, materials, drawings with dimensions and field connections.
 4. Life safety dampers:
 - a. Design Characteristics: Make and model, listings, ratings, components, controls.
 - b. Physical Characteristics: Quantities, materials, drawings with dimensions and field connections.
 - c. Electrical Characteristics: Power requirements, wiring diagrams.
- B. Operation and Maintenance Manuals: For equipment where shop drawings were submitted this section as per Section 230500.

1.4 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified period.
 - 1. VAV Warranty Period: Not less than one year from the date of Substantial Completion.
 - 2. Fabric Duct Warranty Period: Not less than ten years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on 2" static-pressure class unless otherwise indicated.
- B. Ductwork shall be fabricated in accordance with the following schedule. Scheduled gauges are based on galvanized steel. For other materials, this contractor shall increase gauging as required to provide equivalent sheet metal thicknesses:
 - 1. Up to 12" Width: 26 Gauge (0.0217")
 - 2. Up to 30" Width: 24 Gauge (0.0276")
 - 3. Up to 60" Width: 22 Gauge (0.0336")
 - 4. Up to 90" Width: 20 Gauge (0.0396")
 - 5. 90" Width and Up: 18 Gauge (0.0516")

2.2 ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. Fabricated Duct Systems
 - 2. Norlock Metal Products, Inc.
 - 3. SEMCO Incorporated.
 - 4. Spiral Manufacturing Co., Inc.
 - 5. Tangent Air, Inc.
 - 6. United Sheet Metal
- C. Ductwork shall be fabricated in accordance with the following schedule. Scheduled gauges are based on galvanized steel. For other materials, this contractor shall increase gauging as required to provide equivalent sheet metal thicknesses:
 - 1. 3"-14" Diameter: 26 Gauge (0.0217")
 - 2. 15"-26" Diameter: 24 Gauge (0.0276")
 - 3. 28"-36" Diameter: 22 Gauge (0.0336")
 - 4. 38"-50" Diameter: 20 Gauge (0.0396")
 - 5. 52"-60" Diameter: 18 Gauge (0.0516")
 - 6. 61"and Above: 16 Gauge (0.0635")
- D. Transverse Joints in Ducts Larger Than 60 inches in Diameter: Flanged.
- E. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G60.
- C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 RECTANGULAR DUCT CONNECTION SYSTEM

- A. Description: Roll-formed flanges, corner pieces, gasket and metal cleat.
 - 1. Sealer: Integral mastic meeting NFPA 90A and 90B Class I requirements.
 - 2. Gasket: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
 - 3. Schedule: Rectangular ductwork with perimeter greater than 120".

2.5 METAL DUCT SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 - 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 - 2. Tape Width: 4 inches.
 - 3. Water resistant, mold and mildew resistant.
 - 4. Maximum Static-Pressure Class: 6-inch wg, positive and negative.
 - 5. Service: Indoor and outdoor.
 - 6. Service Temperature: Minus 20 to plus 200 °F.
 - 7. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
- C. Water-Based Joint and Seam Sealant (Mastic):
 - 1. Application Method: Brush on.
 - 2. Solids Content: Minimum 65 percent.
 - 3. Water resistant, mold and mildew resistant.
 - 4. Maximum Static-Pressure Class: 6-inch wg, positive and negative.
 - 5. Service: Indoor or outdoor.
 - 6. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Flanged Joint Sealant: Comply with ASTM C 920.
 - 1. General: Single-component, acid-curing, silicone, elastomeric.
 - 2. Type S, grade NS, class 25, use O.
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Round Duct Joint O-Ring Seals:
 - 1. Seal shall provide maximum 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.

2.6 DUCT LINER

A. General Requirements:

1. The manufacturers product identification shall appear on the air stream surface.
2. Duct liner adhesive shall conform to the requirements of ASTM C 916.
3. The finished duct system shall meet the requirements of NFPA 90A and 90B.
4. Maximum flame-spread index of 25 and smoke-developed index of 50.

B. Flexible Elastomeric Liner: Product shall be closed-cell, sponge- or expanded-rubber materials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
2. Additional Requirements:
 - a. UV Resistant: Required on outdoor installations.
 - b. Fungal and Bacterial Resistant:
 - i. UL181 for mold growth.
 - ii. ASTM G21/C 1338 for fungi resistance.
 - iii. ASTM G22 for bacterial resistance.

2.7 DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:

1. Cesco Products; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. NCA Manufacturing, Inc; Metal Industries, Inc.
4. Nailor Industries Inc.
5. Pottorff.
6. Ruskin Company.
7. Vent Products Company, Inc.

B. Backdraft Dampers - Rectangular:

1. Description: Gravity balanced.
2. Up to 2" wg. System Pressure:
 - a. Frame: 0.125"-thick extruded aluminum.
 - b. Blades: Multiple single-piece blades, maximum 6-inch width, 0.050"-thick aluminum with sealed edges.
3. Blade Action: Parallel.
4. Blade Seals: Felt or Vinyl foam for silent operation.
5. Blade Axles: Aluminum.
6. Accessories: Adjustment device to permit setting for varying differential static pressure.

C. Backdraft Dampers - Round:

1. Description: Spring operated. Suitable for vertical airflow, up or down; and horizontal airflow.
2. Frame: 20 ga. galvanized steel.
3. Blades: Multiple single-piece blades, galvanized steel.
4. Blade Seals: Closed cell neoprene foam for silent operation.
5. Blade Axles: Plated steel.

D. Manual Volume Dampers:

1. Standard, Galvanized Steel, Manual Volume Dampers:
 - a. Suitable for horizontal or vertical applications.
 - b. Single blade, or multiple, opposed-blade design.
2. Adjustable quadrants or regulators: Plainly marked to indicate position of damper, with locking nut.

2.8 LIFE SAFETY DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:

1. Cesco Products; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.
4. NCA Manufacturing, Inc; Metal Industries, Inc.
5. Ruskin Company.
6. Vent Products Company, Inc.

B. Fire Dampers:

1. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.
2. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
3. Fire Rating:
 - a. 1-1/2 Hour: Separations rated less than 3 hours.
 - b. 3 Hour: Separations rated 3 hours and up.
4. Frame: Curtain type with blades outside airstream.
 - a. Exception: When mounted behind grilles blades may be in air stream.
5. Mounting Sleeve: Factory- or field-installed, 20 gauge galvanized sheet steel.
6. Mounting Orientation: Vertical or horizontal as indicated.
7. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
8. Heat-Responsive Device: Replaceable, 212 °F rated, fusible links.

2.9 ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:

1. Cesco Products; a division of Mestek, Inc.
2. Ductmate Industries, Inc.
3. Greenheck Fan Corporation.
4. MIFAB.
5. Nailor Industries Inc.
6. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Door: Foam gasket, galvanized sheet metal with 1" insulation fill.

1. Vision panel where noted in Access Door Installation article.
2. Hinges and Latches: Piano hinge and cam latches.
3. Size: 12"x12", unless otherwise noted.

C. Frame: Galvanized sheet steel, with foam gaskets.

2.10 DUCT ACCESS PANEL ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. Ductmate Industries, Inc.
 - 2. Flame Gard, Inc.
 - 3. 3M.
- B. Labeled according to UL 1978 by an NRTL.
- C. Panel and Frame: Minimum thickness 16 gauge carbon steel or 18 gauge stainless steel. Material shall match duct.
- D. Fasteners: Panel fasteners shall not penetrate duct wall.
- E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 °F.

2.11 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. Ductmate Industries, Inc.
 - 2. SEMCO Incorporated.
 - 3. Tuttle & Bailey.
 - 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

2.12 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Either of the following:
 - 1. Factory fabricated with a fabric strip not less than 6" wide attached to two strips of metal compatible with connected ducts.
 - a. Field fabricated with a fabric strip not less than 6" wide clamped to duct by 1"x1"x1/8" angles attached with 5/16 bolts or self-tapping screws, 6" on center.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd.
 - 2. Service Temperature: Minus 40 to plus 200 °F.

- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd.
 - 2. Service Temperature: Minus 50 to plus 250 °F.

2.13 HIGH EFFICIENCY TAKEOFF

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other equivalent:
 - 1. Ductmate Industries, Inc.
 - 2. Lukjan Metal Products.
 - 3. Sheet Metal Connectors, Inc.
- B. Manufactured to conform to SMACNA 2005 duct construction standards:
 - 1. Material: Match duct material, minimum 24 gauge.
 - 2. Body: 45° slope, rectangular opening transition to round.
 - 3. Gasket: EPDM rubber
 - 4. Damper: Minimum 24 gauge, manual volume damper.

2.14 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. Flexmaster U.S.A., Inc.
 - 2. McGill AirFlow LLC.
 - 3. Thermaflex.
 - 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Insulation: Minimum R-3.5, except in attics: R-6.
- C. Flexible Duct Connectors:
 - 1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action.

PART 3 - EXECUTION

3.1 DUCTWORK INSTALLATION

- A. Ductwork shall be run as high as possible in all rooms to maintain proper headroom. Where two or more ducts cross each other, they must be arranged in such a manner as to maintain the greatest possible clearance underneath.
- B. Ductwork shall not cover any electrical outlets or junction boxes. Consult with other trades to avoid interference with piping runs, etc.
- C. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

- D. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- E. Ducts shall conform to dimensions on the Drawings unless location of structural members prohibit. Make minor changes in run of certain ducts without extra cost to the Owner if necessary to avoid unforeseen structural or other interferences.
- F. All ductwork, where internal insulation is to be applied, shall be increased in size so the net internal dimension is that indicated on the Drawings.
- G. In case of a change in dimension, cross-sectional areas shall be maintained. Changes in size throughout shall be of perfect rectangular cross sections with a slope of approximately 1 to 4. Abrupt changes or offsets will not be accepted.
- H. All ducts shall be straight and smooth on the inside with finished joints. No inside standing seams will be permitted in ductwork. No single thickness partitions shall be allowed between ducts. The Engineer reserves the right to order any open seams or joints made tight by caulking or taping. No open joints at corners or elsewhere will be allowed.
- I. Where space permits, elbows shall have a centerline radius equal to 1½ times their width. Shorter radius and square throat elbows shall be used where required to fit restricted areas only and where required by the duct connection details on the Drawings. All short radius and square throat elbows shall be provided with turning vanes.
- J. All vertical ducts or risers shall be self-supporting.

3.2 METAL DUCT SEALING

- A. Seal ducts for duct static-pressure, and seal levels specified in "Duct Schedule" Article.
- B. Leakage Class Definition: Leakage class of 6 means that 6 cfm of leakage per 100 sq ft of duct surface is the maximum allowable threshold if tested at 1 inch test pressure.
- C. Duct Seal Levels Definitions:
 - 1. Level A: All transverse joints, longitudinal seams, and duct wall penetrations. Pressure sensitive tape shall not be used as the primary sealant, unless it has been certified to comply with UL-181A or UL-181B and the tape is used in accordance with that certification.
 - 2. Level B: All transverse joints, and longitudinal seams. Pressure sensitive tape shall not be used as the primary sealant, unless it has been certified to comply with UL-181A or UL-181B and the tape is used in accordance with that certification.
 - 3. Level C: Transverse joints only.

3.3 DUCT LINER INSTALLATION

- A. All ducts requiring insulation shall be lined by carefully adhering the liner in a continuous piece to clean, flat metal sheets with a quick tacking, fire-retardant adhesive.
- B. Coated side of duct liner shall face the air stream.
- C. All exposed edges shall be coated with adhesive.
- D. Ducts over 24" width or breadth shall have liner additionally secured with spot welded pins and washers, one pin and washer to each two square feet of duct liner.

3.4 CONNECTIONS

- A. Make connections to inlet and outlet of all fans and air handling units with flexible connectors.
 - 1. Exception: Fan housings that have the entire fan and motor assembly isolated for vibration.
- B. Connect supply flexible duct to main duct with high efficiency takeoff.
- C. Connect diffusers or light troffer boots to ducts with maximum 10-foot lengths of flexible duct.

3.5 LIFE SAFETY DAMPER INSTALLATION

- A. Install dampers in accordance with manufacturer's UL Installation Instructions, labeling, and NFPA 90A at locations indicated on the drawings. Any damper installation that is not in accordance with the manufacturer's UL Installation Instructions must be approved prior to installation.
- B. Dampers must be accessible to allow inspection, adjustment, and replacement of components. The sheet metal contractor shall furnish any access doors in ductwork or plenums required to provide this access.

3.6 ACCESS DOOR INSTALLATION

- A. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. Upstream of duct coils.
 - 2. Downstream from control dampers and backdraft dampers.
 - 3. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links.
 - 4. Downstream from humidifiers. Include vision panel.
 - 5. Elsewhere as indicated.
- B. Label access doors according to Section 230510, Article "Equipment and Warning Labels" to indicate the purpose of access door.

3.7 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 - 3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.

3.8 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
 - 1. Underground Ducts: May be constructed from one of the following:
 - a. Concrete-encased, galvanized sheet steel.
 - b. Fiberglass reinforced plastic.
 - c. HDPE Duct.
 - d. Concrete-encased, PVC.
- B. Supply Ducts:
 - 1. Pressure Class: Minimum of 0.25-inch wg. greater than scheduled static pressure of attached supply fan.

2. Duct seal levels for pressure class up to 2-inch w.c.:
 - a. Outdoor: A
 - b. Unconditioned Spaces: B
 - c. Conditioned Spaces: C
 3. Duct seal levels for pressure class greater than 2-inch w.c.:
 - a. Outdoor: A
 - b. Unconditioned Spaces: A
 - c. Conditioned Spaces: B
- C. Return Ducts:
1. Pressure Class: Minimum of 0.25-inch wg. greater than scheduled static pressure of attached supply fan.
 2. Duct seal levels for all pressure classes:
 - a. Outdoor: A
 - b. Unconditioned Spaces: B
 - c. Conditioned Spaces: C
- D. General Exhaust Ducts:
1. Pressure Class: Minimum of 0.25-inch wg. greater than scheduled static pressure of attached exhaust fan.
 2. Duct seal levels for all pressure classes:
 - a. Outdoor: C
 - b. Unconditioned Spaces: C
 - c. Conditioned Spaces: B
- E. Intermediate Reinforcement:
1. Reinforcement:
 - a. Angle type: 1-1/2" x 1-1/2" x 1/8" thick.
 - b. Zee type: 1" (h) x 3/4" (w) x 1/8" thick
 - c. Channel type: 1-1/8" (h) x 3" (w) x 1/8" thick
 2. Spacing: 5 feet
 - a. Up to 1" static: Ducts and plenums over 60".
 - b. Up to 3" static: Ducts and plenums over 48".
 - c. Over 3" static: Ducts and plenums over 36".
- F. Elbow Configuration:
1. Rectangular Duct, Elbow:
 - a. Supply: Mitered with vanes.
 - b. Return: Mitered with vanes where indicated.
 2. Rectangular Duct, Radius:
 - a. No Vanes: Minimum radius is equal to duct width.
 - b. With Vanes: Minimum radius is equal to 1/2 of duct width.
 3. Round Duct, Minimum Centerline Radius:
 - a. Up to 18" diameter duct: 1/2 duct diameter.
 - b. 19" diameter duct and larger: Same as duct diameter.
- G. Branch Configuration: high-efficiency take-off.
1. Saddle tap allowed on existing round duct.

3.9 DUCT LINER SCHEDULE

- A. 1/2" Duct Liner:
1. Where indicated on drawings.

2. Return air ductwork for rooftop units.
 - a. Use fiber-free duct line.
 - b. Install an access panel at each elbow with turning vanes back to the unit for inspection purposes.

3.10 DUCT PAINTING SCHEDULE

- A. All painting, if required, is by others.

END OF SECTION

**SECTION 23 34 00
FANS AND FAN SYSTEMS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Cabinet fans (ceiling).
 - 2. Cabinet fans (inline).
 - 3. Dust Collection System.
 - 4. Air Scrubber.

1.2 SUBMITTALS

- A. Shop Drawings: For equipment covered under this section as per Section 230500.
 - 1. Fan Product Data: Include certified performance curves and rated capacities, dampers, motor ratings, and accessories for each type of product indicated. Indicate fan's operating point on curves.
- B. Operation and Maintenance Manuals: For equipment covered under this section as per Section 230500.

1.3 QUALITY ASSURANCE

- A. Motors: Comply with requirements in Section 230520 "General Motor Requirements."

1.4 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified period.
 - 1. Fan Warranty Period: Not less than one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Except where otherwise noted, the following general requirements shall apply:
 - 1. Fans shall bear the AMCA Certified Ratings Seal for air performance.

2.2 FANS GENERAL REQUIREMENTS

- A. Factory-installed and -wired disconnect switch located in line of sight to the fan.
 - 1. Fans installed inside buildings shall have minimum NEMA 1 rating for indoor use.
 - 2. Fans installed outside buildings shall have minimum NEMA 3 rating for outdoor use.
- B. Fan Wheel: Statically and dynamically balanced in accordance to AMCA Standard 204-05.
- C. Propeller Wheel:
 - 1. Securely attached to fan shaft, keyed.
- D. Centrifugal Backward-Inclined Wheels:
 - 1. Single-width-single-inlet and double-width-double-inlet construction with curved inlet flange, backplate, backward-inclined blades, and fastened to shaft with set screws.
 - 2. Welded or riveted to flange and backplate; cast-iron or cast-steel hub riveted to backplate.

E. Centrifugal Forward-Curved Wheels:

1. Black-enameled or galvanized-steel construction with inlet flange, backplate, shallow blades with inlet and tip curved forward in direction of airflow.
2. Mechanically secured to flange and backplate; cast-steel hub swaged to backplate and fastened to shaft with set screws.

F. Shafts:

1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
2. Turned, ground, and polished hot-rolled steel with keyway; anti-corrosive coating.

G. Grease-Lubricated Shaft Bearings:

1. Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing.
2. Minimum L_{10} life in excess of 100,000 hours (equivalent to L_{50} average life of 500,000 hours), at maximum cataloged operating speed.
3. Bearing Lubrication: Extended lube lines with Zerk fittings. Permanently lubricated bearings not allowed unless otherwise noted.

H. Belt Drives:

1. Belt Tensioning: Factory mounted, automatic spring-loaded idler pulley that maintains constant tension on the drive belt.
2. Service Factor Based on Fan Motor Size: 1.5.
3. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
4. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
5. Belts: Oil resistant, nonsparking, and nonstatic.
6. Belt Guards: Fabricate to comply with OSHA and SMACNA requirements of diamond-mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.
7. Motor Mount: Adjustable for belt tensioning and motor adjustment.

I. Lifting Lugs:

1. Clearly labelled and readily accessible without tools.
2. Designed for standard lifting hooks, anchor shackles, or clevis.

J. Nameplate:

1. Die stamped metal plate.
2. Motor Voltage, Horsepower, Hz, Phase, and RPM.
3. Design CFM, Static Pressure, Fan RPM, and Max RPM.

2.3 MANUFACTURERS

A. Except in other Part 2 articles where noted, the following manufacturers are acceptable:

1. Acme.
2. Carnes.
3. Captive-Aire.
4. Cook.
5. JencoFan.
6. Greenheck.
7. New York Blower.

8. Peerless Blowers.
 9. PennBarry.
 10. S&P Ventilation Systems.
 11. Twin City Fan & Blower; Twin City Fan Companies, Ltd.
- B. All manufacturers are subject to compliance with requirements.
- C. Provide products by one of the manufacturers specified or by prior approval.

2.4 CABINET FANS (CEILING)

- A. Description: Factory assembled with one or more centrifugal wheels, direct drive, enclosed in housing, with inlet grille and integral backdraft damper; AMCA rated.
- B. Housing: Steel, lined with acoustical insulation, outlet collar.
- C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft with motor and fan mounted with resilient isolators. Fan shrouds, motor, and fan wheel shall be removable for service.
- D. Grille: Plastic, non-yellowing, louvered designer grille.
- E. Electrical Requirements: Junction box for electrical connection in housing and receptacle for motor plug-in.
- F. Accessories:
 1. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
 2. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.

2.5 CABINET FANS (INLINE)

- A. Description: Inline, duct mounted fans of the centrifugal, belt and direct drive.
- B. Housing: Split, spun aluminum, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting, removable panels for service access, spring loaded backdraft damper.
- C. Direct-Drive Units: Motor mounted in airstream on vibration isolators, with junction box for electrical connection in housing and receptacle for motor plug-in.
 1. Fan Wheels: Steel or polypropylene for smaller sizes.
- D. Belt-Driven Units:
 1. See Fan General Requirements article above.
 2. Motor mounted on adjustable base, factory wired to disconnect switch.
 3. Fan Wheels: Galvanized steel.
- E. Accessories:
 1. Insulated Housing: Fiberglass liner.
 2. Provide vibration isolators between mounting supports and fan housing.

2.6 DUST COLLECTION SYSTEM

- A. Description: Dust collection system consisting of an American Air Filter AIVY to collect larger particles and act as a spark-arrestor to minimize risk of fire. Coated with enamel.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 1. American Air Filter.
- C. Description:
 1. Plug & play compact dust collector.

2. 4800 CFM
 3. Provide NFPA compliance options for handling combustible dust.
 4. Electrical: 208v-3ph-60Hz
 5. Motor: 15 HP open drip proof, fan cooled.
 6. Filters: RED Clean Nanofiber high-performance cartridge with a flame-retardant finish
- D. Compressed Air Manifold:
1. Built-in compressed air cleaning system
- E. Filter Cleaning Controller:
1. Input power: 208v
 2. Pulse controller power: 24v
 3. Enclosure: NEMA 4/4X
 4. Certification: UL 508A
 5. Compressed Air: 3 SCFM @ 100 psig
- F. Fan: Material handling type with spark-proof aluminum alloy wheel.
1. Motor: Totally enclosed, fan cooled motor.
- G. Electrical Panel:
1. Compact and pre-wired
- H. Dust Bin:
1. 26 gallon capacity

2.7 ISOLATION VALVE

- A. As manufactured by Boss Products.
1. Product Code: 50200
 2. Description:
 - a. The VIGIFLAP is an explosion isolation valve designed to prevent propagation of overpressure of flame front caused by an explosion.
 - b. The valve can be held open either by airflow or a proprietary locking mechanism.
 - c. Used in the event of an explosion in the dust collector on the inlet side.
 - d. Valve must comply with NFPA guidelines and is an ATEX Certified device for the containment of explosions.
 3. Equivalent valve by prior approval only.

2.8 FLAMELESS VENT

- A. As manufactured by Rembe
1. Installation shall meet the requirements of NFPA 68.

2.9 AIR SCRUBBER

- A. Manufacturer: SureSeal
- B. Type: 2 stage prefilter and secondary filter
- C. Construction: 16 gauge galvanized steel, "Z" channel support members, fully gasketed tracks and doors.
- D. Filters: Designed to accommodate ASHRAE rated filters that are 6" to 36" in depth.
- E. Performance Data:
1. Dimension: 46"W x 39"H x 22"D

2. Airflow: 4800 CFM
3. Face Velocity: 400 FPM

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's product data, including technical bulletins, product catalog installation instructions.
- B. Examine areas to receive fans. Notify the Engineer of conditions that would adversely affect installation or subsequent utilization and maintenance of fans. Ensure roof openings are square, accurately aligned, and correctly located.
- C. Install fans system as indicated on the Installation, Operation and Maintenance Manual (IOM) and contract drawings.
- D. For dryer booster fans, mount pressure switch in the exhaust duct behind the dryer in the dryer vent recessed box.

3.2 DUST COLLECTOR INSTALLATION

- A. Install dust collector on support structure or on concrete base as indicated. Comply with requirements in Division 03 for concrete pads.
- B. Maintain manufacturer's recommended clearances for service and maintenance.
- C. Visually verify proper rotation of fan wheel.
- D. Verify airtight seal between the cyclone and dust storage container.

3.3 PROTECTION

- A. Protect installed product and finished surfaces from damage during construction to ensure that, except for normal weathering, devices will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Grilles, Registers, and Diffusers.
 - 2. Louvers.

1.2 SUBMITTALS

- A. Shop Drawings: For equipment covered under this section as per Section 230500.
 - 1. Louver Product Data: Show frame profiles and blade profiles, angles, and spacing. Include color selection chart.
- B. Operation and Maintenance Manuals: For equipment covered under this section as per Section 230500.

1.3 REFERENCE STANDARDS

- A. ASHRAE 70 – Method of Testing the Performance of Air Outlets and Air Inlets
- B. ASTM 610 – Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces
- C. ASTM 714 – Test Method for Evaluating Degree of Blistering of Paints
- D. ASTM D1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
- E. ASTM D1654 – Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
- F. ASTM D4752 – Standard Practice for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND GENERAL REQUIREMENTS

- A. Products: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. Grilles, Registers, and Diffusers
 - a. Anemostat Products: a Mestek company.
 - b. Carnes.
 - c. Hart & Cooley Inc.
 - d. Krueger.
 - e. Nailor.
 - f. Price Industries.
 - g. Shoemaker.
 - h. Titus.
 - i. Tuttle & Bailey.
- B. General Diffuser Requirements:
 - 1. Devices shall be specifically designed for variable-air-volume flows.
 - 2. Material: Steel or aluminum.
 - 3. Finish: Baked enamel.

C. General Registers and Grilles Requirements:

1. Material: Steel or aluminum.
2. Finish: Baked enamel.
3. Damper Type: Adjustable opposed blade per Drawing schedule.

D. Filter Grilles:

1. Mounting Frame: Accept standard two inch filter media (by others).
2. Filter Access: Hinge grille from filter frame or removeable grille from filter frame.
3. Fasteners: Quarter turn type.

2.2 GRILLES AND REGISTERS

A. Linear Bar Grille or Diffuser

1. Description: Steel louvered grille suitable for supply or return.
2. Construction
 - a. Steel
 - b. Single fixed deflection, spacing and width per the Drawings.
 - i. Run blades parallel to the long dimension of the grille unless otherwise noted or scheduled on the Drawings.
 - ii. Floor Grilles: Include pencil-proof core spacing
 - c. Units wider than 18 inches: supply in multiple sections with mounting channels as required.
 - i. Units wider than 12 inches are not to be used in floor applications.
 - d. Border and Fastening:
 - i. Grilles shall be provided compatible with the floor, sill or wall they shall mount to as scheduled on the Drawings.
 - ii. Floor mounted grilles shall be fastened to the floor.
3. Paint and Finish:
 - a. Wall or ceiling mounted units: Baked enamel, as scheduled on the drawings.
 - b. Floor mounted units: brushed and clear-coated frame, clear-coated bars.
4. Options: As scheduled on the drawings.
 - a. Damper
 - i. Floor Applications: Provide blade type damper with face-accessible operated screwdriver operator.
 - b. Heavy duty floor grilles: Include a removable core.

B. Adjustable Louvered Grilles and Registers

1. Description: Steel or aluminum louvered grille or register suitable for supply or return.
2. Construction
 - a. Steel
 - b. Single deflection or double deflection per the Drawings.
 - c. Supply Grilles:
 - i. Face Blades: adjustable horizontal or vertical spaced as scheduled on the Drawings.
 - ii. Rear Blades: adjustable horizontal or vertical spaces as scheduled on the Drawings.
 - d. Return Grilles:
 - i. One set of fixed deflection blades, deflection and spaces as scheduled on the Drawings.
 - e. Blade orientation: as scheduled on the Drawings.
3. Frame: Grilles are to be compatible with the ceiling type as scheduled on the Drawings and the architects Reflected Ceiling Plan.
4. Paint and Finish: as scheduled on the drawings.

5. Options: As scheduled on the drawings.
 - a. Opposed Blade Damper
 - b. Border: where grilles are smaller than the lay-in tile, the grille shall be mounted in a steel border of the same size as the ceiling. Paint and Finish to be same as grille.
- C. Heavy Duty Gym Grille
1. Description: Steel or aluminum heavy duty louvered grille for return in areas of high traffic or athletics.
 2. Construction
 - a. Border: 14-gauge steel, smooth contours
 - b. Grilles: Steel, fixed louver type, 45° deflection, 3/8" on center blade spacing.
 - c. Blade orientation: as scheduled on the Drawings.
 3. Frame: As scheduled on the drawings.
 4. Paint and Finish: As scheduled on the drawings.
 5. Options: As scheduled on the drawings.
 - a. Opposed Blade Damper
- D. Fixed Face Grille
1. Description: Aluminum egg crate grille with cubical grid core for use as return or exhaust.
 2. Construction
 - a. Aluminum
 - b. 1/2" x 1/2" x 1/2" grid, 0° core.
 3. Frame: Grilles are to be compatible with the ceiling type as scheduled on the Drawings and the architects Reflected Ceiling Plan.
 4. Paint and Finish: as scheduled on the drawings.
 5. Options: As scheduled on the drawings.
 - a. Opposed Blade Damper
 - b. Border: where grilles are smaller than the lay-in tile, the grille shall be mounted in a steel border of the same size as the ceiling. Paint and Finish to be same as grille.

2.3 CEILING DIFFUSERS

- A. Square Plaque Ceiling Diffuser
1. Description: Square plaque diffuser for 360° radial, horizontal air delivery.
 2. Construction:
 - a. Steel, consisting of a seamless, one-piece formed backpan with a round inlet collar.
 - b. Inner Plaque: Removable, installed no more than 1/4" below the ceiling plane
 - c. Face Panel: Smooth edged with rounded corners.
 - d. Diffusers are to be compatible with the ceiling type as scheduled on the Drawings and the architects Reflected Ceiling Plan.
 3. Paint and Finish: As scheduled on the Drawings.
 4. Options: As scheduled on the Drawings.
 - a. Steel Panel: where diffusers are smaller than the lay-in tile, the diffuser shall be mounted in a steel panel of the same size as the ceiling. Paint and Finish to be same as diffuser.

2.4 LOUVERS

- A. Description: Stationary, horizontal, extruded, drainable head, sloped sill.

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. Airolite Company, LLC (The).
 - 2. American Warming and Ventilating, Inc.; a Mestek company.
 - 3. Arrow United Industries; a division of Mestek, Inc.
 - 4. Greenheck Fan Corporation.
 - 5. Industrial Louvers, Inc.
 - 6. NCA Manufacturing, Inc; Metal Industries, Inc.
 - 7. Nailor Industries, Inc.
 - 8. Pottorff.
 - 9. Ruskin Company; Tomkins PLC.
- C. Material: ASTM B 221, Aluminum Alloy 6063-T5, T-52, or T6.
- D. Construction:
 - 1. Depth: 4 inches.
 - 2. Blade and Frame Thickness: 12 gauge.
- E. Intake Louver Blades: Additional offset or "rain hook" for extra protection against water penetration.
- F. Finish: Anodized finish. Paint to be selected by the Architect during shop drawings. Provide physical color chip for selection.
- G. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
 - 1. Louver Test Reports: Based on tests performed according to AMCA 500-L.
- H. Screen: Aluminum, 1/2" square mesh, 16 gauge wire.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's product data, including technical bulletins, product catalog installation instructions.
- B. Install grilles, registers, and diffusers level and plumb.
- C. Install grilles, registers, and diffusers with an airtight connection to the duct system they serve, and to allow service and maintenance of any accessories, dampers, air extractors or fire dampers within.
- D. Install supply, return, and exhaust air grills/diffusers a minimum 3' away from all smoke/heat detection devices used in the fire alarm system. Field coordinate location of these devices with the pertinent contractors.
- E. Ceiling-Mounted Air Outlets and Inlets: The Drawings indicate a general arrangement of ducts, fittings and accessories. The locations of GRD elements shown on the Drawings are intended to achieve airflow pattern, air volume, noise criteria, throw patterns, and pressure drop design criteria. Place diffusers where indicated on the Drawings as much as is practical. If any other disciplines items or architectural feature interfere with the position or adversely affect the throw of a diffuser, notify the Architect/Engineer for a determination on final placement.
- F. For units installed within a lay-in ceiling tile, install the unit in the center of a manufacturer provided panel matching the construction, paint and finish of the unit. Size the manufacturer panel the same as the surrounding lay-in tile.

3.2 ADJUSTMENT

- A. General: Prior to Air Balancing, adjust all grille, register, and diffuser air patterns as indicated on the drawings, or as directed.

3.3 CLEANING

- A. Clean as recommended by manufacturer. Do not use material or methods which may damage finish surface or surrounding construction.

3.4 PROTECTION

- A. Protect installed product and finished surfaces from damage during construction to ensure that, except for normal weathering, devices will be without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 23 54 00
FURNACES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Furnace.
 - 2. Integrated water heater & air handler.
 - 3. Air conditioning components.
 - 4. Thermostats.

1.2 SUBMITTALS

- A. Shop Drawings: For equipment covered under this section as per Section 230500.
- B. Operation and Maintenance Manuals: For equipment covered under this section as per Section 230500.

1.3 QUALITY ASSURANCE

- A. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- B. Motors: Comply with requirements in Section 230520 "General Motor Requirements."

1.4 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified period.
 - 1. Warranty Period: Not less than one year from the date of Substantial Completion.
- B. Furnace: Commencing on Date of Substantial Completion:
 - 1. Furnace Heat Exchanger: 20 years.
 - 2. Integrated Ignition and Blower Control Circuit Board: Not less than five years.
 - 3. Draft-Inducer Motor: Not less than five years.
 - 4. High-Efficiency Oil Furnace Burner: Not less than three years.
 - 5. Refrigeration Compressors: Not less than 10 years.
 - 6. Evaporator and Condenser Coils: Not less than Five years.

PART 2 - PRODUCTS

2.1 FURNACES, GAS-FIRED, CONDENSING

- A. Description: Factory assembled, piped, wired, and tested gas-fired, condensing furnaces; complying with NFPA 54.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. Amana Heating & Air Conditioning; Goodman Manufacturing Company, L.P.
 - 2. American Standard Companies, Inc.
 - 3. Arcoaire Air Conditioning & Heating.
 - 4. Armstrong Air.
 - 5. Bryant Heating & Cooling Systems; Div. of United Technologies Corp.
 - 6. Carrier Corporation; Div. of United Technologies Corp.
 - 7. Comfortmaker Air Conditioning & Heating.

8. Heil Heating & Cooling Products.
 9. Lennox Industries Inc.
 10. Rheem Manufacturing Company; Air Conditioning Division.
 11. Ruud Air Conditioning Division.
 12. Tempstar Heating & Cooling Products.
 13. Trane.
 14. YORK; a Johnson Controls company.
- C. Cabinet: Steel, baked enamel finish.
1. Cabinet interior around heat exchanger shall be factory-installed insulation.
 2. Lift-out panels shall expose burners and all other items requiring access for maintenance.
 3. Factory paint external cabinets in manufacturer's standard color.
- D. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.
1. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.
- E. Air Filters:
1. Disposable Filters: 2-inch-thick fiberglass media in sheet metal frame.
 2. Provide three extra sets of filters.
- F. Type of Gas: Natural.
- G. Heat Exchanger:
1. Primary: Aluminized or stainless steel.
 2. Secondary: Stainless steel.
- H. Burner:
1. Gas Valve: 100 percent safety two-stage main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
 2. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.
- I. Gas-Burner Safety Controls:
1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
 2. Flame Rollout Switch: Installed on burner box; prevents burner operation.
 3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.
- J. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings prepurges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.
- K. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories.
1. Thermostat: Wall mounted, single stage, heating and cooling.

2.2 AIR CONDITIONING COMPONENTS

- A. General Refrigeration Component Requirements:
1. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Standard for Buildings except Low-Rise Residential Buildings."

- B. Refrigerant Coil: Copper tubes mechanically expanded into aluminum fins. Comply with ARI 210/240, "Unitary Air-Conditioning and Air-Source Heat Pump Equipment." Match size with furnace. Include condensate drain pan with accessible drain outlet.
 - 1. Refrigerant Coil Enclosure: Steel, matching furnace and evaporator coil, with access panel and flanges for integral mounting at or on furnace cabinet and galvanized sheet metal drain pan coated with black asphaltic base paint.
 - 2. Drain Hose: For condensate.
- C. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
- D. Air-Cooled, Compressor-Condenser Unit:
 - 1. Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
 - 2. Compressor: Hermetically sealed reciprocating or scroll type.
 - a. Crankcase heater.
 - b. Vibration isolation mounts for compressor.
 - c. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - d. Two-speed compressor motors shall have manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - 3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.
 - 4. Fan: Aluminum-propeller type, directly connected to motor.
 - 5. Motor: Permanently lubricated, with integral thermal-overload protection.
 - 6. Low Ambient Kit: Permits operation down to 45 °F.
 - 7. Mounting Base: 4" concrete pad.

2.3 THERMOSTATS

- A. Solid-State Thermostat:
 - 1. Type: Wall-mounting, programmable, microprocessor-based unit.
 - 2. Heat/Cool Switching: Automatic.
 - 3. Exposed set point.
 - 4. Exposed indication.
 - 5. Deg F indication.
 - 6. Battery backup protection against power failure for program settings.
 - 7. Programmability: Seven-day with minimum of four temperature presets per day.
- B. Two-Stage, Heating-Cooling Thermostat:
 - 1. Heat-Off-Cool switch.
 - 2. Fan on-auto switch.
 - 3. Exposed set point.
 - 4. Exposed indication.
 - 5. Deg F indication.
- C. Control Wiring: Unshielded twisted-pair cabling.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's product data, including technical bulletins, product catalog installation instructions.

- B. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.
- C. Suspended Units: Suspend from structure using threaded rods, spring or elastomeric hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.
- D. Controls: Install thermostats at mounting height of 48 inches above floor to center of device.
 - 1. Line voltage thermostats installed by Electrical Contractor.
- E. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.
- F. Install ground-mounted, compressor-condenser components on 4-inch- thick, reinforced concrete base; 4 inches larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 03.

3.2 CONNECTIONS

- A. Drawings indicate general arrangement of gas piping, fittings, and specialties. Connect gas piping with union or flange and appliance connector valve.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Install condensate drains to indirect waste. Provide neutralizer for condensate from flue.
- D. Vent and Outside-Air Connection, Condensing, Gas-Fired Furnaces: Connect plastic piping vent material to furnace connections and extend outdoors. Terminate vent outdoors with a cap and in an arrangement that will protect against entry of birds, insects, and dirt.
 - 1. Slope pipe vent back to furnace or to outside terminal.
- E. Connect ducts to furnace with flexible connector. Comply with requirements in Section 233100.
- F. Connect refrigerant tubing to refrigerant coil in furnace and to air-cooled, compressor-condenser unit.
- G. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.
- H. Install new filters in each unit within 14 days after Substantial Completion.

END OF SECTION

**SECTION 23 55 00
FUEL-FIRED HEATERS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Unit heaters, gas-fired.
 - 2. Thermostats.

1.2 SUBMITTALS

- A. Shop Drawings: For equipment covered under this section as per Section 230500.
 - 1. Include rated capacities, operating characteristics, and accessories.
 - 2. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Wiring Diagrams: Power and control wiring.
- B. Operation and Maintenance Manuals: For equipment covered under this section as per Section 230500.

1.3 QUALITY ASSURANCE

- A. Motors: Comply with requirements in Section 230520 "General Motor Requirements."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Tube heaters shall be certified to the ANSI Z83.20 standard and bear the CSA certification label.

1.4 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified period.
 - 1. Warranty Period: Not less than one year from the date of Substantial Completion.
- B. Fuel-fired unit heaters: Not less than five years from the date of Substantial Completion.
- C. Tube heaters:
 - 1. Tube Exchangers: Not less than five years from the date of Substantial Completion.
 - 2. Burner: Not less than ten years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 UNIT HEATERS, GAS-FIRED

- A. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.8/CSA 2.6.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. Lennox Industries, Inc.
 - 2. Modine Manufacturing Company.
 - 3. Reznor/Thomas & Betts Corporation.

- 4. Sterling HVAC Products; Div. of Mestek Technology Inc.
- C. Type of Gas: Natural.
- D. Type of Venting: Indoor, separated combustion, power vented.
- E. Housing: Steel, with integral draft hood and inserts for suspension mounting rods.
- F. Heat Exchanger: Aluminized or stainless steel.
- G. Burner Material: Aluminized steel with stainless-steel inserts.
- H. Unit Fan: Propeller blades riveted to heavy-gage steel spider bolted to cast-iron hub, dynamically balanced, and resiliently mounted.
- I. Controls: Regulated redundant gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
 - 1. Gas Control Valve: Single stage.
 - 2. Ignition: Electronically controlled electric spark with flame sensor.
 - 3. Fan Thermal Switch: Operates fan on heat-exchanger temperature.
 - 4. Control transformer. Minimum 50 VA, or as coordinated with the Division 230900 contractor for their requirements to be met + 10% capacity.
 - 5. High Limit: Thermal switch or fuse to stop burner.
- J. Thermostat: Wall mounted, single stage, heating only.
- K. Accessories:
 - 1. Vertical discharge louvers.
 - 2. Power Venter: Centrifugal aluminized-steel fan, with stainless-steel shaft; 120-V ac motor.

2.2 THERMOSTATS

- A. Single-Stage, Heating-Only Thermostat:
 - 1. Heat-Off switch.
 - 2. Fan on-Auto switch.
 - 3. Exposed set point.
 - 4. Exposed indication.
 - 5. Deg F indication.
- B. Control Wiring: Unshielded twisted-pair cabling.

PART 3 - EXECUTION

3.1 UNIT HEATER INSTALLATION

- A. Comply with manufacturer's product data, including technical bulletins, product catalog installation instructions.
- B. Install and connect gas-fired unit heaters and associated fuel and vent piping according to NFPA 54, and applicable local codes and regulations.
- C. Suspended Units: Suspend from structure using threaded rods, spring or elastomeric hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.
- D. Controls: Install thermostats at mounting height of 48 inches above floor to center of device.
 - 1. Line voltage thermostats installed by Electrical Contractor.

- E. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.

3.2 CONNECTIONS

- A. Drawings indicate general arrangement of gas piping, fittings, and specialties. Connect gas piping with union or flange and appliance connector valve.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.

END OF SECTION

SECTION 23 60 00
CENTRAL COOLING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
1. Compressor and condenser units, air cooled.

1.2 SUBMITTALS

- A. Shop Drawings: For equipment covered under this section as per Section 230500.
1. Refrigeration Piping Diagram: All pipe sizes, traps, double risers and accessories required for proper operation for this particular installation.
 2. Chiller Product Data: Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
 3. Cooling Tower Product Data: For each type of product indicated. Include rated capacities, pressure drop, performance data, furnished specialties, and accessories.
 - a. Include complete set of manufacturer's prints of cooling tower assemblies, control panels, sections and elevations, and unit isolation.
 4. Wiring Diagrams: For power, signal, and control wiring.
- B. Operation and Maintenance Manuals: For equipment covered under this section as per Section 230500.
1. Include: Condensing unit start-up report on 6 to 120-ton systems.
 2. Include: Chiller start-up reports.
 3. Include: Cooling tower startup service reports.

1.3 QUALITY ASSURANCE

- A. DX Start-Up Report: Provide services of manufacturer's authorized and factory-trained representative to perform start-up services for 6 to 120 ton systems and submit a written report. The following will be addressed as minimum:
1. Compressor crankcase oil level.
 2. Suction pressure.
 3. Discharge pressure.
 4. Each compressor amp and volt reading for each leg
 5. Low pressure cut-out.
 6. Low pressure cut-in.
 7. High pressure cut-out.
 8. Check out all control functions.
 9. Prepare a written startup report that records results of tests and inspections.
- B. Chiller Start-Up Report: Provide services of manufacturer's authorized and factory-trained representative to perform start-up services and submit a written report. The following will be addressed as minimum:
1. Power supply voltage, amperages, and correct power phasing.
 2. Compressor oil levels and pressures.
 3. Each compressor amp and volt reading for each leg.
 4. Verify chilled water strainer free of debris and flow switch operational.
 5. Chilled water flows, pressure drops, and entering/leaving temperatures.
 6. Refrigerant pressures, temperatures, minimum/maximum pressures.
 7. Refrigerant saturated condenser and evaporator temperatures.

8. Refrigerant superheat and subcooling temperatures.
 9. Fan amperages (as applicable).
 10. Low Pressure Cut-Out - PSI
 11. Low Pressure Cut-In -PSI
 12. High Pressure Cut-Out -PSI
 13. Refrigerant freezestat.
 14. Chilled water freezestat.
 15. Check out all control functions.
 16. Prepare a written startup report that records results of tests and inspections.
- C. Chiller ARI Rating: Rate performance according to requirements in ARI 550/590, "Water Chilling Packages Using the Vapor Compression Cycle."
- D. ASHRAE Chiller Compliance:
1. ASHRAE 15 for safety code for mechanical refrigeration.
 2. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/ IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- E. ASME Chiller Compliance: Fabricate and stamp water chiller heat exchangers to comply with ASME Boiler and Pressure Vessel Code.
- F. Cooling Tower Start-Up Report: Provide services of manufacturer's authorized and factory-trained representative to perform start-up services and submit a written report. The following will be addressed as minimum:
1. Verification of installation.
 2. Verification of passivation plan implemented.
 3. Verification of chemical treatment plan implemented.
 4. Verification of all safety interlocks.
 5. Verification of mechanical float valve.
 6. Verification of fan rotation direction.
 7. Verification of fan lubrication.
 8. Verification of vibration switch operation.
 9. Harmonic imbalance on variable speed fans.
 10. Power supply voltage, amperages, and correct power phasing.
 11. Bleed valve flow rate.
 12. Submit startup report.
- G. ASHRAE/IESNA 90.1 Cooling Tower Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- H. ASME Cooling Tower Compliance: Fabricate and label heat-exchanger coils to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- I. Motors: Comply with requirements in Section 230520 "General Motor Requirements."

1.4 FAULT CURRENT PROTECTION

- A. Mechanical equipment with electrical requirements of 20 amps or greater shall be marked from the manufacturer with the short-circuit current rating (SCCR) on the equipment nameplate. Minimum SCCR value shall be as listed below unless scheduled otherwise on Drawing schedules.
- B. Ratings for 208/3/60 systems:
1. 20-amp current protection or less: 5,000 SCCR.
 2. 40-amp current protection or less: 10,000 SCCR.
 3. 150-amp current protection or less: 35,000 SCCR.
 4. Above 150-amp current protection: 65,000 SCCR.

- C. Ratings for 480/3/60 systems:
 - 1. 20-amp current protection or less: 10,000 SCCR.
 - 2. 60-amp current protection or less: 35,000 SCCR.
 - 3. Above 60-amp current protection: 65,000 SCCR.

1.5 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified period.
 - 1. Warranty Period: Not less than one year from the date of Substantial Completion.
- B. Compressor and Condenser Units:
 - 1. Compressor: Not less than five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 COMPRESSOR AND CONDENSER UNITS - AIR COOLED

- A. Description: Factory assembled and tested, air cooled; consisting of casing, compressors, condenser coils, condenser fans and motors, and unit controls.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. AAON
 - 2. Carrier Corporation; Commercial HVAC Systems.
 - 3. Daikin Applied
 - 4. Trane
- C. Prior Approval Requirements: Any manufacturer that submits a Prior Approval request must provide the following at minimum: selection drawings that indicate physical size and performance characteristics, weight, and electrical characteristics.
- D. Unit Casings: Designed for outdoor installation with weather protection for components and controls and with removable panels for required access to compressors, controls, condenser fans, motors, and drives. Additional features include the following:
 - 1. Steel, galvanized or zinc coated, for exposed casing surfaces; treated and finished with manufacturer's standard paint coating.
 - 2. Perimeter base rail with forklift slots and lifting holes to facilitate rigging.
 - 3. Gasketed control panel door.
 - 4. Fused disconnect switch, factory mounted and wired, for single external electrical power connection.
 - 5. Condenser coil hail guard.
- E. Compressor: Hermetic scroll compressor designed for service with crankcase sight glass, crankcase heater, and backseating service access valves on suction and discharge ports.
 - 1. Capacity Control: Hot-gas bypass.
- F. Refrigerant: See manufacturer.
- G. Condenser Coil: Seamless copper-tube, aluminum-fin coil, including subcooling circuit and backseating liquid-line service access valve. Factory pressure test coils, then dehydrate by drawing a vacuum and fill with a holding charge of nitrogen or refrigerant.
- H. Condenser Fan: Propeller-type vertical discharge; either directly or belt driven. Include the following:
 - 1. Separate motor for each fan.

2. Dynamically and statically balanced fan assemblies.
- I. Operating and safety controls include the following:
 1. Manual-reset, high-pressure cutout switches.
 2. Automatic-reset, low-pressure cutout switches.
 3. Low-oil-pressure cutout switch.
 4. Compressor-winding thermostat cutout switch.
 5. Three-leg, compressor-overload protection.
 6. Control transformer. Minimum 50 VA, or as coordinated with the Division 230900 contractor for their requirements to be met + 10% capacity.
 7. Magnetic contactors for compressor and condenser fan motors.
 8. Timer to prevent excessive compressor cycling.
- J. Accessories:
 1. Low-Ambient Controller: Cycles condenser fan to permit operation down to 0 °F with time-delay relay to bypass low-pressure switch.
 2. Gauge Panel: Package with refrigerant circuit suction and discharge gauges.
 3. Hot-gas bypass kit.

PART 3 - EXECUTION

3.1 DX INSTALLATION

- A. Comply with manufacturer's product data, including technical bulletins, product catalog installation instructions.
- B. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances.
- C. Install ground and floor mount units on concrete base. Comply with Division 03 for concrete materials and installation requirements.
- D. Install roof-mounting units on equipment supports specified in Division 07.
- E. Vibration Isolation: Mount compressor and condenser units on rubber pads with a minimum deflection of 1/4 inch.

3.2 REFRIGERANT CONNECTIONS

- A. Comply with requirements for piping in Section 232000 "HVAC Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect refrigerant piping to air-cooled compressor and condenser units; maintain required access to unit. Install furnished field-mounted accessories.

3.3 DX FIELD QUALITY CONTROL

- A. Start-up and verification testing shall be performed by the Contractor and start-up checklist or other documentation submitted to Engineer.
- B. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- C. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
- D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

- E. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

END OF SECTION

**SECTION 23 70 00
CENTRAL HVAC EQUIPMENT**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Blower coil air-handling units.
 - 2. Packaged Roof Top Units (RTU).

1.2 SUBMITTALS

- A. Shop Drawings: For equipment covered under this section as per Section 230500.
- B. Air Handler Shop Drawings: Include manufacturer's technical data for each unit, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
 - 1. Fan Product Data: Include certified performance curves and rated capacities, dampers, motor ratings, and accessories for each type of product indicated. Indicate fan's operating point on curves.
 - 2. Certified coil-performance ratings with system operating conditions indicated.
 - 3. Dampers, including housings, linkages, and operators.
- C. MAU Shop Drawings: Include rated capacities, furnished specialties, and accessories.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- D. RTU Shop Drawings: Include manufacturer's technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- E. Operation and Maintenance Manuals: For equipment covered under this section as per Section 230500.
 - 1. Include air handler and RTU start-up reports.

1.3 QUALITY ASSURANCE

- A. Start-Up Report, equipment above 3,000 cfm: Provide services of manufacturer's authorized and factory-trained representative to perform start-up services and submit a written report. The following will be addressed as minimum:
 - 1. Fan motor speed.
 - 2. Fan motor actual and full load amps.
 - 3. Suction pressure (as applicable).
 - 4. Discharge pressure (as applicable).
 - 5. Minimum fresh air setting (RTU).
 - 6. Verification of proper economizer operation (RTU).
 - 7. Submit start-up report.
- B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Motors: Comply with requirements in Section 230520 "General Motor Requirements."

1.4 FAULT CURRENT PROTECTION

- A. Mechanical equipment with electrical requirements of 20 amps or greater shall be marked from the manufacturer with the short-circuit current rating (SCCR) on the equipment nameplate. Minimum SCCR value shall be as listed below unless scheduled otherwise on Drawing schedules.
- B. Ratings for 208/3/60 systems:
 - 1. 20-amp current protection or less: 5,000 SCCR.
 - 2. 40-amp current protection or less: 10,000 SCCR.
 - 3. 150-amp current protection or less: 35,000 SCCR.
 - 4. Above 150-amp current protection: 65,000 SCCR.
- C. Ratings for 480/3/60 systems:
 - 1. 20-amp current protection or less: 10,000 SCCR.
 - 2. 60-amp current protection or less: 35,000 SCCR.
 - 3. Above 60-amp current protection: 65,000 SCCR.

1.5 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified period.
 - 1. Warranty Period: Not less than one year from the date of Substantial Completion.
- B. Packaged Roof Top Units:
 - 1. Heat Exchanger: Not less than five years from date of Substantial Completion.
 - 2. Compressors: Not less than five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 BLOWER COIL AIR HANDLER

- A. Configuration: Factory packaged compact air-handling units.
- B. Description: Factory packaged compact air-handling unit for space ventilation, heating, cooling, filtration and distribution. Factory assembled draw-thru, horizontal or vertical discharge. Unit may consist of a fan and coil section with factory-installed hydronic and/or direct expansion coil, filter section, mixing box as indicated on the equipment schedules.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. Daikin.
 - 2. Magic Aire.
 - 3. Trane.
 - 4. Williams.
- D. Prior Approval Requirements: Any manufacturer that submits a Prior Approval request must provide the following at minimum: selection drawings that indicate physical size, component characteristics (CFM/HP/weight/electrical characteristics), and letter indicating current ship date from time of bid for all components.
- E. Unit Casings:
 - 1. Materials: Galvanized steel.
 - 2. Insulation: 1" fiberglass.
 - 3. Access Panels: At fan and motor section, each coil section, insulated.
- F. Condensate Drain Pans: Polymer, sloped, with primary and auxiliary drain connections.

- G. Fan: Centrifugal, double width, double inlet, forward curved, direct drive.
 - 1. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.
- H. Motor: Open, drip-proof, ECM, variable speed, internal overload protection; factory installed and programmed.
- I. DX Cooling Coil: Quality Control: AHRI Certified, leak tested to 450 psig.
 - 1. Refrigerant: R-410A.
 - 2. Construction:
 - a. Tubes: Copper.
 - b. Fins: Aluminum, mechanically bonded to tubes.
 - c. Casing: Galvanized steel, suction and liquid lines extended to exterior.
- J. Filters: Pleated, 2 inch flat, MERV 13. Provide three additional sets.
- K. Mixing Box: Parallel blade, low-leak with edge seals, linked dampers.
- L. Electrical: Single point power connection.
- M. Controls: Low voltage contacts.

2.2 PACKAGED ROOFTOP UNITS (RTU)

- A. Description: Packaged, outdoor, central-station air-handling units, mounted on the roof or on a concrete base on ground.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or other prior approved:
 - 1. AAON.
 - 2. Carrier Corporation.
 - 3. Daikin Applied.
 - 4. Lennox International, Inc.
 - 5. YORK International Corporation.
 - 6. Trane
- C. Prior Approval Requirements: Any manufacturer that submits a Prior Approval request must provide the following at minimum: selection drawings that indicate physical size, component characteristics (CFM/HP/weight/electrical characteristics), and letter indicating current ship date from time of bid for all components.
- D. Casing: Formed and reinforced insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
 - 1. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
 - 2. Casing Insulation: 1/2" thick, foil faced fibrous mat.
- E. Condensate Drain Pans: Formed sections of galvanized-steel sheet, with threaded nipple drain connections.
- F. Fans:
 - 1. Direct-Driven Supply-Air Fans: Choose an item.; with permanently lubricated, multispeed motor resiliently mounted in the fan inlet.
 - 2. Relief-Air Fan: Choose an item.; shaft mounted on permanently lubricated motor.
- G. DX Cooling Coil: Quality Control: AHRI Certified, leak tested to 450 psig.
 - 1. Refrigerant: See manufacturer.

2. Construction:
 - a. Tubes: Copper.
 - b. Fins: Aluminum, mechanically bonded to tubes.
 - c. Casing: Galvanized steel, suction and liquid lines extended to exterior.
 - d. Suction Headers: Copper tubing, connection at bottom of header.
 - e. Liquid Distributors: Pressure type, equalizing.
 3. Multiple Stage: Intertwined circuits.
- H. Filters: Pleated, 2 inch, MERV 8. Provide three additional sets.
- I. Gas Furnace: Factory assembled, piped, and wired; complying with ANSI Z21.47 and NFPA 54.
1. Burners: Stainless steel.
 - a. Fuel: Natural gas.
 - b. Ignition: Electronically controlled electric spark or hot-surface igniter with flame sensor.
 2. Heat-Exchanger and Drain Pan: Stainless steel.
 3. Venting: Gravity vented.
 4. Safety Controls:
 - a. Gas Control Valve: Modulating.
 - b. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.
- J. Dampers:
1. Outdoor-Air Damper: Linked damper blades, for 0 to 25 percent outdoor air, with motorized damper.
 2. Outdoor- and Return-Air Mixing Dampers: Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet. Connect operating rods with common linkage and interconnect linkages so dampers operate simultaneously.
 - a. Damper Motor: Modulating with adjustable minimum position.
 - b. Relief-Air Damper: Gravity actuated or motorized, as required by ASHRAE/IESNA 90.1, with bird screen and hood.
- K. Electrical: Provide for single connection of power to unit with control-circuit transformer with built-in overcurrent protection. Control transformer shall be minimum 50 VA, or as coordinated with the Division 230900 contractor for their requirements to be met + 10% capacity.
- L. Controls: Factory wired with necessary controls and contactor pressure lugs or terminal block for power wiring.
1. Control Sequence: The resident control algorithms shall make all heating, cooling, and/or ventilating decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures.
 2. Control Features: Accurate temperature control, minimize drift from set point, anti-short cycle timing and time delay between compressors.
 - a. Provide supply fan static pressure control for VAV RTU's.
 3. Communications Interface: BACnet MS/TP.
 4. Unit-Mounted Annunciator Panel for Each Unit:
 - a. Lights to indicate power on, cooling, heating, fan running, filter dirty, and unit alarm or failure.
 - b. Digital display of outdoor-air temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.

M. Accessories:

1. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.
2. Coil guards of painted, galvanized-steel wire.

PART 3 - EXECUTION

3.1 BLOWER COIL AIR HANDLER INSTALLATION

- A. Install air handler on support structure or on concrete base as indicated. Comply with requirements in Division 03 for concrete pads.
- B. Suspended Units: Suspend units from structural-steel support frame using threaded steel rods and elastomeric pads on hangers.
- C. Maintain manufacturers recommended clearances for service and maintenance.
- D. Install piping adjacent to air-handling unit to allow service and maintenance.
- E. Connect duct to air-handling units with flexible duct connectors.
- F. Change filters at completion of work before test and balance.

3.2 RTU INSTALLATION

- A. Install gas-fired units according to NFPA 54, "National Fuel Gas Code."
- B. Install and secure RTUs on roof curbs, and coordinate roof penetrations and flashing with roof construction.
 1. Install ducts to termination at top of roof curb.
 2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
- C. Install RTU on support structure or on concrete base as indicated. Comply with requirements in Division 03 for concrete pads.
 1. Equipment Mounting: Install RTU using elastomeric mounts with minimum 1/4" deflection.
 2. Coordinate wall penetrations and flashing with wall construction.
- D. Connect ducts to RTUs with flexible duct connectors.
- E. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
- F. Install controls and equipment shipped by manufacturer for field installation with RTUs.
- G. Change filters at completion of work before test and balance.

3.3 EQUIPMENT START-UP

- A. Start-up and verification testing shall be performed by the Contractor and start-up checklist or other documentation submitted to Engineer.
- B. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION

DICKINSON MUSEUM CENTER EXPANSION
DICKINSON, NORTH DAKOTA
COMMISSION NO. 25501

DIVISION 26 – ELECTRICAL

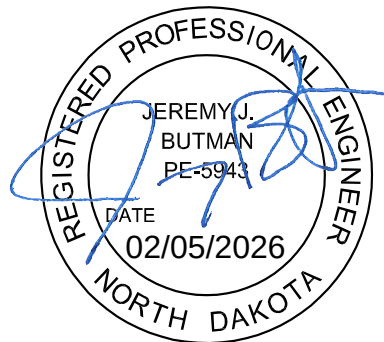
SECTION 260500	COMMON WORK RESULTS FOR ELECTRICAL
SECTION 260505	TEMPORARY FACILITIES & CONTROLS
SECTION 260510	REMODELING WORK
SECTION 260519	CONDUCTORS
SECTION 260526	GROUNDING & BONDING FOR ELECTRICAL SYSTEMS
SECTION 260533	RACEWAYS
SECTION 260534	OUTLET, PULL & JUNCTION BOXES
SECTION 260540	FLOOR BOXES
SECTION 260553	IDENTIFICATION
SECTION 260583	CONNECTIONS TO EQUIPMENT
SECTION 260923	LIGHTING CONTROL SYSTEM
SECTION 262416	PANELBOARDS
SECTION 262713	ELECTRIC SERVICE
SECTION 262726	WIRING DEVICES & DEVICE PLATES
SECTION 262813	FUSES
SECTION 262816	ENCLOSED SWITCHES & CIRCUIT BREAKERS
SECTION 262913	MOTOR STARTERS
SECTION 263213	GENERATOR SET
SECTION 263600	TRANSFER SWITCHES
SECTION 264313	SURGE PROTECTION DEVICES
SECTION 265100	LUMINAIRES
SECTION 266510	OVERHEAD DOOR WIRING
SECTION 266530	ELECTRIC HEATING EQUIPMENT

DIVISION 27 – COMMUNICATIONS

SECTION 270500	DIVISION 27 GENERAL PROVISIONS
SECTION 270528	NETWORK SYSTEMS ROUGH-IN
SECTION 271513	NETWORK SYSTEMS CABLING

DIVISION 28 – ELECTRONIC SAFETY & SECURITY

SECTION 280500	DIVISION 28 GENERAL PROVISIONS
SECTION 284611	FIRE ALARM & DETECTION



SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 – GENERAL

1.1 DESCRIPTION

A. Specification Format

1. These Specifications are written in imperative and abbreviated form. This imperative language of the technical sections is directed at the Contractors, unless specifically noted otherwise. Incomplete sentences shall be completed by inserting "shall", "the Contractor shall", and "shall be", and similar mandatory phrases by inference in the same manner as they are applied to notes on the Drawings. The words "shall be" shall be supplied by inference where a colon (:) is used within sentences or phrases. Except as worded to the contrary, perform all indicated requirements whether stated imperatively or otherwise.
2. Three Part Format
 - a. "Part 1.00 - General": Covers those areas which relate to the Work, and which define the general administrative and technical requirements specific to a particular section.
 - b. "Part 2.00 - Products": Defines, in detail, the acceptance equipment and materials to be incorporated into the Work.
 - c. "Part 3.00 - Execution": Describes, in detail, the manner in which items covered by Part 2 are to be incorporated into the Work.
3. Where Codes, Specifications and Drawings are in conflict, the Contractor will be deemed to have bid the more expensive method. Refer all such discrepancies immediately to the Engineer prior to commencing related work.

B. Definitions

1. "Furnish" - Supply equipment as required by these Drawings and Specifications, delivered to the job site for installation or use by others.
2. "Install" - Fix in position for total operational use all apparatus as shown, specified or required. Provide all miscellaneous fittings and wiring supplies.
3. "Or Approved Equal" - Equipment or materials selected by Contractor subject to Engineer's acceptance.
4. "Or Equivalent" - Equipment or materials selected by Contractor matching the function and performance of equipment or materials listed.
5. "Provide" - Furnish and install in place, total and operational.
6. "Manufacturer's Representative" – person properly trained/certified for the specific equipment and a regular employee of the Manufacturer, the Manufacturer's Representative Agency, a third party specializing company, or the selling distributor.
7. "Substantial Completion" - The date when the project has been completed, inspected, and accepted by the Engineer and Owner.

C. Work Included

1. Provide labor, equipment and materials in connection with Work specified and shown on Drawings.
2. Work of this Division is subject to requirements of Instructions to Bidders, General Conditions, Supplementary Conditions, Division One, and all other sections of this Specification.
3. Examine site and all Contract documents prior to submittal of bid.

D. Work Installed But Furnished Under Other Directives

1. Provide service for electrically operated equipment not specified in Division 26, 27 & 28. Verify size and locations of such connections by securing all rough-in requirements from the equipment supplier.
2. Equipment requiring electrical service shall be furnished with motors, special controls and remote electrical devices as specified in other Divisions.
3. Verify extent of controls and devices furnished by referring to Divisions where Work is specified.
4. Provide disconnects, starters, control devices, thermal units, fuses, switches and all necessary power and control wiring. Include the installation of remote electrical devices furnished separately with the equipment. Provide identification for remote devices as directed by the Engineer.
5. Contractors of other Divisions providing electrically operated equipment shall verify with the Electrical Contractor the proper voltage and phase before releasing equipment for shipment.
6. Unless otherwise specified, Contractor responsible for furnishing such equipment is also responsible for setting in place.

1.2 ALTERNATES

A. General

1. The work of this Section is affected by the Alternates described in this Specification.

B. Alternate E-1

1. The Owner wishes to know in advance the possible cost to renovate the west restroom in the existing museum.
2. Base Bid: No additional work.
3. Under Alternate Bid E-1 on the Bid Form, state the Contract Sum to renovate the west restroom room 127 as shown on sheets E300, E400, and E500.

C. Alternate E-2

1. The Owner wishes to know in advance the possible cost to renovate the east restrooms in the existing museum.
2. Base Bid: No additional work.
3. Under Alternate Bid E-2 on the Bid Form, state the Contract Sum to renovate the east restrooms rooms 110 & 111 as shown on sheets E300, E400, and E500.

D. Alternate E-3

1. The Owner wishes to know in advance the possible cost to provide new cabling to all existing security cameras in the existing museum.
2. Base Bid: No additional work.
3. Under Alternate Bid E-3 on the Bid Form, state the Contract Sum to provide and install new data cabling to all existing cameras in the existing museum as shown and described on sheet E500.

1.3 CONTINGENCY

A. Use contingency only on issuance of Change Orders.

B. Refer to Division 1 for the amount to include in the Electrical Bid.

- C. Money remaining in contingency at close of project will be credited to the Owner by Change Order.

1.4 SUBMITTALS

A. Substitution and Prior Approval to Quote.

1. The reference to manufacturer's name and catalog or model numbers shall be interpreted as establishing a standard of quality, not as limiting competition.
2. Suppliers wishing to price material or equipment not referenced in Specifications or on Drawings shall apply in writing to Engineer for approval to quote. Electronic submittals shall be in PDF format. Include complete descriptive technical data on the proposed item consisting of: model numbers, type, size and performance characteristics. Procedure also applies to requests by Contractor. Self-addressed, stamped envelope required for return reply.
3. The request for prior approval to quote shall be received in Engineer's office no later than 192 hours (eight days) prior to bid opening. All substitute items approved for quotation will be listed in Addenda sent to all planholders in advance of bid opening.
4. Contractors choosing to use material or equipment other than those shown on Drawings or specified in detail, but approved for quotation, shall be responsible for physical dimensions and coordination. Architect, Engineer, or Owner will not be responsible for costs of necessary changes and additional work required by Contractor or any other trades.
5. Substitutions will not be permitted after bid opening.

B. Correspondence

1. Direct all correspondence concerning Division 26, 27, & 28 submittals to:

BRAD GULBRANSON
PRAIRIE ENGINEERING, P.C.
619 RIVERWOOD DRIVE, SUITE 205
BISMARCK, ND 58504
bgulbranson@prairieengineeringpc.com

C. Shop Drawings

1. Before any of the materials are delivered to the job, submit to Engineer via the Prime Contractor complete Shop Drawings for each item indicated.
2. Include catalog numbers, performance data, dimensions and other descriptive information.
 - a. The actual part numbers and options for equipment to be utilized shall be highlighted to indicate exact equipment to be furnished.
 - b. Only include information relevant to the equipment being provided. Any extraneous materials shall be removed prior to submittal.
3. Shop Drawings shall be in electronic PDF format and shall include catalog sheets showing all necessary information. Shop drawings shall be separated by specification section, and equipment from separate specification sections shall not be combined.

4. Shop Drawings shall be submitted under the appropriate specification section of the electronic submittal service being used. The shop drawing file for each section shall include the specification section number, section name, and revision number. Example: "262726 Wiring Devices REV 01".
 - a. If an electronic submittal service is not being used, shop drawings may be emailed to the Engineer at the email address indicated above. Emailed shop drawings shall not exceed 10 MB. If shop drawings exceed 10 MB, contact the Engineer to arrange for a file transmittal method.
5. Each Shop Drawing folder shall be **stamped, initialed, and dated**, on a cover sheet included in the PDF submittal by Division 26 Contractor to indicate they have thoroughly reviewed them in accordance with General Conditions. **Email message text not acceptable.**
 - a. If the Division 26 contractor is under a Prime Contractor, the Prime Contractor may also include a review stamp. However, this does not relieve the Division 26 contractor from applying their review stamp.
6. Shop Drawings not in conformance with Specification will be returned to Prime Contractor without review.
7. A maximum of two reviews will be completed for each section. Additional submittals required due to lack of proper corrections being made may be subjected to review fees from the Engineer billed to the Division 26 contractor.

D. As-Built Drawings

1. Designate one set of clean blueprints at project site as As-Built Drawings. Make As-Built Drawings available to Engineer during project visitation.
2. As work progresses, Contractor's field supervisor shall mark As-Built Drawings in red pencil to indicate actual conditions of installation.
3. Show same general details as Drawings.
4. Give particular attention to marking actual locations of feeders and underground runs.
5. Affix all addendum and change order descriptions to appropriate as-built drawing sheet, utilizing spray adhesive.
6. Submit As-Built Drawings to Engineer along with Record Manuals at close of project in PDF format.
 - a. As-Built Drawings shall be submitted as one PDF file.
 - b. Record Manuals shall be submitted as one PDF file.
7. Provide minimum one hard copy of As-Built Drawings to the Owner.
 - a. Review Division 1 for additional requirements for hard copies of As-Built Drawings.

E. Record Manuals

1. Upon completion of Work of this Division and as condition of its acceptance, Contractor shall compile Record Manuals.
 - a. List project name, date, Contractor's name, address and telephone number on exterior label of each Record Manual.
 - b. Provide one electric PDF copy to Engineer for review.
 - 1) After electronic PDF copy is reviewed and approved, provide one hard copy of Record Manual to Owner. Include an index sheet indicating each major piece of equipment, supplier and supplier's telephone number. Provide tabbed dividers indicating major groupings of equipment.
 - 2) Review Division 1 for additional requirements for hard copies of Record Manuals.
 - c. Record Manual information shall be included for all equipment/material where Shop Drawings are required. **Also include all installation, operation and maintenance data packaged with any equipment.**

2. Turn over to Owner all spare equipment and devices specified and shown. List quantities on Contractor letterhead or invoice, obtain signature of Owner's representative acknowledging receipt, and include with each Record Manual.
3. Include one copy of formal instructional recordings, properly identified as to specification section.
4. Include copy of State Electrical Board Wiring Certificate in each Record Manual.
5. Include service equipment fault current calculation and step-down transformer fault current calculations in Record Manuals. Utility transformer fault current shall be calculated per Section 260553-3.3. Step-down transformer fault current shall be calculated per Section 262200-1.2. Provide in tabular form, as per the following example:

Transformer	kVA	Sec. Voltage	Phase	Impedance	Fault Current	Date Calculated
Utility	300	480	3	1.06%	34,043 amps	11/15/2016
T-1	150	208	3	3.8%	10,958 amps	11/15/2016

6. Calculate the available fault current (AFC) for the mechanical and electrical equipment listed and provide the information in tabular form, utilizing naming convention on the drawings.
 - a. HVAC Equipment 1HP and larger
 - b. Refrigeration Equipment
 - c. Elevator Equipment
 - d. Industrial Control Panels
 - e. Electrical Distribution Equipment
 - f. Branch Panelboards
 - g. MCC's.

7. Fault Current Table Format Example:

Equipment	Voltage	Phase	AFC at Equip.	Date Calculated
<u>AH-1</u>	480	3	5,289 amps	11/15/2016
<u>CU-1</u>	208	3	2,321 amps	11/15/2016

8. Transformer fault current table and equipment fault current calculation table shall be grouped together in the same tabbed section of the Record Manuals.

1.5 QUALITY ASSURANCE

A. Qualifications of Installers

1. For installation and testing, use only trained licensed and experienced workmen familiar with items required and manufacturer's recommended methods.
2. In acceptance or rejection of installed work, no allowance will be made for lack of skill on the part of the workmen.
3. To the maximum extent possible, retain the same supervisory personnel throughout the duration of the Work.

B. Licenses, Permits, Codes and Standards

1. Materials, workmanship and installation: comply with the latest editions of all applicable codes, local ordinances, industry standards, utility company regulations, insurance carrier requirements and these Specifications.
2. Codes and standards shall include, but not necessarily be limited to, the following:
 - a. Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL)

- b. National Electrical Code (NEC)
 - c. National Fire Protection Association (NFPA)
 - d. Occupational Safety and Health Act (OSHA)
 - e. State and local wiring standards
 - f. Building and fire codes
- 3. The more stringent provisions shall govern where provisions of pertinent codes and standards conflict with these Specifications or Drawings. Where Codes, Specifications or Drawings differ with one another, the Contractor will be deemed to have bid the more expensive method. Refer all such discrepancies to the Engineer immediately.
- 4. Pertinent codes and standards shall not be cited to furnish less than specifically shown or specified.
- 5. Obtain and pay all permits, inspections, licenses and other charges pertaining to the Work. Upon completion of the Work, furnish proof of acceptance by proper agency having jurisdiction.

1.6 GUARANTEE AND WARRANTY

- A. Unless otherwise modified by other sections of this specification, Contractor shall guarantee materials, workmanship and the proper operation of equipment for a period of one year. Warranty period shall begin at date of substantial completion, or date of specific equipment commissioning, whichever is later. Contractor shall correct all equipment, material and workmanship found to be defective or non-conforming to the contract documents without cost to Owner.
- B. Guarantee shall include trips to the project site by Contractor to adjust electrical equipment as required, ensuring it is operating as intended.
- C. Specified guarantee shall not relieve Contractor from liability arising from improper installation or non-compliance with applicable codes.
- D. Contractor shall include written warranty statement, indicating start and end dates of warranty period. Warranty statement shall be included with each copy of the Record Manuals.

1.7 CHANGES TO CONTRACT

- A. Any required changes to the contract after bid date shall be in accordance with General Conditions/Division 1 and this section. Where any discrepancies between the sections are encountered, the more restrictive section shall apply.
- B. Proposed changes shall be accompanied with complete substantiating documentation.
 - 1. Provide an itemized list of quantities for materials, equipment, and supplies.
 - a. Include unit costs for each item and extended price.
 - b. Include unit labor for each item and extended time.
 - 2. Provide subcontractor proposals that include the same substantiating documentation.
 - 3. Provide quotations from suppliers for any specially ordered equipment.
- C. Material costs shall be actual costs to the Contractor, obtaining the materials through normal supply channels, including trade and quantity discounts. Utilizing "suggested pricing" from national pricing organizations for unit costs shall not be accepted. Upon request, the Contractor or Subcontractor shall submit evidence to substantiate the costs.
- D. Labor units shall be industry accepted standard labor hours to perform one unit of work. If the work is being performed in a location that is not considered to be standard working conditions for that specific task, additional labor shall be itemized.

- E. Labor rates shall be the actual rate paid for the workman category along with associated labor burden. Labor burden shall consist only of the mandatory fringe benefits, labor taxes, and labor insurances as affected by payroll. The Owner reserves the right to reject any labor burden which is inconsistent with other similar contractors or where the fringe benefit cost is in excess of established labor agreements.
- F. Allowable markups for Contractor and Subcontractors
 - 1. Overhead on work performed by own forces: 12% maximum.
 - 2. Profit on work performed by own forces: 10% maximum.
 - 3. Commission on work performed by Subcontractors: 5% maximum.
 - 4. Sales tax.
 - 5. Bond and permit increases where applicable.
- G. No additional markups shall be allowed for:
 - 1. Field and/or office supervision/administration time.
 - 2. Tool burden.
 - 3. Shop burden.
 - 4. Overhead/Profit applied to work performed by others.
- H. Additional costs for travel and subsistence shall only be allowed if the proposal includes a request for extension of the completion date. Furthermore, those costs shall be proportional to the number of working days of the extension.
- I. Subcontractors shall compute their costs in the same manner as the Contractor. Subcontractors are subject to the same markup constraints as described herein.
- J. For changes resulting in credit to the costs, no restocking fees for materials shall be applied by the Contractor or Subcontractors.

1.8 TEMPORARY FACILITIES

- A. Refer to Special Conditions and/or Division 1 for details of temporary facilities.

1.9 APPLICATIONS FOR PAYMENT

- A. Refer to Division 1 "Applications for Payment".
- B. Provide one additional copy, sent directly to the Engineer.
- C. Format and content:
 - 1. When included with the Bid, the following categories shall be indicated on the application for payment:
 - a. Project mobilization.
 - b. Demolition.
 - c. Service & Distribution (all switchgear, panels, transformers, motor control centers, and loose controls/disconnects, installed in place).
 - d. Lighting (all fixtures and lamps, installed in place, including pre-fabricated wiring system).
 - e. Wiring Devices (all switches, receptacles, and plates, except voice-data, installed in place).
 - f. Equipment Connections (HVAC, elevator, food service, etc., connected in place).
 - g. Basic Materials (all conduit, wire, boxes, supports, fittings, grounding materials, except special systems and voice-data cabling systems, installed in place).
 - h. Fire Alarm & Detection (all system equipment, installed in place).

- i. Special Systems (all system equipment and cabling, installed in place, broken out by Specification Section. Examples include Clock and Program, Intercom, Nurse Call, Public Address, Sound Reinforcement, Rescue Assistance, TV Signal Cabling, Architectural and Theatrical Lighting Controls, and the like).
- j. Generator (all system equipment, installed in place).
- k. Voice-Data Cabling Systems (all system equipment, installed in place).

PART 2 – PRODUCTS

2.1 MATERIAL

- A. Material and equipment shall be as shown or specified. Provide material not specifically described but required for a complete and proper installation of the Work, subject to the acceptance of the Engineer.
- B. All material and equipment shall be new when delivered to the job and be listed by a Nationally Recognized Testing Laboratory (NRTL).
- C. Owner will not be liable for material installed in non-compliance with codes, standards, and these Contract Documents.

2.2 PRODUCT HANDLING

- A. Protection
 - 1. Use all means necessary to protect the materials of this Division before, during and after installation and to protect the installed work and materials of all other trades.
- B. Replacements
 - 1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

PART 3 – EXECUTION

3.1 GENERAL

- A. Engineer, Architect, or Owner shall not be responsible for the means, methods, techniques, sequences or procedures of construction selected by Contractor.
- B. Engineer, Architect, or Owner shall not be responsible for safety precautions and programs incidental to work of Contractor.
- C. It is the sole responsibility of Contractor to initiate, maintain, and supervise all safety precautions and programs in connection with the Work.

3.2 SURFACE CONDITIONS

- A. Prior to work of each Section of Division 26, 27, & 28, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- B. Verify that work of this Division may be installed in accordance with all pertinent codes, regulations and standards.

3.3 COORDINATION

- A. Order material in a timely fashion to assure it is on the job site when required.
- B. Coordinate installation of material with schedule of other trades to prevent unnecessary delay in construction schedule.

3.4 DISCREPANCIES, CONSTRUCTION CONFLICTS AND DRAWINGS

A. Discrepancies

- 1. Prior to submitting bid, Contractor shall refer any apparent discrepancies or omissions to Engineer for clarification.
- 2. The Architect, Engineer or Owner will not be responsible for any oral instructions or modifications to the contract documents prior to opening of bids.
- 3. Written interpretation or clarification will be made by Addenda.

B. Construction Conflicts

- 1. Conflicts discovered during construction shall be immediately called to the attention of the Engineer for decision.
- 2. Do not proceed with installation in area of question until conflict has been fully resolved.
- 3. When so directed by Engineer, Contractor shall make minor adjustment to avoid interferences with other trades. Such minor adjustments shall be performed at no additional cost to the Architect, Engineer or Owner.

C. Drawings

- 1. Drawings indicate extent and general layout of electrical systems for project. Due to small scale, it is not possible to indicate all fittings and accessories that may be required. Provide such fittings and accessories as required to form a complete and operating system in general conformance with Specifications and Drawings.
- 2. Data indicated on Drawings and in these Specifications is as exact as could be secured, but absolute accuracy is not guaranteed.
- 3. Exact locations, distances, levels and other conditions will be governed by the structure. Field measurements shall take precedence over the Drawings. Use the Drawings and these Specifications for guidance. Secure the Architect's approval for all changes in locations.
- 4. Verify all measurements at site. No compensation will be made because of difference between locations shown on the Drawings and measurements at the building.
- 5. Refer to the architectural drawings for dimensions and locations of walls, partitions, doors, windows, ceiling heights, door swings and other details of construction.

3.5 UNDERGROUND UTILITIES

- A. Locations of existing underground utilities are based on available site information and are shown approximately. Contractor shall determine exact utility locations before commencing work and shall be responsible for repair of damages resulting from his construction activities.
- B. Trench and backfill for installation of underground conduits to depth shown or required. Remove any accumulated water in excavation by pumping. Shore and brace excavation as required by safety regulations. Provide temporary bridges to maintain normal traffic flow. Excavation and backfill required by electrical installations shall be accomplished in accordance with Earthwork Specifications by this Contractor.

3.6 CUTTING AND PATCHING

- A. Carefully lay out all work in advance to minimize cutting, channeling or drilling.
- B. Where necessary, all such cutting and patching shall be done in a manner approved by Architect.
- C. Restore damaged surfaces to their original condition by skilled mechanics of the trade involved. Contractor at fault shall assume all cost.
- D. Use only rotary type drilling tools to cut concrete.
- E. Do not endanger the stability of the structure. Do not at any time cut or alter work of any other Contractor without Architect's consent.

3.7 TESTS

- A. Perform all tests as required by Engineer during construction and as described in other Sections of these Specifications.
- B. Testing of entire installation shall be completed before final inspection.

3.8 INSTRUCTIONS

- A. After all required approvals of the Work have been obtained; demonstrate the operation and maintenance of all electrical equipment to the Owner's personnel.
- B. Provide written and oral operating and maintenance instructions to Owner's representatives. The oral instructions shall be given before the Owner occupies the buildings. Instructions to include all building's electrical systems and equipment.
- C. Copies of written operating and maintenance instructions shall be included with each Record Manual.
- D. Electrical Contractor shall coordinate with Owner at Owner's convenience, formal instruction time for contractor personnel to instruct Owner's Representatives on all equipment. Provide similar equipment supplier's instructions where specified thus. Formal instruction to occur with each Record Manual, being referenced to and a part of the Manual.
- E. Formal instructions shall be recorded when required by other Sections of this Specification by this Contractor. Format shall be digital media capable of being played on Windows or Mac operating systems, or shall be submitted on a USB storage device.
 - 1. Electronic PDF files for the as-built drawings and record manuals shall also be included on the USB storage device with the formal instructions.

3.9 CLEAN UP

- A. Remove all scrap material left on job during and after installation of Work.
- B. All equipment having finished paint surfaces shall be examined upon completion for scratches and other damage. Touch up all surfaces as required with paint of color to match factory finish.

C. Perform all cleaning as required by other Sections of Division 26, 27, & 28.

END OF SECTION

SECTION 26 05 05
TEMPORARY FACILITIES & CONTROLS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Temporary electricity.

1.2 PRODUCT HANDLING

A. Protection

1. Use all means necessary to maintain temporary facilities and controls in proper and safe condition throughout the progress of Work.

B. Replacements

1. In the event of loss or damage, immediately make all repairs and replacements necessary at no additional cost to Owner.

PART 2 – PRODUCTS

2.1 UTILITIES

A. Temporary Facilities

1. General: all costs, including utility company charges, required for the performance of temporary electrical system, shall be paid by Electrical Contractor.
2. Energy charges: Refer to Division 1 for requirements.
3. Temporary Electricity: Electrical Contractor shall:
 - a. Furnish and install all necessary temporary wiring.
 - b. Provide area distribution boxes located so the individual trades may use their own construction type extension cords.
 - c. Provide GFCI protection on all temporary power per NEC.

END OF SECTION

**SECTION 26 05 10
REMODELING WORK**

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide work in remodeled area as shown on Drawings and Specifications.

B. Existing Conditions

1. Visit existing buildings before submitting bid and become familiar with all pertinent existing conditions. Make allowance in bid for all pertinent existing conditions. No Change Orders will be issued:
 - a. For Contractor's failure to visit site and acquaint himself with existing conditions.
 - b. For any portion of remodeled work necessary for complete installation of systems shown.
 - c. Due to Contractor's lack of understanding of amount of work or difficulty of work involved.

PART 2 – PRODUCTS

2.1 See following sections of this Specification.

PART 3 – EXECUTION

3.1 GENERAL

- A. Wiring in existing building shall remain except as noted on Drawings or specified.
- B. Verify existing conditions relative to work involved and make allowances thereto.
- C. Balance additional loads to existing circuitry between phases.
- D. Furnish a revised, typed panel directory on existing panelboards where circuitry is changed.

3.2 CUTTING AND PATCHING

- A. Carefully lay out all work in advance to minimize cutting, channeling or drilling.
- B. Where necessary, all such cutting and patching shall be done in a manner approved by Architect.
- C. Restore damaged surfaces to their original condition by skilled mechanics of the trade involved. Contractor at fault shall assume all costs.
- D. Use only rotary type drilling tools to cut concrete.
- E. Do not endanger the stability of the structure. Do not at any time cut or alter work of any other Contractor without Architect's consent.

3.3 REMOVAL AND/OR REUSE OF EXISTING MATERIALS AND EQUIPMENT

- A. Remove or relocate existing conduits, wires, equipment, devices or fixtures indicated on Drawings or as required.
- B. Remove any existing non-active voice/data cables including trunk cables, and any other special systems cables in the entirety. Verify with Owner prior to removal.
- C. Remove any existing exposed abandoned raceways, including those above accessible ceiling finishes in their entirety. Verify with Owner prior to removal. Where complete conduit removal is not feasible, cut conduit flush with walls and floors, and patch surfaces.
- D. Provide additional code-mandated supports on any remaining (existing prior to project and located within the remodel area) unsupported raceway systems or communications cabling including fiber optic, voice/data and special systems.
- E. Where existing multi-wire lighting and power branch circuits are modified in any way, it is this Contractor's responsibility to provide additional grounded (neutral) conductors as required between the electrical panelboard and existing circuit devices. Circuit breaker tie-handles are not acceptable. In the event that existing raceways are not properly sized to accommodate the required additional conductors, new raceway shall be installed.
- F. Where the reuse of existing conduits, wires, and devices, or fixtures is permissible, verify that wiring is continuous. Existing outlet or junction boxes shall not be rendered inaccessible by structural changes made to the building.
- G. Verify that no devices are cut off from power source unless specifically noted.
- H. Existing equipment which is indicated as being removed and not indicated for reuse shall remain the property of the Owner, stored as directed. Remove and dispose any material the Owner does not wish to retain, except fluorescent lamps and ballasts.
- I. Do not break, dump or otherwise destroy removed fluorescent and HID lamps, due to possible mercury contamination. Removed lamps are to be recycled and converted by an EPA-Licensed company regularly engaged in this business, and offering this service in accordance with all EPA, State, and Local Regulations:

Green Lights Recycling, Inc.
10040 Davenport Street NE
Blaine, MN 55449
(763) 785-0456

Recycle Technologies
4000 Winnetka Ave. N
Minneapolis, MN 55427
(800) 969-5166

Waste Management Lamp Tracker, Inc.
10050 Naples St NE
Blain, MN 55449
(800) 664-1434

or equivalent as selected by the Contractor.

All associated recycling costs shall be included in this Contract. Recycler shall provide Owner with a Certificate of Conversion, indicating Owner's manifested lamps have been properly recycled and converted. Comply with recycler's packing and shipping instructions.

- J. Do not dump or otherwise destroy removed ballasts, due to possible PCB contamination. Removed ballasts are to be destroyed by an EPA Licensed company regularly engaged in this business, and offering this service in accordance with all EPA, State, and Local Regulations:

Green Lights Recycling, Inc.
10040 Davenport Street NE
Blaine, MN 55449
(763) 785-0456

Recycle Technologies
4000 Winnetka Ave. N
Minneapolis, MN 55427
(800) 969-5166

Waste Management Lamp Tracker, Inc.
10050 Naples St NE
Blain, MN 55449
(800) 664-1434

or equivalent as selected by the Contractor.

All associated destruction costs shall be included in this Contract. Recycler shall provide Owner with a Certificate of Destruction, indicating Owner's manifested ballasts have been properly destroyed. Comply with packing and shipping instructions.

- K. Assume existing equipment and fixtures shown to be reused are in good working condition and can be installed without any repairs or, if in unusable condition, notify the Architect for decision. Contractor shall be responsible for any damage by his personnel to equipment in removal or handling.
- L. Provide blank plates as required at existing rough-ins not being re-used.
- M. Clean fixtures and other equipment removed and indicated for reuse. Provide new lamps for reused fixtures.

3.4 CONTINUITY OF SERVICE

- A. Existing building will be in use during construction. Schedule and carry out work for a minimum of inconvenience to the Owner.
- B. All service interruptions shall require a prior approval by Owner. Confine interruptions to the smallest area possible.
- C. Verify that automatically controlled, electrically operated equipment is returned to the same operating condition which existed prior to interruption.

3.5 ASBESTOS

- A. Contractor is assumed to be knowledgeable about Federal, State, and Local requirements with respect to asbestos issues.
- B. Avoid disturbance of any asbestos-containing material (ACM) within the construction area or elsewhere on the site.
- C. Verify with Owner's "Asbestos Survey and Management Plan" the extent (if any) of existing asbestos.

END OF SECTION

**SECTION 26 05 19
CONDUCTORS**

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide a complete system of conductors enclosed in a raceway.

1.2 SUBMITTALS

A. Record Drawings

1. Maintain accurate record drawings in accordance with Section 260500.

PART 2 – PRODUCTS

2.1 CONDUCTOR

A. Copper

1. Soft drawn, annealed.
2. Conductivity of not less than 98% pure copper.
3. Insulated for 600 volt service.
4. #10 AWG and smaller: Solid, THWN/THHN.
5. #8 AWG and larger: Stranded, THWN/THHN.
6. Provide USE where required by Code.

B. MC Cable

1. MC cable is not acceptable for use as a wiring method.

2.2 SPLICES

- A. #10 AWG and smaller: Scotchlock Y, R or G as manufactured by 3M Company, or equivalent.
- B. #8 AWG and larger: Compression type, as manufactured by Anderson, Burndy, Thomas and Betts Company, or equivalent.

2.3 LUBRICANT

A. General

1. NRTL-listed.
2. Flame resistant
3. Compatible with conductor insulation.

B. Acceptable Manufacturer

1. As selected by Contractor.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General

1. Install in accordance with Code, product listing, and manufacturer's recommendations.
2. Install wire and cable in Code-conforming raceways after moisture and debris is swabbed from conduit.
3. Refer to system specified for conductor's peculiar to that system.
4. Conductor sizes: Standard AWG, #12 minimum unless otherwise indicated.
5. Fixture taps: minimum #16 AWG.
6. Conductor temperature ratings: Compatible with the equipment to which it is to be connected. Refer to product listing.
7. Make conductor length for parallel feeders identical.
8. Derate ampacities as required for high ambient temperatures or conductor fill.

B. Color

1. Multi-wire (shared neutral) circuits.
 - a. 120/208 volt
 - 1) Phase conductors: Black, red or blue.
 - 2) Grounded conductor (neutral): White.
 - 3) Grounding conductor: Green or bare.
 - b. 277/480 volt
 - 1) Phase conductors: Brown, orange or yellow
 - 2) Grounded conductor (neutral): Gray
 - 3) Grounding conductor: Green or bare.
2. Separate neutral circuits:
 - a. 120/208 volt
 - 1) Phase conductors: Black, red or blue.
 - 2) Grounded conductor (neutral): White with stripe colored to match phase.
 - 3) Grounding conductor: Green or bare
 - b. 277/480 volt
 - 1) Phase conductors: Brown, orange or yellow.
 - 2) Grounded conductor (neutral): Gray with stripe colored to match phase.
 - 3) Grounding conductor: Green or bare
3. Switch legs: Same as phase conductors.
4. 120 volt isolated ground circuits:
 - a. Phase conductor: Orange.
 - b. Grounded conductor (neutral): White with orange stripe.
 - c. Grounding conductor: Green with yellow stripe.

C. Splices

1. Eliminate wherever possible.
2. Made only at outlet or junction boxes.
3. Obtain special permission from Engineer for any splices in feeder conductors.

D. Voltage Drop

1. Increase size of circuit wiring in accordance with NEC 210.19(A)(1), fine print note, No. 4.
2. Use #10 AWG minimum for all home run conductors longer than 75 feet on 120/208/240 systems and 150 feet on 277/480 systems.

3.2 TESTS

- A. After equipment and wiring is installed, and before it is energized, test all power circuits with a megohmmeter for insulation resistance, phase-to-phase and phase-to-ground faults.
- B. Before testing, disconnect all equipment that might be damaged by the test voltages.

END OF SECTION

SECTION 26 05 26
GROUNDING & BONDING FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Bond and ground all electrical equipment in accordance with National Electrical Code, State/Local Codes, these Specifications, and as shown on Drawings.

B. Description of System

1. The service equipment, conduit systems, supports, cabinets and neutral conductor shall be solidly grounded and bonded in accordance with National Electrical Code to form a permanent effective and continuous grounded system.

PART 2 – PRODUCTS

2.1 GROUND RODS

- A. Steel with a metallically bonded outer layer of electrolytically applied copper.
- B. Minimum 1/2" diameter 10 foot length, unless otherwise indicated.
- C. Sectional rods not permitted.
- D. Manufacturer: ERITECH or equivalent.

2.2 GROUND ROD CLAMPS

- A. Ground rod clamps shall be high strength silicone bronze.
- B. Manufacturer: ERITECH or equivalent.
- C. At Contractor's option, exothermic welding (CADWELD) or impact compression (ERITECH Hammerlock) may be used in place of ground rod clamps.

2.3 WATER PIPE GROUND CLAMPS

- A. Steel U-bolt with bronze saddle.
- B. Manufacturer: Thomas and Betts Company #3900 series or equivalent.

2.4 REBAR GROUND CLAMPS

- A. Bronze alloy construction.
- B. Sized as required by rebar stub out.
- C. Manufacturer: ERITECH #RC series or #EK series as required by local authority. Equivalent products by Thomas and Betts Company acceptable.

PART 3 – EXECUTION

3.1 GENERAL

- A. **Grounding conductors not shown or included on floor plans.**
- B. **When required, increase trade size of raceway accordingly.**
- C. Aluminum not acceptable for use as a grounding conductor.

3.2 SYSTEM GROUNDING

- A. Provide grounding electrode system in accordance with NEC 250.50. If available, each of the items listed in 250.52(A)(1) through (A)(8) shall be bonded together to form grounding electrode system.
- B. Connect grounding electrode conductor to grounded service conductor.
- C. Provide raceway enclosing grounding electrode conductor. If metallic, bond as per NEC 250.64(E). Provide grounding bushing as required complete with jumpers same size as grounding electrode conductor.
- D. To comply with NEC 250.53, provide two ground rods spaced minimum 6'-0" apart.

3.3 EQUIPMENT GROUNDING CONDUCTOR

- A. Non-metallic conduit: Sized in accordance with NEC, except as further modified by this Specification.
- B. Flexible Metal Conduit, Liquidtight Flexible Conduit.
 - 1. Other than for connection of 120 volt recessed luminaires, not acceptable for use as means of grounding.
 - 2. Provide bonding jumper sized in accordance with NEC around all flexible conduits. Use fittings having lugs for termination of jumper.
 - 3. Spiral wrap not acceptable. Lay along surface, secured with cable ties.
 - 4. Bonding jumper maximum length: 6'.
 - 5. Bonding jumper not required where separate equipment grounding conductor is used.
- C. Branch Circuits
 - 1. **Separate equipment grounding conductor required for each raceway.**
 - 2. Size: per NEC 250.122.
 - 3. Bond to grounding bars, junction boxes and luminaire grounding screws.
 - 4. Field-install grounding screw in luminaire if not provided by factory.
- D. Feeders
 - 1. **Separate grounding conductor required.**
 - 2. Bond to grounding bars in switchboards, panelboards and motor control centers.
 - 3. Provide grounding bushing at both ends of all feeders utilizing metallic raceway.
 - a. Bond to grounding bars at both ends.
 - b. Size bonding jumpers to match equipment grounding conductor.

4. Feeder Equipment Grounding Conductor Size:
 - a. Size per NEC 250.122.
 - b. Copper equivalent ampacity when aluminum phase conductors utilized.
5. Do not splice grounding conductor.

E. Water Pipe System

1. Bond interior metal water piping per NEC Section 250.104(A) if water pipe system is not used as part of grounding electrode system.

END OF SECTION

**SECTION 26 05 33
RACEWAYS**

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide all conduit systems as shown on Drawings or required by Codes and Specifications.

B. Description of System.

1. Provide code-conforming raceway system for all conductors unless specifically noted otherwise by phrase "not in conduit".

1.2 SUBMITTALS

A. Record Drawings

1. Maintain accurate record drawings for all raceway runs in accordance with Section 260500.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Metallic conduit and tubing: Allied Tube and Conduit, Republic Conduit, or equivalent.

B. Non-metallic conduit: Carlon Schedule 40 or Schedule 80 where required, Allied Tube and Conduit, Cantex Inc., or equivalent.

C. Flexible metal conduit: Aluminum.

D. Liquidtight, flexible metal conduit: Anaconda Sealtite, or equivalent.

E. Fittings

1. Rigid metal conduit: Appleton, Crouse-Hinds, or equivalent. **Pot metal conduit fittings not acceptable.**
2. EMT:
 - a. **Steel.**
 - b. Setscrew or watertight as required.
 - c. Thomas and Betts Company, or equivalent.
 - d. **Pot metal, "Sock-on" and indenter fittings not acceptable.**
3. Flexible metal conduit: STEEL, Thomas and Betts Company #XC-400 series, or equivalent.
4. Liquidtight flexible metal conduit:
 - a. **Steel.**
 - b. Straight or angled as required.
 - c. Appleton, Thomas and Betts Company or equivalent.

F. Hangers and Supports

1. As required by Codes and Specifications.
2. Raco, Unistrut, or equivalent.
3. ERICO conduit clips, Type 8-M, 12-M and K-8 acceptable for individual branch circuit runs.

G. Metal Surface Raceway

1. Wiremold #500/700 metallic series or equivalent, unless otherwise indicated on Drawings.
2. Provide associated fittings as required.
3. Standard color as selected by the Architect.

H. Wireway

1. NRTL 870 listing throughout, including connectors and fittings.
2. Hinged cover construction.
3. Sealing capability where required.
4. Suitable for "lay-in" installation of conductors.
5. Rust inhibiting phosphatizing undercoat and baked enamel finish.
6. Plated hardware.
7. Square D "Square Duct", or equivalent.

I. Expansion Fittings

1. Metallic: OZ, Thomas and Betts Company, or equivalent.
2. Non-Metallic: Carlon, or equivalent.

J. Firestop Assemblies

1. Firestop systems shall consist of fittings and/or intumescent materials assembled as per UL (or other NRTL) System Details.
2. Product manufacturers: 3M, Chase Technology Corporation, Dow Corning Fire Stop, Hilti, International Protective Coatings Corp. (Flame Safe), or Nelson Fire Stop Systems.

K. Thru Wall and Floor Seals

1. OZ-Gedney Type "FSK", or equivalent.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General

1. Electrically continuous throughout.
2. Plumb and level.
3. Cut square and reamed smooth.
4. Use commercial bender for offsets and bends.
5. Cap to prevent debris from entering during construction.
6. Swab conduit prior to installation of conductor.
7. Provide pull cord in empty conduits.
8. Alter conduit routing to avoid structural obstructions, minimizing crossovers.

9. It is the intent of this Specification to provide reasonable provisions for future expansion of electrical use (See NEC 90.8 and 90.1(B), FPN). Therefore, **install all branch circuit home runs as shown on Drawings. Do not combine home runs or increase quantity of conductors therein.**
10. Install raceway, conduit and fittings in accordance with Code, NRTL listing and manufacturer's recommendations.

B. Concealed Interior Raceway

1. Conceal all raceway within building construction.
2. May be run in a direct line for Contractor's convenience.
3. For Contractor's convenience, **concealed** stubs from concrete-encased PVC conduit runs may extend to first **concealed** junction box.
4. Where applicable, center within insulation any electrical conduit routed in attic space. Provide sealing as per NEC 300.7(A) for all conduits exposed to different temperatures.

C. Exposed Interior Raceway

1. Use limited to mechanical and electrical equipment rooms, motor connections, and panelboards scheduled as surface.
 - a. Run parallel or perpendicular to building lines.
 - b. **Provide RGSC or EMT stubs for concrete-encased PVC conduit runs.** Extend stub from RGSC coupling set flush in floor.
 - c. Provide flexible conduit as required for motor and equipment connections.
2. Shall not be used in finished areas unless specific permission is obtained from Engineer.
 - a. Exposed interior raceway in finished spaces shall be Metal Surface Raceway. Metallic conduit and tubing NOT ALLOWED.

D. Concrete Encased Raceway

1. Shall not interfere with structural integrity of slab, column, or beam.
2. Installation subject to acceptance of Structural Engineer.
3. Maximum diameter 1/3 thickness of concrete member.
4. Install in center of section.
5. Provide expansion fitting when crossing building expansion joint. Grounding integrity of raceway to be maintained.

E. Exterior Raceway

1. Minimum 24" below grade.
2. PVC unless otherwise indicated.
3. **Exterior surface stubs for PVC conduit runs: RGSC, including final underground sweep.** Exterior surface stubs acceptable only where specifically shown.
4. Penetrating Watertight Walls or Floors: Provide block-out with 1/2" clearance around conduit for underground penetrations. Pack with Oakum and caulk with non-shrinking grout or provide conduit entrance seal.
5. Penetrating Roof or Waterproofing Membranes: Provide flashing and pitch pocket.
6. Contractor responsible for providing a watertight penetration.
7. Coat RGSC penetrations with heavy asphaltic-base compound.
8. Unless otherwise indicated, route exterior conduits to interior distribution equipment concealed under slab.

F. Supports

1. Refer to NEC 300.11

2. **Tie wire supports not acceptable.**
3. Support Spacing: NEC.

G. Specific Locations

1. Allow 6" minimum clearance at flues, steam pipes and heat sources.
2. Conduit visible behind grills and registers: paint black.
3. Seal conduit where leaving heated area and entering unheated area.
4. Penetrating non-watertight walls or floors: Pack space between conduit and block-out on both sides with Oakum.
5. Penetrating fire rated walls or floors: Seal to prevent passage of fire or products of combustion.
6. From each flush mounted panel location, stub three additional 3/4" conduits into nearest accessible ceiling space.
7. Do not mount raceway on ductwork, cover access doors, panels, controls, or otherwise hinder normal maintenance and repair of the equipment.
8. Motors:
 - a. Connect to motor feeder or branch circuit by means of flexible metal conduit or liquidtight flexible metal conduit in moist areas.
 - b. Minimum flexible length: 18".
 - c. Where practical, feed floor mounted motors from raceway installed in or under slab.
 - d. When floor mounted motors are fed overhead, provide required support for raceway. Extend raceway to floor and provide a floor flange. Insert "T" conduit fitting at proper height and extend flexible conduit to motor.

3.2 SIZE

- A. National Electrical Code, subject to stated minimums.
- B. Minimum Size

1. Exterior raceway: 3/4".
2. In or under poured concrete (including precast concrete panels): 3/4".
3. Branch circuit home run: 3/4". Consider home run to include raceway length from panelboard, switchboard, or motor control center to nearest power consuming or switching device on that circuit.
4. Feeders: 3/4".
5. All others not listed: 1/2".

3.3 TYPE

A. Intermediate Metal Conduit (IMC)

1. May be used in place of rigid galvanized steel conduit for Contractor's convenience.
2. Comply with manufacturer's recommendations for bending, threading and cutting operations.
3. Install as specified for rigid galvanized steel conduit.

B. Rigid Galvanized Steel Conduit (RGSC)

1. Use:
 - a. Overhead electric and telephone service entrance. IMC or Aluminum not acceptable for this application.
 - b. All raceway exposed to weather. Aluminum not acceptable for this application.
 - c. Where required by national, state and local codes.

2. Fittings: Threaded except at KO type boxes where double locknut/bushing method acceptable.
3. Waterproof entire length with heavy asphaltic base compound when:
 - a. Embedded directly in earth.
 - b. Embedded in concrete directly in contact with earth, with or without vapor barrier.
 - c. Penetrations run directly from concrete with earth, to soil burial.
4. Factory applied PVC coating acceptable in place of asphaltic base compound.

C. Rigid Non-Metallic Conduit (PVC)

1. Use only in slabs and exterior underground locations. See 3.1 B3, C4 and E3 for limitations.
2. Provide insulating bushing at all terminal adapters.
3. Provide equipment grounding conductor within raceway.
4. Increase trade size accordingly for equipment grounding conductor.
5. Utilize commercial heating element type bending equipment. **Do not use torches to bend PVC conduit.**

D. Electrical Metallic Tubing (EMT)

1. Use in all areas not prohibited by NEC and this Specification.
2. Do not use in concrete slabs on or under grade, or walls under grade.
3. Do not use in exterior underground applications.

E. Flexible Metal Conduit

1. Use for connections to transformers, motors, fixed appliances, recessed luminaires and other equipment as required.
2. Use liquidtight conduit with liquidtight fittings in areas of high moisture content.

F. Metal Surface Raceway

1. Install complete with matching boxes, fittings, and end caps, parallel or perpendicular to building construction.
2. Wire adjacent devices to alternate circuits where metal surface raceway contains devices integral to the channel.
3. Feed from flush connector in wall directly into raceway. Field cut base as required with 1/2" knockout for this purpose. Do not utilize Wiremold catalog #2051H for #2000/2100 series.

G. Fire Resistive Walls and Decks

1. Preserve integrity of fire rating through the use of UL (or other NRTL) Listed firestop assemblies of appropriate penetration type and rating time.
2. Install in accordance with manufacturer's recommendations.
3. All floor to floor penetrations and all wall penetrations into Mechanical, Electrical, and Communications Rooms shall be sealed with 1 hour firestop assemblies unless more stringent rating is required by building codes.
4. Include UL (or other NRTL) firestop assembly sheets and manufacturer product data sheets specifically used with the Project Closeout Documentation.

END OF SECTION

SECTION 26 05 34
OUTLET, PULL & JUNCTION BOXES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide all outlet, pull and junction boxes complete with associated covers and rings.

B. Work Installed But Furnished Under Other Directives.

1. Obtain manufacturer's backboxes or recommendations for special equipment.

1.2 SUBMITTALS

A. Record Drawings

1. Maintain accurate record drawings in accordance with Section 260500.

PART 2 – PRODUCTS

2.1 CEILING BOXES

A. Flush and Surface

1. 2-1/8" minimum depth.
2. Square or octagon as required.
3. Galvanized steel.
4. Manufacturer: Appleton, Raco, Steel City or equivalent.

2.2 WALL BOXES

A. Flush

1. One and two gang wall boxes: 4" square box, 2-1/8" minimum depth with appropriate plaster or tile ring.
2. More than three gang: Gangable 3-1/2" deep unless wall cavity limits depth to 2-1/2".
3. Use 4-11/16" square boxes where required by Code.
4. Single gang masonry boxes acceptable only for single conduit entrance. Feed-through circuiting not acceptable. Use 4" square box/tile ring for feed-through applications.

B. Surface Mounted Devices

1. 4" square box, 2-1/8" minimum depth with appropriate 1/2" raised cover.
2. Manufacturer: Appleton, B-Line, Raco, Steel City, Wiegmann, or equivalent.

C. **Sectional, through wall and handy boxes not acceptable.**

2.3 PULL AND JUNCTION BOXES

A. Galvanized steel with cover.

B. Size: National Electrical Code.

C. Manufacturer: Appleton, Racor, Hoffman, Shallbetter, Steel City, Wadsworth or equivalent.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General

1. Install in accordance with code, product listing and manufacturer's recommendations.
2. Install boxes plumb, level and flush with finish surface.
3. Support securely and rigidly.
4. Verify wall depths to ensure adequate clearance for special backboxes.
5. Provide barriers in ganged switch outlets where voltage between adjacent switches exceeds 300 volts.

B. Location

1. Governed by structural conditions and obstructions.
2. Mount switch outlet on strike side of door, maximum 4" from door opening to first switch. Verify door swing with Architectural Plan.
3. Coordinate equipment outlets prior to installation for proper concealment.
4. Center outlets with respect to acoustical tile, paneling and furring trim.
5. Adjust outlets in masonry or tile construction to horizontal and vertical mortar joints.
6. Clear all piping, ductwork and other obstructions.
7. For outlet boxes on opposite sides of walls or partitions with separation distances of 24" or less, pack all interconnecting conduits with Duxseal after conductor installation, to prevent sound transmission.
8. Outlet boxes improperly located shall be corrected at Contractor's expense.

C. Mounting Heights

1. All device mounting heights shall conform to ADA Recommendations. Refer to Standard Electrical Symbol Legend for nominal mounting heights.
2. Verify height of all outlets to ensure installation above top of radiation covers, mirrors, counters and any other obstructions that may alter nominal mounting height.
3. **Measure from finish floor to centerline of outlet.**
4. Mount exterior outlets horizontally. Measure height from nearest interior finish floor below outlet.
5. Mount outlet designated AC (above counter) no less than 4" higher than top of countertop backsplash.

D. Fire Resistive Walls and Ceilings

1. Penetrations for steel electrical outlet boxes permitted, provided:
 - a. Boxes do not exceed 16 square inches in area.
 - b. Area of such openings to not exceed 100 square inches for any 100 square feet of area.
 - c. Outlet boxes on opposite sides of walls or partitions separated by horizontal distance of 24 inches.

E. Pull and Junction Boxes

1. Pull and junction boxes are generally not indicated on Drawings.

2. Install in accordance with National Electrical Code and as required to facilitate wire pulling.
3. Do not install in finished spaces without approval of Engineer.

F. Identification

1. Identify pull and junction boxes containing system voltages in excess of 250 volts to ground with voltage markers.
2. Voltage markers: Not visible in finished areas.

END OF SECTION

**SECTION 26 05 40
FLOOR BOXES**

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide floor boxes complete with devices, fittings and carpet flanges.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Show all details, including dimensions and service fitting repair parts.

B. Record Manuals

1. Submit information in accordance with Section 260500.
2. Include installation and maintenance instructions accompanying equipment.

PART 2 – PRODUCTS

2.1 CONCRETE FLOOR SLABS

A. Type B

1. Box
 - a. Listed and evaluated by an NRTL to meet the applicable U.S. safety standards for scrub water exclusion when used on tile, terrazzo, wood, and carpet covered floors.
 - b. Construction:
 - 1) Stamped steel, 3.25" overall height with 3/4" and 1" side knockouts and 3/4" to 1-1/2" bottom knockouts.
 - c. Provide epoxy coating for specific installations where the box is in direct contact with earth.
 - d. Four independent wiring compartments that allow capacity for up to four duplex receptacles and/or communication services.
 - e. Feed through removable barriers from adjacent compartments.
 - f. Internal power and communication device brackets as required by specified internal device types and quantities. Provide internal blank plates for all unused compartments.
 - g. Manufacturer: Wiremold #RFBA4C series.
2. Activation Kit (Cover)
 - a. Die cast aluminum, low profile, round cover with beveled edge flange to sit on top of floor covering.
 - b. Finish as selected by the Architect.
 - 1) Powder coat finish: Black, Bronze, or Gray.
 - 2) Metallic finish: Brushed Aluminum, Satin Brass, or Satin Nickel.
 - c. Manufacturer: Wiremold #6CTC2 series.

2.2 DEVICE QUANTITIES

- A. Type A: Two duplex receptacles, two data jacks.

2.3 WIRING DEVICES

- A. Power: Receptacles as per Section 262726.
- B. Voice/data: Jacks as per Section 271500.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Verify concrete depth prior to ordering floor boxes.
- B. Verify exact location of each floor box with Architect prior to installation.
- C. Install box opening flush with floor in accordance with Code, product listing and manufacturer's recommendations.
- D. Activation Cover Installation
 - 1. Carpet/VCT floor finishes: Install cover after floor covering installation is completed.
 - 2. Tile floor finishes: Install cover prior to tile/grout installation. Shim cover as required so top of cover is flush with floor.
- E. Install floor boxes with square covers parallel or perpendicular to building lines.

END OF SECTION

SECTION 26 05 53 IDENTIFICATION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Label electrical equipment as required by Codes and Specifications and as specifically directed by Engineer.

PART 2 – PRODUCTS

2.1 PANEL DIRECTORIES

- ##### A. Include directory cards with panelboards.

2.2 NAMEPLATES

- ##### A. Machine-engraved black laminate with white core, except as otherwise indicated.
- ##### B. Minimum letter size: 1/8".
- ##### C. Minimum plate size: 1" X 3".

2.3 VOLTAGE MARKERS

- ##### A. Vinyl impregnated cloth markers with legend as required.
- ##### B. Manufacturer: Ideal #44-360, or equivalent.

2.4 PRESSURE SENSITIVE TAPE

- ##### A. Use only when specifically referred to in other Sections.
- ##### B. Manufacturer: Dymo, or equivalent.

2.5 UNGROUNDED CONDUCTOR IDENTIFICATION

- ##### A. As per NEC 210.5(C) and 215.12(C).
- ##### B. Typewritten cards behind plastic shield, affixed with double-stick carpet tape. Heat surface prior to affixing directory.

PART 3 – EXECUTION

3.1 GENERAL

A. Directory Cards

1. **Typewritten only.** Hand lettering unacceptable, except at "spares" and "spaces", where neat hand lettering with erasable pencil is required.
2. Indicate type of load and rooms where load occurs.

3. **Do not use room numbers as shown on Drawings, but refer to name and numbers on door.**
 4. Do not identify until final load balancing is accomplished.
- B. Nameplates
1. Apply plumb and level with two counter-sunk screws.
 2. Glue, double-stick tape, or similar adhesive not acceptable.
- C. Device Plates
1. Machine-engrave directly on plate in lieu of separate nameplate.
 2. Fill inscriptions with contrasting color.
- D. Voltage Markers
1. Not visible in finished areas.
- E. Pull and Junction Boxes
1. Mark all covers with indelible marker to indicate panelboard designation and circuit numbers for circuits contained within box.

3.2 EMERGENCY SYSTEM COMPONENTS

- A. All boxes and enclosures (including transfer switches, generators and power panels) for emergency circuits shall be permanently marked so they will be identified as a component of an emergency circuit for system.

3.3 SERVICE EQUIPMENT FAULT CURRENT NAMEPLATE

- A. Provide warning nameplate on each service disconnecting means enclosure indicating the fault current of the system.
- B. Fault current shall be calculated at the utility transformer, using an assumed infinite primary bus, and using the actual transformer impedance and kVA values.
- C. Red laminate with white core.
- D. Letter height: minimum 1/4".
- E. Inscription:
- SERVICE AVAILABLE FAULT CURRENT: _____
- TRANSFORMER KVA: _____
- TRANSFORMER IMPEDANCE: _____
- DATE: _____

3.4 "WILD LEG" WARNING NAMEPLATE (240V 3Ø 4W SYSTEMS)

- A. Provide a warning nameplate on all fusible switches, panelboards and switchboards where a grounded (identified) conductor is present.
- B. Red laminate with white core.

C. Letter height: minimum 1/4".

D. Inscription:

CAUTION "B" PHASE HAS 208 VOLTS TO GROUND
240V 3Ø 4W DELTA SYSTEM

END OF SECTION

SECTION 26 05 83
CONNECTIONS TO EQUIPMENT

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. The Contractor shall provide operational electrical connections to all electrically driven or controlled equipment.

PART 2 – PRODUCTS

2.1 MATERIALS

A. General

1. The Contractor shall provide all necessary materials and labor required to make final operational connections to all equipment, generally as shown on the Drawings, and specifically as required by equipment specifications and installation literature.
2. Control devices and panels furnished by others will be delivered to the contractor at the jobsite and shall be installed in accordance with the manufacturer's printed instructions. Review equipment specifications to determine extent of work involved.

PART 3 – EXECUTION

3.1 GENERAL

- A. Provide operational connections for all equipment shown on the Drawings. Connections shall be in accordance with the manufacturer's recommendations and shall be left operating in a manner acceptable to the Engineer and Owner.
- B. Provide available fault current calculations for equipment listed in Section 260500-1.4E based on actual installation criteria (conductor lengths, raceway types, etc.). Calculations shall incorporate the current limiting effects of fuses supplied with local disconnecting means. Include calculation information in Record Manuals.
- C. For all exterior mechanical equipment, provide weatherproof GFCI receptacle outlet within 25' of equipment, circuited to nearest unswitched power. Refer to NEC 210.63 and 406.8.
- D. For all mechanical equipment located in attic and crawl spaces, provide porcelain lamp holder with integral receptacle and lamp guard, circuited to nearest unswitched power via pilot handle toggle switch near access hatch. Engrave plate. Refer to NEC 210.70(C).

3.2 CLEANING

- A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.
- B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 26 09 23
LIGHTING CONTROL SYSTEM

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. It is the intent of this Specification to provide all necessary equipment as detailed, for a complete lighting control system.
2. The work included under this Specification shall cover:
 - a. All labor, materials and equipment to furnish the lighting control system herein specified.
3. The work shall also include the services of a factory-trained representative who shall inspect the system for proper operation and instruct the Owner as to proper operation and maintenance.

B. Manufacturer

1. The system specified is based on equipment as manufactured by Wattstopper. All reference to model numbers and other pertinent information is intended to establish standards or operational concepts, performance, quality and appearance, which must be met.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Provide connection/riser diagram for specific project involved. Upon Engineer's review, provide **additional three** copies for Contractor use at the project site and for Record Drawing/Manual submittal at project closeout.

B. Manuals

1. Provide information in accordance with Section 260500. Manuals shall include descriptions of equipment and methods of maintenance and operations.

PART 2 – PRODUCTS

2.1 SWITCHING SYSTEM

A. Panels to be factory assembled. Include 24 Volt power supply sized as required for relay quantity. Verify primary power supply voltage.

1. Relays
 - a. 20 amp 120/277 volt rated.
 - b. Suitable for all types of lighting loads.
 - c. Mechanically latched.
 - d. 14,000A SCCR minimum.
 - e. Relays indicated for use on life safety circuits shall be UL 924 compliant.

2. Enclosures
 - a. Painted steel backbox with hinged cover. Internal High/Low voltage barriers.
 - 1) Additional barriers as required to separate life safety circuits as per NEC.
 - b. Flush or surface as indicated on Drawings.
 - c. Interior insert with snap brackets and DIN rails for mounting system components.
 3. Programmable Network Time Clock
 - a. 7 day schedule with up to 36 holidays and 6 holiday date ranges.
 - b. Non-volatile program memory.
 - c. Astronomical clock setup.
 4. Multiple relay panel master/slave capability.
 5. Manufacturer: Wattstopper LIA Series; Leviton GreenMax Series, Hubbell CX Series, and LC&D GR Series.
- B. Switches
1. Push button low voltage.
 2. LED status indication for on and off status of button.
 3. Button configuration as shown on the drawings.
 4. Manufacturer: Wattstopper HDLS Series, Leviton RDGSW Series, Hubbell CSXW Series, or LC&D BR Series.
- C. Photosensor
1. Outdoor rated.
 2. Low voltage type with digital output to interface with switching panel control system.
 3. Manufacturer: Wattstopper HPCP8SS Series, Leviton PCOUT-SV, Hubbell LUXSTATLSO, or LC&D PCELL Series.

PART 3 – EXECUTION

3.1 STORAGE

- A. Store Lighting Control Components in a cool, dry space prior to installation.

3.2 INSTALLATION

- A. General
1. Install where shown on Drawings, plumb and level.
 2. Top of trim 6'-3" above finished floor for wall-mounted panel.
 3. Conductors neatly dressed and banded with nylon cable ties.
 4. From each flush installation, stub three additional 3/4" conduits into nearest accessible ceiling space to provide for future utilization of spare circuits.
 5. Provide 3/4" plywood backing for all surface-mounted panels.
 6. Provide individual terminal or lug for each wire. Multiple wires to common terminal or several terminals for single stranded conductor not acceptable.
- B. Provide low voltage cabling from control panel to peripheral devices as per manufacturer's instructions. Provide raceway system where concealed in walls, in mechanical rooms, and rooms without accessible ceilings.

- C. Provide engraved identification nameplate for system cabinet as per Specification 260553.
- D. Provide control station identification as per Drawings.

3.3 TESTS

- A. The system shall be configured as indicated on the drawings. Verify operational configuration with Engineer.
- B. Furnish a letter of verification to Engineer indicating that the system has been tested and configure by manufacturer's representative and is found to be complete and functional. List date of test and name of manufacturer's representative. Testing to include a functional test of all devices and verification of proper configuration for all devices. Notify Owner and Engineer one week in advance of scheduled tests.

3.4 INSTRUCTIONS

- A. Provide the Owner with complete instructions as to proper operation and maintenance of the lighting control system.
- B. Record instructions and include with manual in accordance with Section 260500.

3.5 CLEANING

- A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.
- B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

**SECTION 26 24 16
PANELBOARDS**

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide panelboards where indicated and scheduled.

1.2 SUBMITTALS

A. Shop Drawings:

1. Submit information in accordance with Section 260500. Show all details of:
 - a. Lugs.
 - b. Locations for grounding bar, neutral bar, and directory.
 - c. Main bus amperage and arrangement.
 - d. Weight and physical dimensions of enclosures.
 - e. Cover and lock type.
 - f. Quantity of spaces.
 - g. Quantity, arrangement, amperage and short circuit withstand ratings in RMS amperes for all circuit breakers.
 - h. Any other pertinent data.
 - i. Applicable series rating for this particular riser/fault current combination.

B. Record Manuals

1. Submit information in accordance with Section 260500.
 - a. Include fault current available at buss. Fault current calculations shall be based on actual installation criteria (conductor lengths, raceway types, etc.).
2. Include installation and maintenance instructions accompanying equipment.

PART 2 – PRODUCTS

2.1 MANUFACTURER

- A. Product of same manufacturer.
- B. Sizing and design based upon Eaton equipment; Eaton catalog numbers utilized for reference.
- C. Other Acceptable Manufacturers.
 1. Approved equal units by Siemens, or Square D.
- D. Contractor is cautioned to verify all physical dimensions of "equal" units prior to accepting quotation for bid.

2.2 GENERAL

- A. Provide sub-feed lugs, contactors, main breakers, or other equipment as scheduled.
- B. Provide copper bus, copper isolated neutral bar and copper grounding bar in all panelboards.

- C. Use load centers only where specifically indicated. Provide copper bus with plated aluminum neutral and grounding bars.
- D. NRTL-listed, and "suitable for use as service equipment" when required.
- E. Feeder risers are schematic only and not intended to infer lug arrangements. Contractor to indicate desired lug arrangements and sizes on shop drawings.
- F. Connection from load side of main breaker to panel bus shall be bus bar. Insulated wire and backfed types not acceptable.
- G. NRTL-recognized series ratings acceptable, with minimum ratings as specified herein.

2.3 BRANCH CIRCUIT PANELBOARDS

A. Circuit Breakers

- 1. Bolt-on.
- 2. Breaker Types:
 - a. Under 400 ampere: Quick-make, quick-break, thermal magnetic unless otherwise indicated.
 - b. 400 ampere and over: Solid-state molded case circuit breakers:
 - 1) Breakers shall contain electronic sensing, timing and tripping circuits.
 - a) Long time current
 - (i) Adjustable current pickup.
 - (ii) Adjustable time delay.
 - b) Short time current
 - (i) Adjustable current pickup.
 - (ii) Adjustable time delay.
 - c) Instantaneous current
 - (i) Adjustable current pickup
 - d) Ground fault, with integral test and reset buttons.
 - (i) Where required by the NEC unless otherwise indicated.
 - (ii) Adjustable current pickup.
 - (iii) Adjustable time delay.
 - 2) Include maintenance-mode override with indicating light for:
 - a) Devices serving as Service Disconnect.
 - b) Devices serving as Main Disconnect of separately derived systems.
 - c) 1200 Amp frame and larger.
- 3. Trip indicating.
- 4. Common trip on multi-pole breakers; handle ties not acceptable.
- 5. Minimum SCCR rating:
 - a. NRTL tested and certified series combinations acceptable.
 - 1) 10,000 for systems up to 240 volts.
 - 2) 35,000 for 277/480 volt systems.
- 6. Single pole 15 and 20 ampere ratings to be NRTL-listed as "Switching Breakers" and carry SWD marking.
- 7. FIRE ALARM EQUIPMENT
 - a. Circuit breakers feeding fire alarm control panels and/or other fire alarm equipment shall be equipped with a pad-locking device capable of locking the circuit breaker in the closed position.

B. Bus Assembly and Temperature Rise

- 1. Rating: As scheduled.

2. 98 percent conductivity.
3. "Distributed phase" or "Phase sequence" type bus bar connections.
4. Adjacent single pole breakers connected to opposite polarities.
5. Multi-pole breakers installable in any location.
6. Provisions for additional breakers such that field addition of connectors or mounting hardware will not be required.

C. Wiring Terminals

1. NRTL-listed as suitable for type of conductor specified.

D. Circuit Numbering

1. Starting at top, odd numbers in sequence down left-hand side and even numbers in sequence down right-hand side.

E. Cabinet

1. Enclose bus assembly in steel cabinet.
2. Wiring gutter sizes and steel gauge in accordance with NEMA and NRTL standards.
3. Fabricate box from galvanized steel or equivalent rust resistant steel.
4. Furnish **without** pre-punched knockouts.

F. Fronts

1. Code gauge, full finished steel with rust inhibiting primer and baked enamel finish.
2. Not removable with door in locked position.
3. Adjustable trim clamps.
4. Concealed steel hinges.
5. Door with tumbler-type cylinder lock, catch and spring-loaded door pull.
6. Flush lock not to protrude beyond door front.
7. Key all locks alike.
8. Circuit directory frame and card with clear plastic covering on inside of door.

G. Manufacturer

1. Eaton "Pow-R-Line Series".

2.4 POWER DISTRIBUTION PANELBOARDS

A. Circuit Breakers

1. Bolt-on.
2. Breaker Types:
 - a. Under 400 ampere: Quick-make, quick-break, thermal magnetic unless otherwise indicated.
 - b. 400 ampere and over: Solid-state molded case circuit breakers:
 - 1) Breakers shall contain electronic sensing, timing and tripping circuits.
 - a) Long time current
 - (i) Adjustable current pickup.
 - (ii) Adjustable time delay.
 - b) Short time current
 - (i) Adjustable current pickup.
 - (ii) Adjustable time delay.

- c) Instantaneous current
 - (i) Adjustable current pickup
 - d) Ground fault, with integral test and reset buttons.
 - (i) Where required by the NEC unless otherwise indicated.
 - (ii) Adjustable current pickup.
 - (iii) Adjustable time delay.
 - 2) Include maintenance-mode override with indicating light for:
 - a) Devices serving as Service Disconnect.
 - b) Devices serving as Main Disconnect of separately derived systems.
 - c) 1200 Amp frame and larger.
 - 3. Trip indicating.
 - 4. Common trip on multi-pole breakers; handle ties not acceptable.
 - 5. Equipped with individually insulated braces and protected connectors.
 - 6. Front faces of all circuit breakers to be flush with each other.
 - 7. Affix large, permanent, individual circuit numbers to each breaker in uniform position.
 - 8. Minimum 35,000 SCCR rated.
 - a. NRTL tested and certified series combinations acceptable.

B. Bus Assembly and Temperature Rise

- 1. Rating: As scheduled.
- 2. Insulated bus structure.
- 3. 98 percent conductivity.
- 4. "Distributed phase" or "phase sequence" type bus bar connections.
- 5. Adjacent single pole breakers connected to opposite polarities.

C. Wiring terminals

- 1. NRTL-listed as suitable for type of conductor specified.

D. Cabinet

- 1. Enclose bus assembly in steel cabinet.
- 2. Wiring gutter sizes and steel gauge in accordance with NEMA and NRTL standards.
- 3. Fabricate box from galvanized steel or equivalent rust resistant steel.
- 4. Furnish **without** pre-punched knock-outs.

E. Fronts

- 1. Minimum 12-gauge, full finished steel with rust inhibiting primer and baked enamel finish.
- 2. Circuit directory frame and card with clear plastic covering.

F. Safety Barriers

- 1. As required by UL or other NRTL.

G. Manufacturer

- 1. Eaton "Pow-R-Line Series".

2.5 CABLE TIES

- A. Thomas and Betts Company "Ty-Rap" or equivalent.

2.6 PLYWOOD BACKING FOR SURFACE MOUNTED PANELBOARDS.

- A. 3/4" grade AD, fire-resistant, painted gray (including edges).

2.7 PANEL SKIRTS (COVERS)

- A. Required for all surface panelboards.
- B. Minimum 14-gauge.
- C. Primed and painted to match panelboard.
- D. Same width and depth as panelboard. Single skirt acceptable for double panels.
- E. To span distance between finish floor and bottom of panel, and top of panel to ceiling line, or 8'-0" AFF where no ceiling is shown.
- F. Same manufacturer as panelboard: Not outside vendor.

PART 3 – EXECUTION

3.1 STORAGE

- A. Store panelboards in a cool, dry area prior to installation.

3.2 INSTALLATION

A. General

1. Install where shown on Drawings, plumb and level.
2. Top of trim 6'-3" above finished floor for wall-mounted panelboard.
3. Adjust operating mechanism for free mechanical movement.
4. Conductors neatly dressed and banded with nylon cable ties after final load balancing.
5. From each flush installation, stub three additional 3/4" conduits into nearest accessible ceiling space to provide for future utilization of spare circuits.
6. Provide 3/4" plywood backing for all surface-mounted panelboards.
7. Tighten all lugs in accordance with manufacturer's recommendations.
8. For all fusible distribution panelboards, arrange devices in descending order such that bussed space is at top and largest devices are at bottom.
9. Provide individual terminal or lug for each wire. Multiple wires to a common terminal, or several terminals for single stranded conductor not acceptable.

B. Identification

1. Identify panelboards and directories in accordance with Section 260553.
2. Provide nameplate similar to following example:

PANEL L6
120/208 VOLT 3Ø 4W
2" C – 4 #3/0
FED FROM SWBD #1

3. When required, provide identification as per NEC 210.5(C) at each branch circuit panelboard.

C. Concrete Pad

1. Locate floor mounted panelboard on concrete pad.
2. Dimensions: 4" high and extend 4" from front and sides.
3. Provided by Division 3. Coordinate installation.

3.3 TESTS

A. Balancing Load

1. Circuiting shown on Drawings is designed to produce equal loading on all phases.
2. Under actual operating, check and make circuit adjustments as required to produce balanced condition.

B. GFPE Testing

1. Performed when first installed on site, prior to being energized by utility transformer.
2. Primary current injection method shall be used for testing purposes per NEC 230.95-C.
3. Conducted in accordance with manufacturer's instructions.
4. Conducted in presence of manufacturer's representative.
5. Provide letter of verification to Engineer indicating:
 - a. Date of test.
 - b. Name of manufacturer's representative present.

3.4 CLEANING

- A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.
- B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

**SECTION 26 27 13
ELECTRIC SERVICE**

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide electrical service from Montana Dakota Utilities' point of connection to main switch.

B. Description of System

1. 120/208 Volts, 3 Phase, 4 Wire.

PART 2 – PRODUCTS

2.1 METERING

A. CT metering.

B. Utility company to furnish all instrument transformers and meters.

C. Meter Sockets: Provide as required by utility company.

2.2 CURRENT TRANSFORMER CABINETS

A. Construction

1. NEMA 3R.
2. 14-gauge galvanized steel.
3. Gray enamel finish, or as required by serving utility.
4. Single hinge cover with combination padlock and sealing wire.

B. Bus Assembly

1. Amperage as indicated on Drawings.
2. Copper bus bar.
3. Glaskyd insulator supports.
4. Combination disconnect/connector kit.
5. Window CT bus link kit.
6. Compression lugs.

C. Combination Back Pan

1. Galvanized steel
2. Pre-punched to accept bar type current transformers.

D. Manufacturer: American Midwest Power, Inc., Electro Mechanical Industries, Inc., or States Electric Mfg. Co.

2.3 TRANSITION CABINETS

A. Construction

1. 12-gauge galvanized phosphated steel.
2. Primed and painted one coat forest green enamel.
3. Lift off covers - both sides.
4. Padlocking handle with two point latch mechanism.
5. Penta head sealing bolt.
6. No trough openings, or furnish NEMA 3R cover plates.

B. Bus Assembly

1. Amperage as indicated on Drawings.
2. Copper bus bar.
3. Pre-punched to NEMA standards for up to five utility company lugs.
4. Compression lugs on load side.
5. Ground stud.
6. Provision for bar type CT's.

C. Manufacturer: Shallbetter CB series, or approved equal by American Midwest Power, Inc., Electro Mechanical Industries, Inc., or States Electric Mfg. Co.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Verify with utility company prior to Bid all specific equipment requirements, installation requirements and fees particular to this service installation and make allowances thereto.
- B. Include in Bid all utility company fees and charges associated with service installation.
- C. Include in Bid all miscellaneous lugs, ground rods, site and pad conduits, sleeves, and other appurtenances required for service installation and not provided by utility company.
- D. Transformer and Equipment Pads
 1. Concrete pads provided by Division 3.
 2. Size per utility company requirements.
 3. Coordinate installation.
- E. Contractor totally responsible for all utility company coordination, metering equipment placement, and transformer location, with respect to service installation.
- F. Service installation shall comply with "Electric Service Rules and Regulations" as published by Montana-Dakota Utilities Company.
- G. Cabinets
 1. Install cabinets in accordance with Code, product listing and manufacturer's recommendations.
 2. Install where shown on Drawings.
 3. Plumb and level.
 4. Top of trim 6'-3" above finished floor.

3.2 IDENTIFICATION

- A. Identify cabinets with nameplates in accordance with Section 260553.
- B. Inscription as directed by Engineer.
- C. Provide available fault current calculations for cabinets based on actual installation criteria (conductor lengths, raceway types, etc.). Include calculation information in Record Manuals.

3.3 CLEAN UP

- A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.
- B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES & DEVICE PLATES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide wiring devices complete with device plates of matching or specified color. Wiring devices include receptacles for the connection of portable equipment and switches used for the control of both lighting and fractional horsepower motor loads. Also included are dimmers, occupancy sensors, photoelectric switches and time switches.

B. Work Installed But Furnished by Others

1. Where indicated, install devices furnished by other Divisions of this Specification.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.

B. Record Manuals

1. Provide information in accordance with Section 260500.
2. Include installation and maintenance instructions accompanying the equipment.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Device color: Gray or as selected by Architect. Verify with Architect. (Exception: Red devices on emergency circuits where applicable).
- B. All devices shall be of the same manufacturer, except where specifically noted otherwise with the phrase "NO SUBSTITUTION".

2.2 SWITCHES

A. AC Toggle and Keyed Switches

1. 20-ampere 120/277 volt AC and HP rated.
2. Industrial Grade.
3. Color coded face or body by amperage.
4. Screw pressure plate back wire and side wire.
5. Federal Spec WS-896 listed.
6. Acceptable Manufacturers:
 - a. Cooper 2220 series
 - b. Hubbell 1220 series
 - c. Leviton 1220 series
 - d. Pass & Seymour PS20AC series

B. Pilot Light Switches

1. Neon lamp in red toggle handle, lit in "on" position.
2. 20 ampere, 120/277 volt AC rated.
3. Manufacturer: As listed above.

C. Time Switches

1. Two Circuit SPST switching, voltage rating as required.
2. Digital display with 7-Day programming.
3. Non-volatile program memory (battery backup unacceptable).
4. Manufacturer: Intermatic #ET2725 series.
5. Other acceptable manufacturer: Tork.
6. Special units as shown on Drawings.

D. Remote Photoelectric Switches

1. Threaded swivel mounting with locking nut and neoprene gasket.
2. Light level adjustment slide.
3. Activation: 1-5 footcandle on, 3-15 footcandle off.
4. See Section 260943 for photoelectric switch requirements

E. Spring Wound Timer Switch

1. As shown on Drawings.
2. Manufacturer: Intermatic.
3. Other acceptable manufacturers: Area Lighting Research, Rhodes Mark Time, or Tork.

F. Occupancy Sensors

1. Ceiling Mount – Low Voltage

a. Sensor:

- 1) Self-contained low voltage unit obtaining 24 VDC power from external power pack.
- 2) Passive dual technology sensing combining passive infrared and ultrasonic/microphonic technology. Selective for initial and maintained triggering.
- 3) Ceiling-mount with 360° conical pattern coverage.
- 4) Adjustable time delay, from 5 to 20 minutes.
- 5) Automatic adjustment option for continuous time of day usage monitoring with automatic off delay adjustment.
- 6) Integral light level sensor to prevent turning lights on at selected light level between 10 and 300 footcandles.
- 7) LED activity Indicator.
- 8) Manufacturer: WattStopper #DT-300, Sensorswitch CM-PDT Series, Leviton OSC series, Hubbell OMNIDT series, or approved equal.

b. Power Pack:

- 1) Transforms an input voltage of 120, 240 or 277 VAC to Class 2 24 VDC to power remote sensors.
- 2) Integral 20 amp line voltage relay with relay protection. Where circuit loads exceed 1920 watts @ 120 VAC or 4432 watts @ 277 VAC, provide two-pole power pack or additional single pole power packs as required.
- 3) Provide quantities as required.
- 4) Manufacturer: WattStopper #BZ series, Sensorswitch PP20 series, Leviton OPP20 series, Hubbell UVPP series, or approved equal.

2. Wall Mount
 - a. Self-contained line voltage unit with passive infrared sensing.
 - b. Rating: 120 VAC @ 800 watts, 240/277 VAC @ 1200 watts, electronic ballast rating. No minimum load requirements
 - c. PIR collector beams view out horizontally 35 feet in a wall-to-wall pattern, with a 20-foot effectiveness for small hand or body motions.
 - d. Adjustable time delay, from 5 to 20 minutes, with "OFF" override switch.
 - e. Automatic adjustment option for continuous time of day usage monitoring with automatic off delay adjustment.
 - f. Bypass mode to allow override button to act as a standard on-off switch in case of sensor failure.
 - g. Vandal resistant lens.
 - h. LED activity Indicator.
 - i. Multi-way version:
 - 1) Simultaneous load control from up to four device locations.
 - j. Dual-level version (ab switching):
 - 1) Two separate relays with dual override switches.
 - 2) Independent Auto or Manual mode per relay.
 - k. Manufacturer: WattStopper PW series, Sensorswitch WSX series, Leviton OSSMT series, Hubbell LHIR series, or approved equal.
3. Wall Mount with 0-10V Dimming
 - a. Self-contained line voltage unit with passive infrared sensing.
 - b. Rating: 120 VAC @ 800 watts, 240/277 VAC @ 1200 watts. No minimum load requirements.
 - c. Class 1 control of 0-10 Volt LED dimming for full range dimming control.
 - d. PIR collector beams view out horizontally 35 feet in a wall-to-wall pattern, with a 20-foot effectiveness for small hand or body motions.
 - e. Adjustable time delay, up to 30 minutes, with "OFF" override switch.
 - f. Multi-location capable.
 - g. Manufacturer: WattStopper PW-311, Sensorswitch WSX-D, Hubbell LHD-IRS series, or approved equal.

2.3 RECEPTACLES

A. General Purpose

1. 20 ampere, self-grounding, NEMA 5-20R, industrial specification grade.
2. Nylon face with finder grooves and compact body.
3. Minimum 0.032" triple wipe brass contacts.
4. Corrosion resistant steel strap interlocked with face and body.
5. Screw pressure plate back wire and side wire.
6. Tamper resistant.
7. Federal Spec WC-596 listed.
8. Acceptable Manufacturers:

a. Arrow Hart	TR5362xx
b. Hubbell	HBL5362xxTR
c. Leviton	5362-SGxx
d. Pass & Seymour	TR5362xx

B. GFCI

1. 20 ampere, feed-through type.
2. Two utilization points per device, with vertical orientation.
3. Tamper Resistant.
4. Manufacturer: As listed above.

C. Combination Duplex and USB Charging

1. 20 ampere, Decora style.
2. Two utilization points per device, with vertical orientation.
 - a. Includes one USB-A port.
 - b. Includes one USB-C port.
3. 5 ampere, 5 Volt USB output.
4. Tamper resistant.
5. Manufacturers:

a. Arrow Hart	TRUSBAC20
b. Hubbell	USB20ACPD
c. Leviton	M58AC
d. Pass & Seymour	TR20USBAC6.

D. Damp & Wet Locations

1. All 15 and 20 ampere, 125 and 250 volt non-locking receptacles shall be listed weather-resistant type as per NEC 406.9(A) and 406.9(B)(1).
2. Manufacturer: As listed above.

2.4 DIMMERS

A. LED

1. Control of 0-10 Volt LED dimming for full range dimming control.
2. Wattage as required by luminaire count in room.
3. Integral power pack for positive off.
4. Provide separate power pack if required by total room wattage.
5. Manufacturer: Lutron Diva Series #DVSTV.

2.5 DEVICE PLATES

A. Flush Interior

1. Opening for device intended.
2. 430 or 302/304 stainless steel, or as selected by Architect.
3. Where plastic plates are selected by Architect, provide thermoplastic type.
4. Manufacturer: Cooper, Hubbell, Leviton and Pass & Seymour.

B. Surface Interior

1. 1/2" raised cover

C. Damp & Wet Locations

1. Damp locations:
 - a. Refer to NEC 406.9(A).
 - b. Die-cast aluminum construction with stainless steel springs.
 - c. Unless indicated otherwise on the Drawings, Manufacturer: Pass & Seymour #4500 series or equivalent.
2. Wet locations:
 - a. Refer to NEC 406.9(B).
 - b. Unless indicated otherwise on the Drawings, Manufacturer: Red Dot #CKMU (horizontal) or #CKMUV (vertical), or approved equal by Hubbell.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General

1. Install device and plates where shown on Drawings in accordance with Code, product listing and manufacturer's recommendations.
2. Refer to Section 260534-3.1C for mounting heights.
3. Plumb and level.
4. Tight to wall.
5. Thoroughly cover wall opening around device.
6. Replace all devices and plates that become discolored or burned during construction.
7. Provide blank plates for unused openings.
8. Connect wiring devices by means of single conductor tails. Multiple wire connections not acceptable.
9. Tighten unused connection screws.

B. Identification

1. Identify wall switches which control lighting or equipment not in sight.
2. Refer to Section 260553-3.1C.

C. Receptacles

1. Vertical mounting with grounding pole at bottom.
2. Provide GFCI receptacles at NEC 210.8 locations.

D. Dimmers

1. No common neutrals.
2. Individually mounted: No gang mounting.
3. Do not remove any fins.

E. Photoelectric Switches

1. Install on roof, in center of structure where viewing from ground is minimal.
2. Verify exact location with Architect.
3. Penetrate roof with 3/4" RGSC, securely fastened to structure.
4. Provide flashing to maintain roof integrity.
5. Mount 18" above finished roof surface.
6. Make connections in weatherproof junction box.

F. Occupancy Sensors

1. Provide adequate supports to any structures, ceilings and grid system to safely attach sensors.
2. Mount external power packs (required only for low voltage sensors) within junction box in accessible ceiling space.
3. Verify operating parameters with Engineer.

3.2 TESTS

- #### **A. Proper operation of lighting switches, dimmers and occupancy sensors.**

B. Duplex Receptacles

1. Proper connections.
2. Test all receptacles with NRTL listed receptacle circuit tester similar to Bryant #5266-PT, or Ideal #EZ Check.

3.3 INSTRUCTIONS

- A. Instruct Owner's personnel in proper operation, setting, and maintenance of time switches, dimmers, occupancy sensors, and GFCI receptacles.

END OF SECTION

**SECTION 26 28 13
FUSES**

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide all fuses as required.

B. Work Furnished But Not Installed

1. Provide spare fuses for all sizes and classes required.
2. Quantity: 10%, with a minimum of three each rating, including motor starter control transformer fusing.

1.2 SUBMITTALS

A. Record Drawings

1. Indicate actual class, type and size of fuse installed in each device.

B. Record Manuals

1. Submit information in accordance with Section 260500.

PART 2 – PRODUCTS

2.1 FUSES

A. Larger than 600 amperes.

1. UL-listed, Class L.
2. Manufacturer: Bussmann Limitron KLU or "Hi-Cap" KRP-C, Littelfuse KLP-C, or Brush LCL.

B. 600 Amperes and Less Protecting Feeders or Combination Motor/Branch Circuit Loads

1. UL-listed, Class RK-1.
2. Manufacturer: Bussmann LPN-RK/LPS-RK, Littelfuse LLN-RK/LLS-RK, or Brush LEN-R/LES-R.

C. Elevators

1. UL-listed, Class J.
2. Manufacturer: Bussmann LPJ-SP, or Littelfuse JTD-ID.

D. Motor Starter Control Transformers

1. As recommended by manufacturer.

E. Plug Fuses

1. Dual element, UL-listed Type S with adapter.
2. Use only as indicated on Drawings for fused toggle switches.

2.2 SPARE FUSE CABINET

A. Construction

1. Welded steel or .080 gauge aluminum.
2. Gray enamel finish.
3. Locking handle/cylinder lock.
4. Integral shelving.

B. Size: Minimum 30" H x 24" W X 12" D.

C. Acceptable Manufacturers: American Midwest Power SFC 36, B-Line 243012FC, Bussmann SFC, Gould Shawmut GSFC, or Littelfuse LSFC.

2.3 PLYWOOD BACKING

A. 3/4" grade AD, fire resistant, painted gray (including edges).

PART 3 – EXECUTION

3.1 STORAGE

A. Store fuses in a cool, dry space prior to installation.

3.2 INSTALLATION

A. General

1. Install fuses in accordance with Code, product listing and manufacturer's recommendations.
2. Verify equipment fuse sized for load prior to installation.
3. All fuses shall be of same manufacturer.
4. Do not mix fuse classes in individual applications.
5. Fuses are not required for switchboard devices marked "Spare".

B. Spare Fuse Cabinet

1. Top of trim 6'-3" above finished floor.
2. Provide 3/4" plywood backing.

C. Identification

1. Indicate on inside cover with pressure sensitive tape the size, voltage and type of fuse furnished for each device.

END OF SECTION

SECTION 26 28 16
ENCLOSED SWITCHES & CIRCUIT BREAKERS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide disconnect switches where shown on Drawings or required by Code.
2. Provide enclosed circuit breakers where shown on the Drawings.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Indicate on submittal exact motor or equipment served.
3. Show all details including electrical ratings, enclosure dimensions and other pertinent data.

B. Record Manuals

1. Submit information in accordance with Section 260500.
2. Include installation and maintenance instructions accompanying the equipment.

PART 2 – PRODUCTS

2.1 DISCONNECT SWITCHES

A. Switch Interior

1. Positive "off" position.
2. Lugs: NRTL-listed for aluminum and copper cable.
3. Plated current carrying parts.

B. Switch Mechanism

1. Quick-make, quick-break operating handle and mechanism.
2. Integral part of box.
3. Enclosures: Code gauge sheet steel (NEMA 1) or Code gauge galvanized steel (NEMA 3R).
4. Treat with rust-inhibiting phosphate primer.
5. Finish: Baked enamel.

C. Ratings

1. 250 or 600 volt.
2. Heavy duty.
3. Horsepower rated.
4. NRTL-listed "Suitable for Use as Service Equipment" when required.

D. Fusing

1. NRTL-listed rejection feature.
2. Reject all fuses except UL-listed Class R.

E. Manufacturer: Panelboard manufacturer.

2.2 ENCLOSED CIRCUIT BREAKERS

A. Breaker Types:

1. Under 400 ampere: Quick-make, quick-break, thermal magnetic unless otherwise indicated.
2. 400 ampere and over: Solid-state molded case circuit breakers:
 - a. Breakers shall contain electronic sensing, timing and tripping circuits.
 - 1) Long-time current
 - a) Adjustable current pickup.
 - b) Adjustable time delay.
 - 2) Short time current
 - a) Adjustable current pickup.
 - b) Adjustable time delay.
 - 3) Instantaneous current
 - a) Adjustable current pickup
 - 4) Ground fault, where required, with integral test and reset buttons.
 - a) Adjustable current pickup.
 - b) Adjustable time delay.
 - b. Where used as a main service disconnect, or main branch panel device, provide maintenance-mode override.
3. Trip indicating.
4. Minimum SCCR rating:
 - a. 10,000 for systems up to 240 volts.
 - b. 35,000 for 277/480 volt systems.

B. Manufacturer: Panelboard manufacturer.

2.3 PLYWOOD BACKING FOR SURFACE MOUNTED SWITCHES

- A. For interior locations, mount on 3/4" AD, fire-resistant, painted gray (including edges).

PART 3 – EXECUTION

3.1 STORAGE

- A. Store disconnect switches or enclosed circuit breakers in a cool, dry space prior to installation.

3.2 INSTALLATION

A. General

1. Install all required disconnect switches or enclosed circuit breakers in accordance with Code, product listing and manufacturer's recommendations.
2. Plumb and level.
3. Tighten lugs in accordance with manufacturer's recommendations.

B. Identification

1. Identify disconnect switches or enclosed circuit breakers in accordance with Section 260553.
2. Nameplate required for all disconnect switches. Nameplate to include load served, voltage, horsepower or MCA rating, and fuse size. Nameplate shall be installed inside of cover on exterior disconnect switches.

Example:

RT-1
480 Volt, 3 Ø
35 MCA, 40 A Fuses

3. Do not use schedule number, but indicate load served.
4. Pressure sensitive tape identification for disconnect switches containing fuses.
5. Voltage markers on all disconnect switches containing system voltages in excess of 250 volts to ground.

3.3 TESTING

A. GFPE Testing

1. Performed when first installed on site, prior to being energized by utility transformer.
2. Primary current injection method shall be used for testing purposes per NEC 230.95-C.
3. Conducted in accordance with manufacturer's instructions.
4. Conducted in presence of manufacturer's representative.
5. Provide letter of verification to Engineer indicating:
 - a. Date of test.
 - b. Name of manufacturer's representative present.

3.4 CLEANING

- A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.
- B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 26 29 13
MOTOR STARTERS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide motor starters where shown and scheduled, or as required by Code.

B. Work Installed But Furnished Under Other Directives

1. Refer to Section 260500, Article 1.1, Paragraph D for extent of control devices furnished in other Divisions.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Show all details including electrical ratings, controls, schematic wiring diagrams, enclosure dimensions and other pertinent data.
3. Indicate on submittal exact motor or equipment served.

B. Record Manuals

1. Submit information in accordance with Section 260500.
2. Include installation and maintenance instructions accompanying the equipment.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Product of same manufacturer.
- B. Sizing based upon Eaton equipment.
- C. Other acceptable manufacturers: Approved equal units by Allen Bradley, Schneider, and Siemens.
- D. Contractor is cautioned to verify all physical dimensions of "equal" units prior to accepting quotation for Bid.

2.2 SINGLE PHASE MOTORS WITH INTEGRAL OVERLOAD PROTECTION

- A. Horsepower rated toggle switch, pilot handle where not in sight from motor.

2.3 SINGLE PHASE MOTORS WITHOUT INTEGRAL OVERLOAD PROTECTION

A. Manual Motor Starter

1. Manually operated toggle switch with integral overload protection.
2. Rendered inoperative unless thermal unit is in position.

3. Provide pilot light for manual starters not in sight from motor.
4. Provide flush-mounted starters with stainless steel plates.
5. NEMA 1 enclosures for surface-mounted starters unless otherwise required by environment.

B. Fused Toggle Switch

1. 4" square box mounting.
2. Complete with fuse adapter and plug fuse of correct rating.
3. Manufacturer: Bussmann or Reliance.
4. **Use only where specifically shown.**

2.4 THREE PHASE AND SPECIFIED SINGLE PHASE MOTORS

A. Across-the-line

1. Magnetic type, non-reversing unless otherwise scheduled.
2. Rated in accordance with NEMA standards, sizes and horsepower ratings.
3. Provide combination fusible unit with Class R fuse holders, where disconnect and starter are shown at the same location.
4. Minimum size: NEMA size 0.
5. Manufacturer's series: Eaton Freedom series, or approved equal units by Allen Bradley 512 series, Schneider 8538 series or Siemens Class 17 series.
6. Control
 - a. 120 volt control transformer
 - b. Control fusing:
 - 1) 250 volt - in accordance with NEC.
 - 2) 600 volt - primary and secondary fusing regardless of VA rating of control transformer.
 - c. Cover-mounted devices for single-speed starters:
 - 1) Transformer operated LED green pilot light for running indication, with push-to-test feature.
 - 2) H-O-A selector switch, unless otherwise scheduled.
 - d. Cover-mounted devices for two-speed starters:
 - 1) Transformer operated LED pilot lights for running indication, with push-to-test feature: Green for low speed, amber for high speed).
 - 2) High-low-off-auto selector switch, unless otherwise scheduled.
 - e. Molded coil construction.
7. Overload Protection – exterior locations
 - a. Resettable overload protection on all phases.
 - b. Class 20 construction.
 - c. Starter inoperative if one or more overload units removed.
8. Overload Protection – interior locations
 - a. Self-powered.
 - b. Solid state construction with adjustable overload protection on all phases.
 - c. Manual reset with capability for remote reset function.
 - d. Phase loss protection.
 - e. Ambient-insensitive within operating range of -25°C to 55°C.
 - f. Solid state construction, Class 20.
 - g. Starter inoperative if overload unit is removed.

9. Electrical Interlocks
 - a. Space for minimum three, any arrangement NO or NC.
 - b. Quantity: Two NO per starter.

B. Solid State Starters

1. Control and interlock options as previously indicated.
2. Run bypass contactor.
3. Class 20 overload protection.
4. Heavy-duty rating.
5. Temperature: NRTL-listed for -30 to 50°C ambient.
6. Rated for 4 starts per hour
7. Adjustable ramp times, torque control, and kick start.
8. Solid state reduced voltage type: Eaton 801+ Series.
9. Other acceptable manufacturers: As previously indicated.

2.5 THREE PHASE POWER MONITOR

- A. Provide for all three phase motors larger than two horsepower, and all three phase compressor equipment.
 1. Not required for motors served by solid state starters or variable frequency drives.
- B. Line voltage to match system.
- C. Operating parameters:
 1. Trip: 90% rated voltage on any or all phases.
 2. Reset: 93% rated voltage on all three phases.
 3. Dead band between trip and reset: 3%.
 4. Repeat accuracy: 1% maximum at 0-70°C.
 5. Trip Delay Time: Two seconds.
 6. Reset: Two seconds.
 7. Output contact rating: Pilot Duty, 470 VA @ 600 VAC.
 8. Transient Protection: 2500 Volts for 10 MS.
- D. Special Options
 1. NEMA 1 or 3R enclosure as required.
 2. Adjustable Time Delayed Restart: 30-300 seconds. Set at 300 seconds.
- E. Manufacturer: Motor Saver Model 350.
- F. Other acceptable manufacturers: Eaton #D65 series.

2.6 EMERGENCY SYSTEM TIMING RELAY

- A. Where indicated on Motor and Equipment Schedule, provide solid state timing relay to delay system start.
- B. Allen-Bradley Bulletin 700-RT99 W110A1 with program key assortment 700-RTX per relay.
- C. Mount in NEMA 1 enclosure near starter of equipment to be controlled.

2.7 PLYWOOD BACKING FOR SURFACE MOUNTED STARTERS

- A. 3/4" grade AD, fire-resistant, painted gray (including edges).

PART 3 – EXECUTION

3.1 STORAGE

- A. Store motor starters in cool, dry space prior to installation.

3.2 INSTALLATION

A. General

1. Plumb and level.
2. Install motor starters in accordance with Code, product listing and manufacturer's recommendations.
3. Tighten all lugs in accordance with manufacturer's recommendations.
4. Verify correct size overload protection with motor nameplate data and manufacturer's recommendations.
5. Where power factor correction is specified for connection to motor terminals (i.e. load side of overload units), reduce overload rating as per manufacturer's recommendations.
6. Provide 3/4" plywood backing where several controls are shown grouped for surface mounting.

B. Identification

1. Identify motor starters in accordance with Section 260553.
2. Provide two nameplates for all motor starters: One for starter, other for equipment. Do not mount equipment nameplate on motor. Rather, mount on equipment, in visible location near motor.
3. Do not use motor schedule numbers, but indicate motor or load served.
4. Provide pressure-sensitive tape identification in accordance with Section 260553 and 262813 for all motor starters containing fuses.
5. Indicate proper thermal overload unit by circling correct number on chart affixed to cover of starter.
6. Provide voltage markers for all motor starters containing a system voltage in excess of 250 volts to ground.
7. Voltage markers not required for motor starters which form a part of a motor control center as specified in Section 262419.

3.3 TESTS

A. Proper operation.

B. Correct rotation.

C. Solid state motor starters

1. Furnish letter of verification to Engineer indicating solid state motor starters have been tested by manufacturer's representative.
2. List date of test and name of manufacturer's representative.

3.4 INSTRUCTIONS

- A. Manufacturer's representative shall instruct Owner in proper maintenance and testing of solid state motor starters. Include name of Owner's representative in letter of verification.
- B. Record instructions and include with Record Manuals in accordance with Section 260500.

3.5 CLEANING

- A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.
- B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

**SECTION 26 32 13
GENERATOR SET**

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. NFPA 110 Level 1, standby-rated, engine-generator set to supply emergency power to selected loads when normal power is not available.

B. Description of System

1. Upon failure of normal power, automatic transfer switch shall cause engine to start automatically, attain rated voltage and frequency, and transfer load.

1.2 SUBMITTALS

A. Submittals for Prior Approval to Quote

1. Refer to Section 260500 for "Prior Approval to Quote" procedure.
2. Clearly indicate following on cover letter of submittal:
 - a. Combustion air CFM based on 110°F ambient.
 - b. Cooling air CFM based on 110°F ambient.
 - c. External static pressure capability of pusher fan (inches of water).
 - d. Unobstructed volume of radiator core available for cooling, cubic feet.
 - e. Heat rejection through cooling system.
 - f. Heat rejection to generator room.
 - g. Exhaust pipe size for particular distance of run.
 - h. Muffler dimensions.
 - i. Lift capacity of fuel pump.
 - j. Location of nearest maintenance and repair facility under the ownership of the supplier.
 - k. Any exceptions taken to technical requirements of Part 2, this Section.

B. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Include complete data for maintaining and operating unit:
 - a. Fuel requirements.
 - b. Lubrication requirements.
 - c. Exercising.
 - d. Tests to be performed.
 - e. Spare parts list.
 - f. Trouble shooting guide.
 - g. Description of operation.
3. Provide multiple copies. One to remain with generator and the other copies for Record Manuals.

C. Record Manuals

1. Submit information in accordance with Section 260500.
2. Include installation and maintenance instructions accompanying equipment.

3. Include written warranty and maintenance agreements.

1.3 QUALIFICATIONS

- A. Manufacturer: Company specializing in package engine generator sets with minimum five years documented experience.
- B. Supplier: Authorized distributor of engine generator manufacturer with service facilities within 350 miles of the project site.

PART 2 – PRODUCTS

2.1 GENERATOR SET

A. General

1. Fuel: #2 diesel or #1/winter blend as directed by Owner.
2. Engine driven, inline or V-type 4-cycle/stroke, 1,800 RPM with electronic governor.
3. Complies with current EPA regulations for nonroad engines of required hp.
4. Liquid cooled.
5. Furnish fuel pump, fuel filter with integral heater, and flexible fuel line.
6. Flexible fuel line to be braided metal, size as required.
7. Integral radiator with duct adapter.
8. Anti-vibration mounting pads between engine/alternator and base frame.
9. Heater
 - a. Water jacket type.
 - 1) Thermostatically controlled.
 - 2) Sized to maintain adequate block temperature to ensure prompt starting.
 - 3) Provide engine mounted isolation valves to facilitate removal and replacement.
 - 4) Provide one per in-line engine and one per bank for vee type engines.
 - 5) Manufacturer: Kim Hotstart or equivalent by generator supplier.
10. Safety Shutdowns.
 - a. NFPA 110 Level 1.
 - b. Dedicated shutdowns: Not to be included with monitoring functions.

B. Rating

1. 60 kW, 208-Volt, 3-Phase.
2. kW rating established at .8 power factor.
3. Adjust alternator size as required to accommodate large-motor starting transients and/or harmonics if applicable.
4. Voltage regulation + 2%, no load to full load.
5. 125° C temperature rise at full load.

C. Instrumentation

1. Electronic control panel, including (but not limited) to the following digital indications:
 - a. Oil pressure.
 - b. Coolant temperature.
 - c. AC voltmeter, ammeter, voltmeter/ammeter switch.
 - d. Running time meter.
 - e. Frequency meter. Electronic type. Vibrating reed and dial type not acceptable.
 - f. Integral start-stop engine controls.
 - g. 15 second crank with manual override.
 - h. NFPA 110 Level 1 safety indications.

2. Provide network interface module for web based access of all generator diagnostic information.
- D. Remote Annunciator
1. Electronic control panel, including (but not limited) to the following digital indications:
 - a. NFPA 110 Level 1 safety indications with separate LED for each item.
 2. Visual and audible, with silence button on horn.
- E. Output Circuit Breaker
1. Refer to Section 262416 for approved circuit breaker types.
 2. Integral mounting. Field mounting not acceptable.
- F. Manufacturer: MTU #4R0113DS60 Series or equivalent by Caterpillar or Generac.

2.2 SUB BASE FUEL TANK AND ACCESSORIES

- A. General
1. Integral skid-mount type, with wiring accessibility for underground conduit runs.
 2. Sized for minimum 24-hour full-load operation.
 3. Integral low fuel and high fuel contacts for remote annunciation.
 4. Double wall design with leak detection system.
 5. Constructed and tested in accordance with UL 142.
- B. Manufacturer: Klein, Tremont or equivalent by generator supplier.

2.3 MUFFLER

- A. General
1. All welded construction.
 2. Protected by high temperature, corrosion resistant coating.
 3. Suitable for mounting in any position.
 4. Rain cap, drip cap, and thimble.
 5. Exhaust connector:
 - a. Flexible.
 - b. Stainless steel bellows type.
 - c. 18" minimum length.
 - d. Flanged connections for trade sizes 4" and larger.
 - e. Drain plugs.
- B. Size in accordance with manufacturer's recommendations, matched to specific engine use.
- C. Rating: Critical.
- D. Overall attenuation: 24 to 28 dBA.
- E. Manufacturer: Riley Beaird, Inc., Maxim Silencer M41 series or equivalent by generator supplier.

2.4 STARTING BATTERIES

A. General

1. Industrial-grade lead acid.
2. Sized to provide three 15-second crank cycles.
3. Include battery tester, cables and clamps.
4. Tray conforming to NEC 480.8.
5. Battery heating pad.
 - a. Manufacturer: Kim #KB series with #AL-S thermostat or equivalent by generator supplier.

2.5 BATTERY CHARGER

A. Cabinet

1. Wall-mount with NEMA 1 or 3R type enclosure as required by location.

B. Indicators

1. DC ammeter.
2. DC voltmeter.

C. Electrical Characteristics

1. Overload protection.
2. Silicon diode full wave rectifiers.
3. Voltage surge suppressor.
4. Fused AC input.
5. 120 volt single phase input + 10%.
6. Float range (Volts DC per cell @ 25° C): 2.15-2.19.
7. Equalize range (Volts DC per cell @ 25° C): 2.25-2.45.
8. Charger to automatically select equalize mode whenever normal power is restored. Automatically switches back to float mode when normal equalizing potential reached.
9. Capacity: Sized for specific batteries utilized, to prevent undercharging and overcharging.

D. Manufacturer: Master Control System #MBC6 series.

E. Other acceptable manufacturers: La Marche or equivalent by generator supplier.

2.6 PROTECTIVE HOUSING

A. Weather-resistant

1. The engine generator set shall be factory-enclosed in heavy gauge steel enclosure:
 - a. Constructed with corner posts, coated with electrostatically applied zinc and finished with baked enamel paint (color as selected by Owner from standard color options).
 - b. With large easily opened doors to allow access to the engine, generator and control panel. Each door shall be fitted with stainless steel, lockable hardware, with identical keys. padlocks do not meet this Specification.
 - c. Mounted on the generator frame and shall include 2" Aeroflex or equivalent insulation with motor-operated intake and pressure exhaust damper (dampers shall be located on opposite ends of the enclosure). Motor-operated dampers shall be spring operated to open and motor closed.

- d. With snow hoods or internal louvers (intake and exhaust).
- e. Muffler shall be integral to enclosure (not mounted on top of enclosure). Rain cap included. Attenuation as required to meet overall requirements.
- f. Package shall be pre-wired. All block heaters, battery chargers, unit heaters, etc. shall be wired by the manufacturer, facilitating a single point connection to a load center or fused terminal strip in the field.
- g. With vermin proofing.
- h. Sound levels shall be between 63-70 dBA with full load at 7 meters.

2.7 FUEL POLISHER

- A. Compact packaged apparatus including programmable controller, replaceable 3 micron water block filter, magnetic conditioner, and pump.
- B. Capable of polishing up to 640 gallons of fuel in 8 hours, 1.3 GPM flow rate.
- C. AXI International #FPS-DX-S or approved equal.
- D. Fuel polisher shall be factory installed/wired/plumbed inside the Generator Protective Housing.

2.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: One for each type and rating used.
 - 2. Indicator Lamps: Two for each type used.
 - 3. Filters: Three additional sets of each fuel, oil, and air filter elements required for the engine.
 - 4. Fuel Polisher: Three additional water block filters and water block strainer baskets.

PART 3 – EXECUTION

3.1 STORAGE

- A. Store generator in a cool, dry space prior to installation.

3.2 INSTALLATION

- A. Install generator in accordance with Code, product listing and manufacturer's recommendations.
- B. Provide Electrical Circuitry/Connections.
 - 1. Generator Power.
 - 2. Generator Engine Start Accessories.
 - a. Batteries.
 - b. Battery Charger: 20/1 circuit breaker.
 - c. Battery heating pad: Same circuit as battery charger.
 - d. Ignition.
 - 3. Generator Engine Heaters
 - a. Water jacket heater: 20/1 or 30/2 circuit breaker as required.

4. Fuel System.
 - a. Tank float switch.
 - b. Solenoid valve - DC from engine.
 5. Remote Annunciator
 - a. Generator.
 - b. Tank float switch.
 - c. Rupture alarm float switch.
- C. Provide network cabling in accordance with Division 27.
1. Provide one cable, category type as required by Section 271500, from nearest data rack patch panel to generator. Provide conduit for cable for any exterior locations, or in exposed ceiling areas, to nearest cable tray. Cable may extend in cable tray to data rack. If no cable tray is available, extend cable above accessible ceiling spaces with proper supports as per Section 271500. Where any portion of cable is installed in conduit below grade, provide water-blocked cable.
- D. Concrete Pad
1. Locate generator on concrete pad.
 2. Dimensions: 8" high and extend minimum 8" from all sides of frame.
 3. Verify and maintain required clearances as per manufacturer's recommendations.
 4. Provided by Division 26. Coordinate installation.
- E. Mount remote annunciator panel where indicated on Drawings. Provide raceway system and conductors as required.

3.3 START-UP AND TESTING

- A. Supplier of generator shall provide the services of a factory-trained technician at start-up and testing of the installation.
- B. Notify owner, engineer, and local fire Marshall or Fire Chief one week in advance of scheduled testing. Division 26 Contractor responsible for test coordination and scheduling.
- C. A fuel allowance of \$600.00 for onsite setup and initial testing shall be included in the bid. Fuel allowance shall be used to fill tank to maximum amount possible for allowance amount. Supplier shall use any remaining fuel allowance to refill tank after testing. Supplier shall provide actual fuel receipts with test reports to verify fuel amount filled. Any allowance amount remaining after testing refill is completed shall be credited back to the Owner via change order.
- D. Factory-trained technician to perform tests as required and adjustments as needed. Tests shall include, but not be limited to:
 1. Phase Rotation Test (phase rotation to match normal power).
 2. Function test of all engine shutdown features such as low oil pressure, over-temperature, over-speed.
 3. Vibration test.
 4. Measure system charging voltage and individual cell voltages.
 5. Measure electrolyte specific gravity and level.
 6. Resistance load bank test:
 - a. Stepped sequence, no load to full load, timed for proper engine "break-in" to ensure proper ring seating.
 - b. Dry-type bank.
 - c. Two hours under full load.

- d. Perform at project site.
 - e. Provide written report for Record Manuals.
- 7. Automatic transfer switch operation and adjustment.
- E. Furnish letter of verification to Engineer indicating that the generator system has been tested by the manufacturer's factory-trained technician and is found to be complete and functional. List date of testing, name of factory-trained technician, and names of any other persons in attendance.

3.4 INSTRUCTIONS

- A. The generator supplier factory-trained technician shall instruct the Owner in proper operation, maintenance and testing of the complete generator system. Indicate on letter of verification, name of Owner's representative receiving instructions.
- B. Record instructions and include with Record Manuals in accordance with Section 260500.

3.5 WARRANTY

- A. Warranty shall be for a period of two years from date of project substantial completion, and shall include defective parts, workmanship, labor, mileage and travel time. Running hours shall not be limiting factor.
- B. Provide written warranty agreement

3.6 MAINTENANCE SERVICE

- A. At substantial completion, begin 24 months full maintenance servicing by skilled employees of the manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventative maintenance as recommended by the manufacturer and adjusting as required for proper operation. Maintenance service shall include parts and supplies as used in the manufacture and installation of the original equipment along with all required labor, mileage, and travel time.
- B. Provide written maintenance agreement.

END OF SECTION

SECTION 26 36 00
TRANSFER SWITCHES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide transfer switch for standby power system, in accordance with NFPA 110 Level 1, as shown on Drawings, and specified herein.

B. Description of System

1. Automatic transfer switch to stop and start emergency generator and transfer load from normal to emergency source.

1.2 QUALITY ASSURANCE

A. UL Standard 1008.

- B. To ensure coordinated equipment operation and performance, and to centralize responsibility, equipment covered by this Section shall be furnished and warranted by the same supplier as the emergency generator.

1.3 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Include:
 - a. Amperage.
 - b. Voltage.
 - c. Phase pole quantity and neutral configuration.
 - d. Dimensions.
 - e. Installed weight.
 - f. Electrical connections.
 - g. Time delays.
 - h. Enclosure type.
 - i. Short circuit withstand rating.
 - j. Any other pertinent information.

B. Record Manuals

1. Submit information in accordance with Section 260500.
 - a. Include fault current available at each set of lug terminals. Fault current calculations shall be based on actual installation criteria (conductor lengths, raceway types, etc.). Provide separate calculation from normal power source and alternate power source; indicate calculated values for each.
2. Include manufacturer's instructions for maintaining and operating the transfer switch, including repair parts list, adjusting time delay relays, troubleshooting guide, wiring schematics and etc.
3. Provide multiple copies: One to remain with transfer switch, other copies for Record Manuals.

PART 2 – PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCH

- A. Ampere rating, voltage rating and phase pole quantity as indicated on the Drawings or as required by generator full load ampere rating.
- B. Use rating shown on standard specification sheet. Special ratings not acceptable.
- C. Mechanically held with open transition.
- D. Solid neutral.
- E. Time Delays
 - 1. NFPA 110 Level 1.
 - 2. Engine starting, adjustable .5 to 6 seconds. Factory set at one second.
 - 3. Transfer to emergency after emergency source attains 90% of rated voltage and 95% of rated frequency, adjustable 0 to 5 seconds. Factory set at .5 seconds.
 - 4. Retransfer to normal, adjustable 0 to 30 minutes. Delay automatically bypassed if emergency source fails and normal source is available. Factory set at 20 minutes.
 - 5. Engine cool down, adjustable 0 to 5 minutes. Factory set at 5 minutes.
- F. Test switch to momentarily simulate normal source failure.
- G. Auxiliary contacts, two NO-NC rated 10 amps, 208 V 60 Hz.
- H. Source identification signal lights.
- I. Microprocessor Controller:
 - 1. Undervoltage, overvoltage, underfrequency, overfrequency and voltage unbalance monitoring of both normal and emergency sources.
 - 2. Adjustable dropout and pickup set points for all five situations.
 - 3. Phase monitoring to control inrush currents at transfer.
 - 4. Generator exercising to be 7-day programmable with selectable “load” or “no load” testing.
 - 5. LCD display with keypad for menu driven control of set points, time delays and generator exerciser functions.
 - 6. Real time clock with battery backup.
 - 7. Include Ethernet communication module for network interface capabilities. Allows web based access to all parameters available at HMI.
- J. Provide power manager module to monitor/report electrical characteristics.
 - 1. Voltage per phase, neutral, and unbalance.
 - 2. Current per phase, neutral, and unbalance.
 - 3. Real, Apparent, and Reactive power per phase and total.
 - 4. Power Factor.
 - 5. Frequency.
 - 6. Accumulated Energy.
- K. Manufacturer: ASCO 7000 series.

- L. Other acceptable manufacturers: Approved equal units by Russelectric Inc. (RMT series).

2.2 REMOTE ANNUNCIATOR

- A. Graphical touch-screen.
 - 1. ATS reporting/monitoring with alarm annunciation.
 - 2. NFPA 110 generator annunciation.
 - 3. Generator real time performance dashboard.
 - a. Including but not limited to engine speed, oil pressure, coolant temp, and fuel level.
- B. Web based with remote access capability.
- C. Alarm reporting via email/text.
- D. Manufacturer: ACSO 5705 series.

PART 3 – EXECUTION

3.1 STORAGE

- A. Store transfer switch in a cool, dry area prior to installation.

3.2 INSTALLATION

- A. Install transfer switch in accordance with Code, product listing, and manufacturer's recommendations.
- B. Securely mount transfer switch and accessories where shown on Drawings.
- C. Provide all control and power wiring/connections.
- D. Provide network cabling in accordance with Division 27.
 - 1. Provide one cable, category type as required by Section 271500, from nearest data rack patch panel to generator. Provide conduit for cable for any exterior locations, or in exposed ceiling areas, to nearest cable tray. Cable may extend in cable tray to data rack. If no cable tray is available, extend cable above accessible ceiling spaces with proper supports as per Section 271500. Where any portion of cable is installed in conduit below grade, provide water-blocked cable.

3.3 TESTS

- A. Test in conjunction with generator.

3.4 INSTRUCTIONS

- A. Manufacturer's representative shall instruct Owner in proper operation, maintenance and testing of complete transfer switch system. Representative shall assist the Owner in programming an exercise schedule that meets NFPA 110 Level 1 requirements. Indicate on Section 263213 letter of verification, name of Owner's representative receiving instructions.
- B. Record instructions and include with Record Manuals in accordance with Section 260500.

3.5 CLEANING

- A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.
- B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 26 43 13
SURGE PROTECTION DEVICES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide integral Surge Protective Device in panelboards and switchboards where indicated and scheduled.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.

B. Record Manuals

1. Submit information in accordance with Section 260500.
2. Include installation and maintenance instructions accompanying equipment.

PART 2 – PRODUCTS

2.1 TYPE 2 SURGE PROTECTIVE DEVICE (SPD)

A. Provided only in panelboards and switchboards as indicated on the drawings.

B. The panelboard/switchboard manufacturer shall internally install SPD protection within the panelboard and the entire assembly shall be UL 67 listed.

C. SPD requirements:

1. Listed and component recognized in accordance with latest editions of UL 1449, UL 96A and UL 1283.
2. Minimum surge capacity ratings as indicated on the drawings. Operating voltage and configuration as indicated on the drawings
3. 200kA Short Circuit Current Rating (SCCR). SPD devices obtaining SCCRs using upstream over current protection are prohibited.
4. 20kA nominal discharge current.
5. EMI/RFI noise filtering attenuation up to 50dB for 10kHz – 100MHz.
6. Self-contained module design, with each suppression element metal-oxide varistor (MOV) based incorporating thermal protection. End of life mode shall be open circuit.
7. Surge current diversion paths between each phase conductor and the neutral conductor, between each phase conductor and the ground and between the neutral conductor and ground. For delta configured systems, the SPD shall have components connected between each phase conductor and between each phase conductor and ground.

8. UL 1449 latest edition listed and recognized component voltage protection rating (VPR) shall not exceed:

<u>VOLTAGE</u>	<u>L-N</u>	<u>L-G</u>	<u>N-G</u>	<u>L-L</u>
240/120 1Ø	700V	700V	700V	1200V
208Y/120	700V	700V	700V	1200V
240D/120	700/1200V	700/1200V	700V	1800V
480Y/277	1200V	1200V	1200V	2000V

9. Designed to withstand a maximum continuous operating voltage (MCOV) of not less than 115% of nominal RMS voltage.
10. Equipped with on board visual and audible diagnostic monitoring devices mounted on the front cover of the SPD.
- Indicating lights shall provide full time visual diagnostic monitoring of the operational status of each phase of the surge current diversion module.
 - Audible diagnostic monitoring shall be by way of audible alarm. This alarm shall activate upon a fault condition. An alarm on/off switch shall be provided to silence the alarm.
 - LCD display surge counter located on the front cover of the SPD. Counter shall be equipped with a manual reset with protection from accidental operation and utilize non-volatile memory.
 - A set of Form "C" dry contacts shall be provided for remote annunciation.
11. Warranty: The panelboard manufacturer shall warranty the SPD for full replacement if destroyed by transients, including lightning, for a period of ten (10) years.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. SPD protection modules shall be factory installed by the panelboard/switchboard manufacturer integral to the panelboards/switchboards indicated on the drawings. Each entire assembly shall be UL 67 listed.

3.2 TESTS

- A. Verify all SPD equipment is active and in proper working condition prior to final project inspection.

3.3 CLEANING

- A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.
- B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 26 51 00
LUMINAIRES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Furnish and install a complete luminaire for each lighting outlet.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500 including voltage, housing and door frame material, lens type, diffuser thickness, lumen output, and color temperature.

B. Record Manuals

1. Provide information in accordance with Section 260500.

1.3 COORDINATION

- A. Confirm compatibility and interface of luminaire with other materials and job conditions prior to ordering. Report discrepancies to Engineer and defer ordering until clarified.
- B. Provide frames, trim rings, and backboxes as required.
- C. Coordinate with work of all other Divisions to avoid conflicts between luminaires, supports, fittings and mechanical equipment. Ceiling clearances are minimal. It is imperative that Contractors coordinate conduit and duct runs to facilitate luminaire installation as shown on reflected ceiling plans. Engineer will not be responsible for interferences arising from lack of field coordination between trades.

PART 2 – PRODUCTS

2.1 LUMINAIRES

A. General

1. UL or other NRTL listed.
2. Where shown to be installed in fire-rated assemblies, luminaires shall be listed in accordance with UL Standard 1598. Supplemental penetration protection (tenting) will be accomplished by General Contractor in accordance with UL Fire Resistance Directory. Coordinate installation with General Contractor. Supplemental protection shall be spaced minimum 1/2" away from the luminaire, per UL Standard 1598.
3. Verify ceiling finishes and equip all recessed luminaires with appropriate frames as required.
4. Furnish luminaires intended for use in lay-in grid ceilings with proper clips for compliance with NEC.
5. Refer to Section 260500 for "Prior Approval to Quote" procedure.

B. LED Lighting Systems

1. General: All LED lighting system components must be UL or other NRTL listed.
2. Light Engines:
 - a. Meets or exceeds 70% lumen maintenance at 50,000 hours based on IESNA LM-79-2008.
 - b. Minimum 80+ CRI rating.
 - c. 4000K color temperature, or as scheduled on drawings.
 - d. Minimum delivered lumens as scheduled on drawings.
3. Electronic drivers for LED's:
 - a. Factory installed.
 - b. Multi-volt for use on either 120v or 277v systems.
 - c. THD: < 20%.
 - d. Factory installed quick-disconnect plug internal to the luminaire for driver removal.
 - e. Rated for a minimum of 50,000 hours.
 - f. 0-10 Volt dimming standard. Provide non-dimming drivers only as scheduled.
 - 1) Controls and wiring as per manufacturer's recommendations. Provide power packs for wall-box dimmers as required for positive luminaire off.
4. Downlights shall incorporate integral diffuser type lens. Exposed modules not acceptable.
5. Emergency battery packs:
 - a. Include self-testing/self-diagnostics with audible alarm option.
 - b. Factory installed.
 - c. Minimum lumens as scheduled.
6. Spare Drivers:
 - a. Luminaire manufacturer shall keep reasonable driver stocks on hand for replacement of defective drivers under guarantee period.
7. Guarantee period: Minimum 60 months from date of substantial project completion.
 - a. Guarantee shall include all parts and labor required to bring luminaire to complete operation.
 - b. Labor shall be performed by an Owner approved Electrical Contractor licensed in the area the work is to be performed.
 - c. Any costs for equipment rentals required to service luminaires under warranty shall be the responsibility of luminaire manufacturer.

PART 3 – EXECUTION

3.1 STORAGE

- A. Store luminaires in a cool, dry space prior to installation.

3.2 INSTALLATION

- A. General

1. Install luminaires plumb and true, free of light leaks, warps, dents and other irregularities.
2. Equip any outlets not specifically labeled with a luminaire the same as those in rooms used for similar purposes.
3. Run all directional lenses the same direction in rooms, corridors and other adjacent areas that contain square luminaires.
4. Continuous row luminaires: Hang level in straight line and butt tightly together.
5. Verify exact location of luminaires with reflected ceiling plan. Any discrepancies between the lighting plan, reflected ceiling plan, or installed ceilings shall be brought to the attention of the Engineer for clarification prior to installation.

6. Coordinate with Mechanical Contractor in advance of installation to prevent space conflicts.
7. Connect recessed luminaires to branch circuitry by means of single flexible metal conduit 6'-0" in length.

B. Barriers

1. Required where recessed luminaires are installed in insulated ceilings.
2. Suitable material to satisfy NRTL requirements.
3. Provided by Division 26 when not indicated otherwise.
4. Coordinate installation.

C. Luminaire Supports

1. Provide adequate supports to any structures, ceilings and grid systems to safely suspend or attach luminaires.
2. General Contractor to provide ceiling support systems as required by that portion of the Specifications. Electrical Contractor to provide any additional supports on an "as needed" basis to prevent ceiling from sagging or developing other irregularities.
3. Contractor responsible for providing proper suspension and mounting devices and to safely support all luminaires shown on Drawings, regardless of ceiling systems.
4. Rigidly support surface suspended ceiling system with anchors, hangers or clips designed for the purpose.
5. Support surface-mounted luminaires at four-foot intervals.
6. Install recessed luminaires in accordance with manufacturer's recommendations.
7. Rigidly support recessed luminaires to structural members or properly supported ceiling system with hangers, clips or fasteners designed for the purpose.
8. Support pendant and stem-hung luminaires at four-foot intervals.

D. 0 – 10 Volt Dimming Control Circuits

1. Installed in accordance with NEC Article 725.
2. Class 1 systems
 - a. #14 AWG THWN/THHN solid conductors installed in the same raceway as associated power wiring.
3. Class 2 systems
 - a. #18/2 non-shielded cable unless otherwise indicated on the drawings.
 - b. Plenum rated where required.
 - c. Cable shall be installed in raceway when concealed within walls, in mechanical rooms, and rooms without ceilings.
 - 1) DO NOT INSTALL IN SAME RACEWAY AS POWER CIRCUITRY.
 - d. Cable not required to be enclosed in raceway when installed above accessible ceilings.
 - 1) Route cables parallel or perpendicular to building construction.
 - 2) Support cables from building structure utilizing approved methods.
 - 3) Neatly coil excess cable length of pre-terminated assemblies.
 - 4) All cable runs shall be continuous between devices. NO SPLICING.

3.3 TESTS

- A. Upon completion of this portion of the Work and prior to its acceptance by Owner, check for proper alignment and operation of all lighting equipment.

3.4 CLEAN UP

- A. Clean all luminaires immediately prior to final inspection.

END OF SECTION

**SECTION 26 65 10
OVERHEAD DOOR WIRING**

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide all wiring and control equipment not furnished with overhead door, for complete and satisfactory operation.

B. Overhead door wiring includes:

1. Power connections.
2. Control station installation.
3. Control connections between limit switches, safety devices, and door operator.

C. Work Not Included

1. Refer to overhead door section of specification for extent of material furnished with door.

PART 2 – PRODUCTS

2.1 MATERIAL

A. Disconnect Switches

1. Refer to Section 262816.
2. Separate switches required for each door.
3. Toggle switches acceptable for 115 volt rated motors.

B. Outlet Boxes

1. Refer to Section 260534.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install controller, push-button or key-operated stations for each overhead door. Provide conduit, boxes and wiring material required for electrical connection, including control cable connection to limit switches and safety devices.
- B. Where used, locate key-operated control stations on exterior of building, flush mounted. Seal conduit after conductor installation.

END OF SECTION

**SECTION 26 65 30
ELECTRIC HEATING EQUIPMENT**

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Furnish and install all electric heating equipment as scheduled on Drawings.

1.2 SUBMITTALS

A. Shop Drawings

1. Provide information in accordance with Section 260500.

B. Record Manuals

1. Provide information in accordance with Section 260500.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Size, wattage and control as scheduled.

PART 3 – EXECUTION

3.1 STORAGE

- A. Store electric heating equipment in a cool, dry space prior to installation.

3.2 INSTALLATION

- A. Install in accordance with Code, product listing, and manufacturer's recommendations.
- B. Mount baseboard heaters above Architectural base.

END OF SECTION

SECTION 27 05 00
DIVISION 27 GENERAL PROVISIONS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. The provisions and requirements of Section 260500 shall be applicable to Division 27.
- B. All Division 27 work shall be included under the Division 26 contract.
- C. The Contractor shall take special note that any conflicts between the Contractor and any Division 27 subcontractors shall not become an issue of the Engineer or Owner. It shall be the Contractor's responsibility to coordinate with the Division 27 subcontractor/s to determine where their work leaves off and where the subcontractor's work begins. The Contractor shall be responsible for all specified work including the operations of work under Division 27.

END OF SECTION

SECTION 27 05 28
NETWORK SYSTEMS ROUGH-IN

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide raceways for network systems as shown on the Drawings.

B. Work furnished and installed by others.

1. Local serving telephone utility shall place the service entrance cable to the point of presence, install circuit protection cabinet, protectors, and ground the entrance cable as needed to the service grounding conductor provided under this contract.
2. Owner's network systems supplier shall provide all end-user software, programming, computer servers, terminals and personal computers.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Main telephone terminal boards (TTB): $\frac{3}{4}$ " grade AD fire-resistant plywood, painted gray (including edges). Dimensions as required by serving utility company.

B. Voice/data terminal board (TTB):

1. $\frac{3}{4}$ " grade AD fire-resistant plywood, painted gray (including edges). Dimension as required by Owner's network system supplier. May be included with main telephone terminal board for single board installation.

C. Raceways:

1. As specified in Section 260533 and sized as shown on Drawings, minimum 1".

D. Boxes:

1. 2-1/8" deep unless restricted by wall thickness.
2. As specified in Section 260534 and 260540.

E. Blank plates:

1. As specified in Section 262726, yoke-mounted. Box-mounted plates not acceptable.

F. Firestop Assemblies

1. NRTL listed 4" square pathway with intumescent material designed to seal out fire, smoke, and toxic gases.
2. Quantity shall equal or exceed the width of the associated cable tray. i.e. a 6" wide tray requires two pathways.
3. Include mounting accessories as required by application specifics.
4. Manufacturer: EZ Path Series 44, 3M Model PT4SD or approved equal.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Serving Communications Utility Requirements

1. Raceways:
 - a. Provide telephone service entrance conduit, stubbed to terminal board from property line.
 - b. Verify service entrance conduit size and quantity, and property line location with serving utility.
 - c. Provide bushing or connector at each conduit stub.
 - d. Provide pull wire in each telephone conduit run.
2. Provide surface double-duplex receptacle at main telephone terminal board, fed from dedicated spare circuit breaker. Receptacles to be isolated ground type, with separate grounding conductor connected to panelboard grounding bar.
3. Provide telephone board communication grounding bus as required by serving utility, minimum #6 solid SDBC in conduit, extended shortest and most direct route to ground bar at main switch. Terminate in ground bar affixed to telephone terminal board, location as directed by serving utility.
4. Entire installation to comply with serving utility company requirements.

B. Raceways:

1. Stub from rough-in location into nearest accessible ceiling space, or location as indicated on Drawings.
2. Provide bushing or connector at each conduit stub.
3. Provide pull wire in each voice/data raceway.
4. Provide raceway system where concealed in walls, in mechanical rooms and rooms without accessible ceilings.

C. Provide blank plates for all rough-in boxes not concealed by Owner's voice/data equipment.

D. Entire installation to comply with Owner's network systems supplier requirements.

END OF SECTION

SECTION 27 15 13
NETWORK SYSTEMS CABLING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Provide Network Cabling System as shown and described.

B. Work furnished and installed by others.

1. Voice: The Owner will provide all telephone handsets.
2. Data: The Owner will provide all end-user software, programming, computer servers, terminals and personal computers.
3. Surveillance: The surveillance system cameras, servers, switches and storage equipment will be provided and installed either by the Owner or under other Sections of this specification.

C. Description of System

1. Voice: Work shall include, but not be limited to, devices, faceplates, cables and cable assemblies, connecting blocks, cable management, terminations, and final acceptance testing.
2. Data: Work shall include, but not be limited to, devices, faceplates, cables and cable assemblies, cable management, patch panels, data racks, terminations, and testing.
3. Surveillance: Work shall include, but not be limited to, cables and cable assemblies, cable management, terminations, and testing.

1.2 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Indicate:
 - a. Mounting details.
 - b. Connection diagrams.
 - c. Description of devices.
 - d. Name of installation Contractor/Subcontractor.

B. Record Manuals

1. Provide information in accordance with Section 260500.
2. Include manufacturer's data for adjustment, operation and maintenance of equipment and name of service organization.

PART 2 – PRODUCTS

2.1 MANUFACTURER/SUPPLIER

- A. The system specified is based on equipment as manufactured by General Cable, Panduit, Commscope and other manufacturers as listed. All reference to model numbers and other pertinent information is intended to establish the standards of operational concepts, performance, quality and appearance which must be met. Backboards, conduit, cable tray, and rough-ins shall be by Electrical Contractor.
- B. Contractors/Subcontractors performing Section 271500 work shall have personnel trained/certified in communications cabling installation via equipment manufacturers' or industry standards' training programs. Refer to Section 260500-1.5 Quality Assurance.
- C. Acceptable installers:
 - 1. Computer Store, 1100 S Broadway, Minot, ND 58701, 701/838-3967.
 - 2. Data Connections, 4016 37th Avenue NW, Mandan, ND (701) 426-8771.
 - 3. Dell-Comm, Inc. 812 S 18th St., Bismarck, ND 58504, 701/222-2887.
 - 4. Installers not listed above and wishing to quote shall refer to Specification 260500-1.4 for approval procedure. No consideration shall be given to any installer not pre-approved.

2.2 DEVICES AND FACEPLATES

- A. Data jacks: Single outlet RJ45, eight-pin/eight wire, modular construction, TIA/EIA-568.2-D Category 6 compliant, T568A and T568B identification, Panduit Mini-Com #CJ688TG, Commscope #MGS400 series, Leviton #61UJK series, or approved equal.
- B. Voice jacks: Same as data jacks.
- C. Voice wall-mount face plate/jack assembly: Stainless steel with Category 6 keystone jack, Panduit #KWP6, Commscope #630B8, Leviton #4108W1SP series, or approved equal.
- D. Faceplates
 - 1. Single gang with ID windows and two or four modular inserts as dictated by jack count shown on the drawings.
 - 2. 430 or 302/304 stainless steel, or as selected by Architect.
 - a. Panduit #CFPL2/4 series, Commscope #M12/14SP-L series, Leviton #43080-1L2/4 series, or approved equal.
 - 3. Where plastic plates are selected by Architect.
 - a. Panduit #CFPE2/4 series, Commscope #M12/14L series, Leviton #42080-2/4 series, or approved equal.
- E. Provide blank modules as required. Panduit #CMB, Commscope #M81, Leviton #41084 series, or approved equal.
- F. Color: Devices as selected by Owner, faceplates as selected by Architect.
- G. Surveillance Cameras
 - 1. Jack assembly for cameras mounted to accessible ceilings shall utilize Panduit Model #CBXQ1IW-A enclosure mounted to building structure above the ceiling. Surveillance system provider shall be responsible for patchcord between camera and jack.

2. Cameras mounted directly to rough-ins or surface boxes shall utilize cable terminated to RJ45 Plug, Panduit Model #FP6X88MTG field terminating type or approved equal. Provide minimum 12" extra cable length within rough-in or camera mounting equipment.

2.3 CABLES AND CABLE ASSEMBLIES

- A. Station cables (voice and data): Four unshielded, twisted pair, #23 gauge, Category 6 – 350 MHz, solid copper conductor, cable tray and plenum rated.
 1. General Cable #7131900, Commscope #2088B, Berk-Tek #10032094 or equivalent meeting the following characteristics at 250 MHz.
 - a. ACR: 10.5 dB min. @ 100m
 - b. PS-ACR: 8.5 dB min. @ 100m
 - c. ELFEXT: 24.5 dB min.
 - d. PS-ELFEXT: 21.5 dB min.
 - e. NEXT: 43 dB min.
 - f. PS-NEXT: 41 dB min.
 - g. ATTEN.: 32.8 dB max. @ 100m
 - h. LCL: 26 dB min.
 - i. Return Loss: 20 dB min.
- B. Extended Range cable: Four unshielded, twisted pair, #22 gauge, Category 6, solid copper conductor, cable tray and plenum rated.
 1. Limited power listed for up to 90 Watts (PoE Type 4)
 2. Certified for 10 Mbps transmission up to 250 meters.
 3. Certified for 1 Gbps transmission up to 200 meters.
 4. General Cable #8131800, Paige #258300336, or equivalent meeting the following characteristics at 250 MHz.
 - a. Insertion Loss: 30.6 dB/100m max.
 - b. Return Loss : 17.3 dB/100m min.
 - c. NEXT: 38.3 dB/100m min.
 - d. PSNEXT: 36.3 dB/100m min.
 5. Use only where indicated on the Drawings.
- C. Outside Plant cable: Four unshielded, twisted pair, #23 guage, Category 6, solid copper conductor, gel filled water block for underground/wet applications and UV resistant insulation.
 1. General Cable #7136100, Commscope #1572A, Berk-Tek #10139885 or equivalent meeting the following characteristics at 250MHz.
 - a. Insertion Loss: 32.8 dB max.
 - b. Return Loss : 17.3 dB min.
 - c. NEXT: 38.3 dB min.
 - d. PSNEXT: 36.3 dB min.
- D. Outside Plant Extended Range cable: Four unshielded, twisted pair, #22 gauge, Category 6, solid copper conductor, gel filled water block, wet listed, and extended range.
 1. Limited power listed for up to 90 Watts (PoE Type 4)
 2. Certified for 10 Mbps transmission up to 250 meters.
 3. Certified for 1 Gbps transmission up to 200 meters.

4. General Cable #8146100, Paige #258330804, or equivalent meeting the following characteristics at 250 MHz.
 - a. Insertion Loss: 30.6 dB/100m max.
 - b. Return Loss : 17.3. dB/100m min.
 - c. NEXT: 38.3 dB/100m min.
 - d. PSNEXT: 36.3 dB/100m min.

2.4 WIRELESS ACCESS POINT (WAP) CABLING

- A. Cabling for WAP's shall be Limited Power Listed CAT 6A.
 1. Data jacks: Single outlet RJ45, eight-pin/eight wire, modular construction, TIA/EIA-568.2-D Category 6A compliant, T568A and T568B identification, Panduit Mini-Com #CJ6X88TG, or approved equal.
 2. Above Ceiling Installation: Panduit #CBXQ2IW-A, or Approved Equal surface termination box attached to building structure.
 3. Station cables: Four unshielded, twisted pair, #23 gauge, Category 6A – 500 MHz, solid copper conductor, cable tray and plenum rated. UL Listed CMP-LP (0.7A).
 - a. General Cable #7151850 or Approved Equal meeting the following characteristics per 100 meters at 500 MHz.
 - 1) ACRF: 13.8 dB min.
 - 2) PSACRF: 10.8 dB min.
 - 3) PSAACRF: 32.0 dB min.
 - 4) NEXT: 33.8 dB min.
 - 5) PSNEXT: 31.8 dB min.
 - 6) PSANEXT: 60.0 dB min.
 - 7) Return Loss: 15.2 dB min.

2.5 MISCELLANEOUS PRODUCTS

- A. Cable management:
 1. 6" die-cast aluminum distribution rings: Allen Tel #GB13C or equivalent.
 2. Plenum velcro cable ties: Panduit #HLSP series or equivalent.
 3. Cable hooks with retainers: B-Line #BCH series or equivalent.
- B. Patch Panels
 1. Patch panels shall have modular jack-style termination connectors, be 24-port or 48-port in size, one or two standard EIA rack spaces in height. The panels shall have separate port and panel designation strips. Panduit #CP24BL or #CP48BL, Commscope #M2400-1U-GS, Leviton #49255-H24 or #49255-H48, or approved equal.
 2. Quantity: As required by station cable count.
- C. Data Rack (DTR)
 1. Data Racks to be provided by owner.
- D. Identification:
 1. Panduit #LS8E or Pan-Mark labeling systems or equivalent. Hand lettering not acceptable.

E. Power Strip:

1. 19" rack-mounted surge suppression strip. Six (6) NEMA 5-20 duplex receptacles. UL1449 listed. Clamping level not to exceed 330 volts.
2. Manufacturer: Leviton #5500-192 or equivalent.
3. Quantity: One per data rack.

2.6 COLOR

- A. All cables shall match their associated jack color for type of system served unless otherwise indicated.
- B. Verify cable and jack color configuration with Engineer/Owner's Rep.
- C. Typical color configuration.
1. Voice Jacks – Match Faceplate (Yellow cable)
 2. Data Jacks – Yellow
 3. WAP – Orange
 4. Cameras – Purple

PART 3 – EXECUTION

3.1 STORAGE

- A. Store system equipment in cool, dry space prior to installation.

3.2 GENERAL

- A. Securely install components where shown on Drawings.
- B. Contractor shall adjust and provide all other assistance required at final inspection to bring the system satisfactorily on-line.
- C. Install in accordance with NEC, EIA/TIA Standards, NRTL listing, and manufacturer's recommendations and instructions.
- D. Cable:
1. Install cables in raceways as required by Section 270528 and in cable tray (communications type) where cable tray is specified.
 2. Route open air cables (where not in raceway or cable tray) parallel or perpendicular to building construction supporting with specified products, maximum 4'-0" on center.
 3. Bundle multiple open air cable runs located in TTB/TB rooms together with velcro cable ties
 4. Identify ends of cables with room designations as directed by Owner.
 5. Bending radius shall be minimum 1".
 6. All cable runs shall be continuous, **NO SPLICING.**

3.3 DATA

- A. Provide Data Rack(s) as shown and specified.
- B. Install patch panels and cable management system in Data Rack.

- C. Install data station cable from patch panel to data outlet locations as shown on the Drawings. Cable length not to exceed 295 feet.
- D. Terminate cables according to T568A or T568B wiring scheme as determined by Owner's system requirements.
- E. Identify cable at both ends according to Owner's convention. Arrange patch panels and patch panel jacks as per Owner's convention. Identify all patch panels, patch panel jacks, and faceplate jacks according to Owner's convention.
 - 1. If no convention is available, room numbers shall be incorporated into the identification.
Ex: For room 120, use 120-1 for first cable, 120-2 for second cable, etc.

3.4 SURVEILLANCE

- A. Install separate dedicated patch panels in Data Rack for the camera cables.
- B. Install station cable from patch panel to camera locations as shown on the Drawings. Cable length not to exceed 295 feet. Verify exact camera location and mounting configuration with Surveillance System installer.
- C. Terminate cables according to T568A or T568B wiring scheme as determined by Owner's system requirements.
- D. Identify cable at both ends according to Owner's convention. Arrange patch panels and patch panel jacks as per Owner's convention. Identify all patch panels, patch panel jacks, and faceplate jacks according to Owner's convention.
 - 1. If no convention is available, camera numbers shall be incorporated into the identification.
Ex: For camera 21, use C-21.

3.5 GROUNDING

- A. For each data rack, provide one #10 AWG solid copper conductor from data rack to nearest panelboard with equipment ground bus.
- B. Where multiple data racks are located in single room (more than 2), provide isolated communication grounding bus in room. Extend #6 solid SDBC in conduit, extended shortest and most direct route to ground bar at nearest panelboard with equipment ground bus. Extend one #10 AWG solid copper conductor from each data rack to communication grounding bus in room.

3.6 TESTING REQUIREMENTS

- A. All terminated voice and data cables shall be tested and certified for TIA/EIA-568.2-D. Category 6 standards. The test shall be performed on the permanent link configuration (from station jack to patch panel jack). These standards require the following when tested at 250 MHz:
 - 1. Return Loss shall be no less than 10.0dB.
 - 2. Insertion Loss (Attenuation) shall not exceed 31.1dB.
 - 3. Near End Cross Talk (NEXT) shall be no less than 35.3dB.
 - 4. Power Sum Near End Cross Talk (PSNEXT) shall be no less than 32.7dB.
 - 5. Attenuation to Crosstalk Ratio Far-end (ACRF) shall be no less than 16.2dB.

6. Power Sum ACRF (PSACRF) shall be no less than 13.2dB.
 7. Propagation Delay shall be less than 490 nanoseconds.
 8. Propagation Delay Skew shall be less than 44 nanoseconds.
- B. All terminated WAP cables shall be tested and certified for TIA/EIA-568.2-D. Category 6A standards. The test shall be performed on the permanent link configuration (from station jack to patch panel jack). These standards require the following when tested at 500 MHz:
1. Return Loss shall be no less than 8.0dB.
 2. Insertion Loss (Attenuation) shall not exceed 43.8dB.
 3. Near-end Cross Talk (NEXT) shall be no less than 26.7dB.
 4. Power Sum Near-end Cross Talk (PSNEXT) shall be no less than 23.8dB.
 5. Attenuation to Crosstalk Ratio Far-end (ACRF) shall be no less than 10.2dB.
 6. Power Sum ACRF (PSACRF) shall be no less than 7.2 dB.
 7. Propagation Delay shall be less than 490 nanoseconds.
 8. Propagation Delay Skew shall be less than 44 nanoseconds.
 9. Power Sum Alien Near-end Cross Talk (PSANEXT) shall be no less than 49.5 dB.
 10. Power Sum Alien Attenuation to Crosstalk Ratio Far-end (PSAACRF) shall be no less than 23.7 dB.
- C. Additional testing shall include line mapping and cable length before final acceptance by Owner.
1. DC resistance shall be less than 3% or less than 150 milli-Ohms.
- D. All permanent link cable runs shall be documented with a hard copy print-out of the test results. Compile one copy of test results in a loose-leaf binder, similar to manual references in Section 260500, 1.04E. Submit at project completion with referenced Record Manual.
- E. Field tester to be Level III and conform to TIA/EIA 568.2-D Annex A & B requirements.

3.7 CLEANING

- A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.
- B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 28 05 00
DIVISION 28 GENERAL PROVISIONS

PART 1 – GENERAL

1.1 DESCRIPTION

- A. The provisions and requirements of Section 260500 shall be applicable to Division 28.
- B. All Division 28 work shall be included under the Division 26 contract.
- C. The Contractor shall take special note that any conflicts between the Contractor and any Division 28 subcontractors shall not become an issue of the Engineer or Owner. It shall be the Contractor's responsibility to coordinate with the Division 28 subcontractor/s to determine where their work leaves off and where the subcontractor's work begins. The Contractor shall be responsible for all specified work including the operations of work under Division 28.

END OF SECTION

SECTION 28 46 11
FIRE ALARM & DETECTION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work Included

1. Furnish and install a complete extension of the existing fire alarm and detection system in accordance with NFPA 72 and this specification.

B. Work not included

1. Where required, the Owner shall be responsible for:
 - a. Line lease or service fees associated with signal transmission (alarm, supervisor, and trouble) to a remote central station.
 - b. Any proprietary interface equipment not specified herein and required by the Owner's monitoring service.

C. Description of System

1. General: Provide a complete, non-coded, addressable, microprocessor-based fire alarm system with initiating devices, notification appliances, and monitoring and control devices as indicated on the Drawings and as specified herein.
2. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary. The system shall be capable of on site programming to accommodate system expansion and facilitate changes in operation. All software shall be stored in a non-volatile programmable memory within the fire alarm control panel (FACP). Loss of primary and secondary power shall not erase the instruction stored in memory.
3. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. Separate alarm, supervisory and trouble logs shall be provided.
4. Wiring/Signal Transmission
 - a. Transmission shall be addressable signal transmission, dedicated to fire alarm service only.
 - b. Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the fire alarm control panel. Provide a distinctive indicating audible tone and alphanumeric annunciation.
 - c. System connections for initiating, signaling line circuits and notification appliance circuits shall be Class A or Class B as described in Part 3 of this specification.
5. Analog Smoke Detectors
 - a. Monitoring: The FACP shall individually monitor detectors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The FACP shall determine the condition of each detector by comparing the detector value to the stored values.
 - b. Environmental Compensation: The FACP shall maintain a moving average of the detector's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.
 - c. Programmable Sensitivity: Smoke detectors shall have multiple sensitivity levels, programmed and monitored from the FACP.
 - d. The FACP shall automatically indicate when an individual detector needs cleaning.

- e. The FACP shall continuously perform an automatic self-test on each detector, which will check detector electronics and ensure the accuracy of the values being transmitted. Any detector that fails this test shall indicate a trouble condition.
- 6. Analog Heat Detectors
 - a. Monitoring: The FACP shall individually monitor detectors for alarm condition and shall individually adjust for fixed temperature sensing and rate-of-rise sensing. The FACP shall determine the condition of each detector by comparing the detector value to the stored values.
 - b. Programmable Sensitivity: Heat detectors shall have rate-of-rise temperature detection values selectable at the FACP for either 15° F or 20° F per minute. Fixed temperature sensing is independent of rate-of-rise sensing and shall operate at either 135° F or 155° F.
 - c. The FACP shall continuously perform an automatic self-test on each detector, which will check detector electronics and ensure the accuracy of the values being transmitted. Any detector that fails this test shall indicate a trouble condition.
- 7. Power Requirements
 - a. The FACP and each required expansion panel shall receive 120-volt AC power via a dedicated 20-ampere circuit breaker from the nearest panelboard. The incoming power to each panel shall be supervised so that any power failure will be indicated at the FACP and sound a trouble signal. The primary power branch circuit supplying fire alarm equipment shall supply no other loads. The circuit breaker:
 - 1) Location shall be permanently identified at the corresponding control unit.
 - 2) Shall have a listed circuit breaker locking device installed.
 - 3) Shall have a red marking which shall not damage the overcurrent protective device or obscure the manufacturer's markings.
 - 4) Shall be permanently identified as to its purpose: "FIRE ALARM" for fire alarm systems, "EMERGENCY COMMUNICATIONS" for emergency communications systems, and "FIRE ALARM/ECS" for combination fire alarm and emergency communications systems.
 - b. The FACP shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 5 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic. System batteries shall be supervised so that a low battery condition or disconnection of the battery shall be indicated at the control panel.
 - c. All circuits requiring system-operating power shall be 24-volt DC and shall be individually fused at the control panel.
 - d. The system shall support 100% of the addressable devices in alarm operation at the same time, under both primary (AC) and secondary (battery) power conditions.
- 8. Fire Sprinkler Monitoring
 - a. Water Flow: Activation of a water flow switch shall initiate a general alarm operation.
 - b. Valve Supervisory Switch (Tamper Switch): The activation of any valve supervisory switch shall activate system supervisory operations.
 - c. Activation of either a water flow switch or valve supervisory switch shall distinctly report which device is in alarm at the FACP and any required remote annunciator(s).

1.2 REQUIRED SYSTEM FUNCTIONS

- A. Priority of Signals: Alarm events have the highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Supervisory and Trouble events have second-level and third-level priority respectively. Events of a higher-level priority take precedence over events of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.

- B. Non-interfering: The activation of an addressable device does not prevent receipt of signals from subsequent activations.
- C. Transmission to Remote Central Station: The FACP shall have the capability to automatically route alarm, supervisory, and trouble signals to a central station via Internet Protocol (IP) over the public open Internet.
- D. Types of Signaling: The FACP shall be NRTL-listed for the applicable types of signaling methods used, i.e.: Temporal Coded, Non-Coded, March Time and/or Internet Protocol.
- E. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP and any required remote annunciator(s), indicating the location and type of device.
- F. General Alarm: Activation of an alarm initiating device shall include:
 - 1. Indication of alarm condition at the FACP and any required remote annunciator(s).
 - 2. Identification of the device that is the source of the alarm at the FACP and any required remote annunciator(s).
 - 3. Operation of all audible and visual notification appliances throughout the building until silenced at the FACP and any required remote annunciator(s). Audible alarm notification shall operate steady or match existing building convention.
 - 4. Shutting down designated air handling equipment, and activating smoke dampers and exhaust fans as required by alarm input.
 - 5. Have the capability to automatically route the signal to a Remote Central Station.
 - 6. The control panel shall be capable of bypassing Items 4 and 5 through the use of programmable touch pads on the front of the control panel. These touch pads shall be password-protected to prevent unauthorized tampering.
 - 7. Record the event in the FACP historical log.
 - 8. Closing doors normally held open by magnetic door holders.
 - 9. Initiate elevator recall in accordance with ASME/ANSI A17.1, when designated fire alarm detectors are activated.
 - 10. Initiation of smoke control sequence.
 - 11. Unlocking of designated doors.
- G. Supervisory Operations: Upon activation of a supervisory device such as fire pump failure, low air pressure switch, and tamper switch, the system shall operate as follows:
 - 1. Activate the system supervisory service audible signal and illuminate the LED at the FACP and any required remote annunciator(s).
 - 2. Pressing the Supervisory Acknowledge key will silence the supervisory audible signal while maintaining the supervisory LED "on" indicating off-normal condition.
 - 3. Record the event in the FACP historical log.
 - 4. Transmission of supervisory signal to Remote Central Station.
- H. Alarm Silencing: If the "Alarm Silence" button is pressed, all audible alarm signals shall cease. (Visual signals shall continue to operate.)
- I. System Reset:
 - 1. The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide the operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-arming the system. The display message shall indicate, "ALARM PRESENT, SYSTEM RESET ABORTED."

2. Should an alarm condition continue, the system will remain in an alarmed state.
- J. Drill: A manual activation (drill) switch shall be provided to initiate an alarm on the FACP.
- K. Manual Control: Manual controls shall be supervised so that an "off normal" position of any switch shall cause an "off normal" system trouble. The "off normal" status shall be clearly identified in plain language on the FACP alphanumeric display.
1. Manual Bypass Control: The ability to perform a manual bypass of selected automatic functions shall be provided.
 2. Circuit Enable/Disable Control: The system shall have provisions for disabling and enabling each circuit individually for maintenance or testing purposes.
- L. WalkTest: The system shall be capable of being tested by one person without returning to the control panel to reset the system after each alarm. Enabling the one-person test feature at the FACP shall activate the "One person Testing" mode of the system as follows:
1. The control panel shall automatically log each alarm and each trouble condition tested, and reset the system for the next condition to be received. Should the walktest feature be left off for a preprogrammed length of time without any activity, the system shall revert to the normal operating mode automatically.
 2. The city circuit connection and suppression release circuits shall be bypassed for the testing group.
 3. Control relay functions associated to the testing group shall be bypassed.
 4. The FACP shall indicate a trouble condition.
 5. The alarm activation of any initiating device in the testing group shall cause the audible notification appliances to sound a code to identify the device.
 6. The control panel shall automatically reset itself after signaling is complete.
 7. Any momentary opening of an initiating or notification appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating the trouble condition.

1.3 SUBMITTALS

A. Shop Drawings

1. Submit information in accordance with Section 260500.
2. Indicate:
 - a. Mounting details.
 - b. Cabinet dimensions.
 - c. Wiring diagrams.
 - d. Description of devices.
 - e. Floor plan layout of fire alarm system indicating location of devices, wiring between devices, and intensities of audible and visual appliances. Upon request, the Engineer will furnish AutoCAD files of the floor plan. Submit one copy to Engineer for approval. Upon receipt of Engineer's approval, provide **additional four** copies. Submit one copy to Engineer. Remaining copies for Contractor use at the project site and for Record Drawing/Manual submittal at project closeout (redlined to indicate actual conditions of installation).

B. Record Manuals

1. Provide information in accordance with Section 260500.
2. Include complete data for operation and maintenance of the system, consisting of:
 - a. Wiring diagrams.
 - b. Testing.

- c. Maintenance.
 - d. Description of system operation.
 - e. Addition of devices.
 - f. Frequency of testing procedures.
 - g. All data referenced in NFPA 72, 7.5.
3. Provide multiple copies (including shop drawing connection/riser diagram), one to remain in control panel, other copies for Record Manuals.

1.4 MANUFACTURER/SUPPLIER

- A. The existing system is manufactured by Simplex. All reference to model numbers and other pertinent information is intended to establish the standards of operational concepts, performance, quality and appearance, which must be met.
- B. Other acceptable manufacturers: Edwards Systems Technology, or Potter Electric Signal.
 - 1. Being listed as an acceptable manufacturer in no way relieves obligation to provide all equipment and features in accordance with this specification.
 - 2. All new equipment must be compatible with the existing Simplex fire control system.
- C. All equipment shall be NRTL-listed, and shall be furnished by one manufacturer to ensure listing/equipment compatibility as required by NFPA 72.
- D. Supplier providing equipment and services under this Section shall have:
 - 1. A factory-authorized service center located in North Dakota within 250 miles of the project site. Referenced service center shall be under direct control of the Supplier, staffed by employees of the Supplier, and contain an inventory of replacement material requisite for timely maintenance. Referenced service center shall be operational for a minimum five-year period or have equivalent five-year industry experience with installation and programming prior to bid opening.
 - 2. A minimum of one employee at the above referenced service center certified by National Institute for Certification in Engineering Technologies (NICET). Certification shall be in the Fire Protection Engineering Technology field, Fire Alarm Systems sub-field, and shall be minimum Level III.
- E. Acceptable Suppliers:
 - 1. ACS, 3410 13th St NE, Minot, ND (701) 446-8840.
 - 2. Electro Watchman, Inc., 4715 19th St SE, Mandan, ND (701) 258-6169.
 - 3. Forte, 1930 East Century Avenue, Bismarck, ND (701) 258-6360.
 - 4. Nardini Fire Equipment Co. Inc., 303 20th St N, Fargo, ND (800) 950-1139.
 - 5. NewVison, 3320 Hamilton St. Unit 5, Bismarck, ND 58503 (701) 222-8888.
 - 6. SimplexGrinnell, 2821 Fiechtner Drive, Fargo, ND (800) 342-4668.
 - 7. Systems Technology, 1424 44th St N, Fargo, ND 58102 (701) 235-0558.

PART 2 – PRODUCTS

2.1 CENTRAL SYSTEM

- A. Fire Alarm Control Panel (FACP)
 - 1. Existing FACP is Simplex #4007 Series.

B. Expansion Panels

1. NAC Addressable Controller
 - a. Stand-alone panel providing power and communications interface for addressable notification appliances with:
 - 1) Three isolated output channels for addressable notification appliance control.
 - 2) Channels that are Signaling Line Circuits (SLC's), each rated at 2-1/2 A and for up to 63 addressable notification appliances (up to 189 per controller).
 - 3) Individual supervision of each appliance allowing Class B wiring to be branch connected and "T" tapped.
 - 4) Comply with UL 864.
 - b. Input power: 120-volt AC.
2. NAC Extender
 - a. Stand-alone panel capable of:
 - 1) Powering a minimum of four non-addressable notification appliance circuits. Each circuit rated 2 A @ 24-volt DC.
 - 2) Controlling non-addressable notification appliances.
 - b. Internal power supply and battery charger capable of charging internal-mounted batteries or batteries mounted in an external cabinet where required.
 - c. Connected to the FACP via addressable communications circuit. Via the communications circuit each output notification appliance circuit can be individually controlled for general alarm or selective area notification.
 - d. Alarms from the FACP shall signal the NAC extender panel to activate. The panel shall monitor itself and each of its NACs for trouble conditions and shall report trouble conditions to the FACP.
 - e. Input power: 120-volt AC.

C. Alarm Initiating Devices

1. Manual fire alarm station:
 - a. "Address capable"
 - b. Non-coded single action.
 - c. Provide two spare stations.
2. Automatic area smoke detection station:
 - a. "Address" capable.
 - b. Combination photoelectric smoke and fixed heat plug-in "head" unit which mounts to a twist-lock base.
 - c. Individual station sensitivity levels are selected and monitored at the control panel.
 - d. Self-restoring.
 - e. White or Black color.
 - 1) Verify color for each area/room with architect and engineer.
 - f. Comply with UL 268.
 - g. Provide three spare stations.
3. Automatic duct smoke detection station:
 - a. "Address" capable.
 - b. Automatic photoelectric smoke detection station with associated duct housing and sampling tubes as required.
 - c. Refer to Motor and Equipment Schedule for equipment requiring duct detection.
4. Automatic area heat detection station:
 - a. "Address" capable.
 - b. Combination rate-of-rise and fixed temperature rate compensated sensing plug-in "head" unit, which mounts to a twist-lock base.
 - c. Individual station rate-of-rise temperature levels are selected and monitored at the control panel. Fixed temperature level is independent of rate-of-rise levels and shall operate at 135° F or 155° F. Select appropriate mode.

- d. Locations requiring temperature ratings exceeding 155° F may include hardwired detector on an addressable base.
- e. Self-restoring.
- f. Low profile.
- g. White or Black color.
 - 1) Verify color for each area/room with architect and engineer.
- h. Provide two spare stations of each rating.

D. Alarm Notification Appliances (Addressable)

- 1. Each notification appliance shall contain an electronic module and a selectable address setting to allow it to occupy a unique location on the circuit. This on-board module shall also allow the circuit to perform appliance diagnostics that assist with installation and subsequent test operations. A visible LED on each appliance shall provide verification of communications.
- 2. The controlling signaling line circuit digitally communicates with each appliance and receives a response to verify the appliance's presence on the circuit. The circuit provides a digital command to control appliance operation.
- 3. Audible alarm notification appliance:
 - a. Electronic horn type appliance with a High/Lo Setting, programmable by appliance from the FACP or by channel from the addressable controller.
 - b. Flush mount.
 - c. Red finish.
 - d. Comply with UL 464.
- 4. Visual alarm notification appliance:
 - a. Xenon or LED flash tube and associated lens/reflector system.
 - b. Comply with Americans With Disabilities Act (ADA). Provide Candela intensities as dictated by location and NFPA 72, 18.5.
 - c. "Fire" lettering on housing or lens.
 - d. Comply with UL 1971.
 - e. Adjustable intensity selector integral to appliance.
- 5. Where shown ganged together on Plans, combine audible and visual alarm notification appliances into one red device.
- 6. Manufacturer: Same as control panel.

E. Auxiliary Devices

- 1. Magnetic door holder:
 - a. 24 volt or match existing.
 - b. Extra low profile for use with concealed wiring.
- 2. Individual addressable module (IAM):
 - a. Module provides supervised, location specific addressability, to a single initiating device by monitoring normally open, dry contacts. Closure of contacts initiates an alarm or trouble signal as required by the device being monitored.
 - b. Used to provide addressable monitoring of devices such as flow or tamper switches, etc.
 - c. Powered directly from signaling line circuit. No separate power source required.
 - d. Mount in single-gang box, minimum 2-1/2" deep.
 - e. Included with flush or surface cover as required.
 - f. Provide a separate IAM for each device being monitored.
- 3. Individual addressable relay module (Relay IAM):
 - a. Module provides control and status tracking of a Form "C" SPDT, dry contact.
 - b. Module power and communications provided directly from the signaling line circuit.
 - c. Used to provide addressable control functions such as elevator recall, HVAC control, fan control, damper control, etc.

- d. Mount in standard 4" square box.
- e. Included with flush or surface cover as required.

F. Manual Shutdown

- 1. Manual shutdown capability included with motor starter.

G. Automatic Shutdown

- 1. Automatic shutdown capability for air handling equipment where required by NFPA 90A.
- 2. Locate fan shutdown relays remote from fire alarm control panel, controlled by integral relay in fire alarm control panel, with bypass switch.
- 3. Refer to Motor and Equipment Schedule for equipment requiring automatic shutdown.
- 4. Wiring: Two-wire parallel independent circuit to fire alarm control panel.

H. Remote Annunciator

- 1. Alphanumeric LCD display with the same "look and feel" as the FACP operator interface.
- 2. Status LED's provide system status in addition to LCD display information. Status LEDs included for:
 - a. Alarm.
 - b. System trouble
 - c. System supervisory.
 - d. Alarm silenced.
 - e. Power on.
- 3. Should an abnormal condition be detected the appropriate LED shall flash. The unit audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions. When acknowledged, the LED shall remain on until reset.
- 4. Captive key switch enables following push buttons:
 - a. Alarm acknowledge.
 - b. Trouble acknowledge.
 - c. Alarm silence.
 - d. System reset.
 - e. Supervisory acknowledge
- 5. Touchscreen type remote annunciator incorporating the same functionality as listed shall be acceptable.

I. Fire Sprinkler System Equipment

- 1. Flow switch(es) and valve supervisory switches furnished and installed by Fire Sprinkler Contractor, wired by Electrical Contractor.
- 2. Fire sprinkler alarm notification appliance (bell or audible-visual signaling unit) furnished by Fire Sprinkler Contractor, installed and wired by Electrical Contractor.

PART 3 – EXECUTION

3.1 STORAGE

- A. Store fire alarm components in a cool, dry area prior to installation.

3.2 INSTALLATION

A. General

- 1. Install in accordance with code, product listing, and manufacturer's recommendations.

2. Wiring to comply with all national, state and local fire codes.
3. All fire alarm circuitry shall be installed in raceway unless otherwise noted. Refer to Section 260533 for acceptable raceways.
4. Conductors:
 - a. Quantity as required by manufacturer.
 - b. Signaling Line Circuits (SLC):
 - 1) Two-conductor #18 AWG, twisted pair shielded or unshielded cable as per manufacturer requirements.
 - 2) NFPA 72 Class A, "T" tapping not permitted (exceptions as per NFPA 72, 12.3.8.1 acceptable).
 - c. Alarm notification appliance circuits (NAC):
 - 1) Solid, #14 AWG minimum, size for maximum 5% voltage drop.
 - 2) NFPA 72 Class A, "T" tapping not permitted (exceptions as per NFPA 72, 12.3.8.1 acceptable).
 - 3) Audible appliances (horns) controlled separately from visual appliances.
 - 4) All visual appliances shall flash in synchronization.
 - d. Miscellaneous Circuits: (such as magnetic door holders & etc.)
 - 1) Solid, #14 AWG minimum, size for maximum 5% voltage drop.
 - e. Color Coding: Manufacturer/Supplier requirements.
 - f. Enclosed in raceway system (i.e. conduit).
 - g. To ensure proper supervision of initiating and indicating circuitry, three wires maximum per wire-nut.
5. Raceway Systems:
 - a. Size raceway systems and junction boxes as per NEC.
 - b. All junction boxes, junction box covers and raceway systems except those embedded directly in earth or concrete, or surface metal raceway systems (wiremold), shall be externally identified by permanent bright red paint suitable for the purpose, to easily distinguish from other communication or power raceway systems. Items shall be painted prior to installation. In addition to field painted conduit, factory painted conduit as manufactured by Allied Tube & Conduit (Fire Alarm™ EMT), acceptable.
 - c. Route outgoing and return Class A circuits in separate conduits (exceptions as per NFPA 72, 12.3.8.1 acceptable).
 - d. Multiple circuits acceptable in same raceway system.
6. Terminations:
 - a. Connect all devices according to manufacturer's data.
 - b. Made on terminal strips with separate joint for each conductor.
 - c. Number identify all strips as shown in wiring diagram included with manual.
 - d. Number identify all conductors to agree with terminal strip numbering.
 - e. When required, end of line devices to be mounted on terminal strips in the FACP.
 - f. Wire-nut terminating not acceptable.
7. Do not zone alarm notification appliances. Rather, route notification appliance circuits (NAC's) with signaling line circuits (SLC's). Terminate and jumper as required to maintain supervision on identified terminal strips.
8. Locate devices as generally shown on Drawings and as specifically indicated on installation instructions.
9. Remote fan shut-down relays to be mounted near controller or equipment.
10. Where control panel is shown to be surface-mounted, provide 3/4" grade AD, fire-resistant, gray painted (including edges), plywood backing.
11. Provide 1/2" conduit from fire alarm control panel to nearest network rack offering internet access. Provide a four-pair minimum Category 5e UTP data cable terminated to the IP communicator module. Ensure owner's internet access equipment complies with secondary power requirements as required by NFPA 72. If owner provided internet access is not available, provide additional dedicated IP equipment as required to obtain internet service in conformance with NFPA 72.

12. Provide elevator/fire alarm interface as per Section 262822.

B. Spot-Type Detectors

1. Locate as generally shown on Drawings and as specifically indicated in NFPA 72 and on installation instructions.
 - a. All detectors in rooms with gas fired equipment shall include CO sensor.
2. Provide protective plastic wrapping to prevent entrance of construction dust. Field-install during construction. Remove immediately prior to supplier testing. Replace protective plastic wrapping and remove day of final inspection.
3. All smoke/heat detection devices shall be located a minimum of 3' from any supply, return, or exhaust air diffusers/grills.

C. Duct Detectors

1. Installed and arranged to automatically initiate general alarm.
2. Provide at a suitable location in the return air stream prior to exhausting from building or being diluted by outside air.
3. Provide at a suitable location in main supply duct on downstream side of filters.
4. Refer to Motor and Equipment Schedule for equipment requiring duct detection.
5. Locate as specifically indicated in NFPA 72 and on installation instructions. Coordinate with supplier's representative prior to installation, exact location to ensure accurate sampling of air stream. Provide quantity as required by duct geometry.
6. Do not install head on sampling tube base in housing until final supplier testing, unless a protective cover is included with the detector head.

D. Remote Annunciator

1. Flush mounting.
2. Gangable switch box as required.
3. Minimum two #14 AWG conductors and one #18 AWG twisted shielded pair, or as required by manufacturer.

E. Fire Sprinkler System Equipment

1. See Mechanical Drawings and Specifications for locations and quantities.
2. Valve supervisory switches:
 - a. Integral contact shall serve as supervisory initiating device for separate "Address".
 - b. Supervisory only. Will not sound general alarm, or "Trouble".
3. Flow Switch:
 - a. Consists of two Form "C" (NO-NC) contacts.
 - b. One contact shall serve as alarm initiating device for separate "address".
 - c. Second contact shall control fire sprinkler alarm notification appliance. Connect to nearest 120 volt egress circuit. Provide transformer and relay as required.

3.3 TESTS

- A. Prior to final inspection, verify that the fire alarm system is in proper working condition, free from false alarms. Furnish a letter of verification to Engineer indicating that the system has been tested by manufacturer's representative and is found to be complete and functional. List date of test and name of manufacturer's representative. Indicate in letter that testing was in accordance with NFPA 72, Chapter 14, including re-acceptance testing when applicable. Include copies in control panel and Record Manuals.

- B. Notify Owner, Engineer, and Local Fire Marshall or Fire Chief one week in advance of scheduled tests. Electrical Contractor responsible for test coordination and scheduling.

3.4 INSTRUCTIONS

- A. Manufacturer's representative shall instruct Owner in proper operation, maintenance and testing of complete fire alarm and detection system. Indicate on letter of verification, name of Owner's representative receiving instructions.
- B. Record instructions and include with Record Manuals in accordance with Section 260500.

3.5 CLEANING

- A. **Clean** and **vacuum interior** to remove all wire and insulation scraps, dust and dirt.
- B. Clean all exposed surfaces immediately prior to final inspection.

END OF SECTION

SECTION 31 10 00 SITE CLEARING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Clearing and protection of vegetation.
 - 2. Removal of existing debris.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 SITE CLEARING

- A. Protect benchmarks, survey control points, and existing site features to remain in place. Damage to these items shall be repaired by the Contractor at no additional expense to the Owner.
- B. Ensure all necessary erosion and sediment control measures are in place prior to commencing site clearing.
- C. Minimize production of dust due to clearing operations. Do not use water if it will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- D. Clear areas as indicated by the Plans.
- E. Apply an approved soil sterilant where existing vegetation is replaced by gravel, concrete, or asphalt.
- F. Backfill any voids left from site removals per ***Specification Section 31 22 00 - Grading***.

3.02 EXISTING UTILITIES AND AS-BUILT ELEMENTS

- A. Coordinate work with utility companies as needed. Notify utility companies before starting work and comply with their requirements. Obtain required permits for Work, if needed.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without the proper permits from the authority having jurisdiction.
- D. Protect existing structures and other elements that are not to be removed.

3.03 VEGETATION

- A. Do not remove or damage vegetation that is not shown for removal, or that is outside the property lines.

- B. Protect trees to remain by providing substantial fencing around entire trees at the outer tips of its branches in areas where work will be occurring. No clearing is to be performed inside this line.
- C. In areas where vegetation must be removed and no subgrade preparation is specified, removed vegetation with minimum disturbance to the subsoil.
- D. Dispose of removed vegetation off-site, unless otherwise indicated
- E. Remove stumps and roots to a minimum depth of 18-inches below proposed finish grade. Fill holes left by removal of stumps and roots using suitable fill material, with top surface neat in appearance and smooth enough not to constitute a hazard to pedestrians.
- F. If vegetation outside the removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace these items at no cost to the Owner.

3.04 PAVEMENT AND BASE

- A. Remove pavement and base in areas as noted by the Plans.
- B. Saw a vertical full-depth cut along the proposed removal edge of pavements prior to removal to provide a clean vertical face along the edge of the remaining pavement after removal is complete. Remove concrete pavements to the nearest joint when possible.
- C. Remove aggregate base beneath pavement through its full depth, where required.
- D. If removed aggregate is to be salvaged for re-use, avoid contaminating aggregate with subgrade materials.
- E. Take care during removals to avoid damage to adjacent pavements and site features to remain.
- F. Dispose of removed materials off-site, unless otherwise noted.

3.05 DEBRIS

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

END OF SECTION

SECTION 31 22 00

GRADING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Removal and storage of topsoil.
 - 2. Performing excavation and fill to planned subgrade elevations in areas outside the building footprint.
 - 3. Finish grading.
- B. Reference Standards (The current standard as of the date noted on the plans shall be utilized, unless noted otherwise):
 - 1. North Dakota Department of Transportation (NDDOT) Standard Specifications for Road and Bridge Construction
 - 2. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials.
 - 3. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 4. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 - 5. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)).
 - 6. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 - 7. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - 8. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- C. Reference Reports:
 - 1. Report of Geotechnical Exploration, if available.

1.01 SUBMITTALS

- A. Compaction Density Test Reports.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Topsoil - Soil Type: Re-use removed topsoil from the site.
 - 1. Graded and free of clumps larger than 1½-inch in diameter.
 - 2. Free of roots, rocks larger than ½-inch, subsoil, debris, large weeds, and foreign matter.
- B. General Fill - Fill Type: Subsoil excavated on-site, unless recommended otherwise by the Soils Exploration Report.
 - 1. Graded.
 - 2. Free of lumps larger than 3 inches, rocks larger than 2 inches, organic material, and debris.

3. Material must meet the requirements of the Geotechnical Report, if available.

2.02 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. When fill materials or topsoil need to be stored on site, locate stockpiles per the following requirements:
 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 2. Prevent contamination.
 3. Protect stockpiles from erosion and deterioration of materials.
 4. Do not place stockpiles in standing water or locations where water will drain.
 5. Place in a location that does not adversely affect the work being performed on-site.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey benchmarks and intended elevations for the Work are as indicated.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Stake and flag locations of known utilities.
- C. Locate, identify, and protect from damage above and below grade utilities to remain.
- D. Protect site features to remain, including but not limited to benchmarks, survey control points, existing structures, fences, sidewalks, paving, and curbs from damage by grading equipment and vehicular traffic.
- E. Ensure all erosion and sediment control measures are in place prior to commencing site grading.

3.03 ROUGH GRADING

- A. Remove and salvage topsoil thru its full depth from areas to be further excavated, re-landscaped, or re-graded, without mixing it with foreign materials. Stockpile and stabilize salvage an adequate quantity topsoil for re-use after completion of grading. Excess topsoil shall be disposed of off-site.
- B. Do not remove topsoil when wet.
- C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.
- D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.
- E. Excess subsoils remaining after completion of grading shall be disposed of off-site, unless otherwise indicated on the Plans.
- F. Verify that all soil types and compaction of soils meet the requirements of the Geotechnical Report. If questionable soils are encountered on-site that are not discussed in the Geotechnical Report, contact the Architect immediately to determine what measures should be taken to correct the subgrade issues.

- G. When excavating through roots, perform work by hand and cut roots with sharp axe.

3.04 FILLING

- A. Fill to contours and elevations indicated using unfrozen materials.
- B. Fill up to subgrade elevations unless otherwise indicated.
- C. Employ a placement method that does not disturb or damage other work.
- D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen, or spongy subgrade surfaces.
- E. Place in lifts with a maximum compacted thickness of 8-inches.
- F. Maintain moisture during compaction to within the following tolerances attain required compaction density, unless otherwise noted by the geotechnical report:
 - 1. Clay: -1% to +3% of optimum moisture content
 - 2. Sand: $\pm 3\%$ of optimum moisture content
- G. Maintain the following minimum compaction densities relative to the soils maximum dry density as determined using the Standard Proctor per ASTM D698, unless otherwise specified or indicated, unless otherwise noted by the geotechnical report:
 - 1. Under foundations: 98%
 - 2. Under paving, slabs-on-grade, and similar construction: 95%
 - 3. Under landscape surfaces: 90%
- H. Reshape and re-compact fills subjected to vehicular traffic.

3.05 FINISH GRADING

- A. Before Finish Grading:
 - 1. Verify subgrade has been contoured per the Plans.
 - 2. Verify that compaction and/or soils meet the requirements of the Geotechnical Report.
 - 3. Verify positive drainage of the subgrade.
- B. Slope grade away from building minimum 2-inches in 10-feet minimum, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- C. Remove debris, roots, branches, stones larger than 1/2-inch in size. Remove soil contaminated with petroleum products.
- D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3-inches.
- E. Place topsoil during dry weather.
- F. Remove roots, weeds, rocks, and foreign material while spreading.
- G. Near plants spread topsoil manually to prevent damage.
- H. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.
- I. Lightly compact placed topsoil.

3.06 TOLERANCES

- A. Maximum Variation of Surface Flatness: $\pm\frac{1}{2}$ -inch in 10-feet.
- B. Top Surface of Grading: $\pm\frac{1}{2}$ -inch from required elevations.

3.07 FIELD QUALITY CONTROL

- C. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D3017, or ASTM D6938.
- D. Evaluate results in relation to compaction curve determined by testing backfill material in accordance with ASTM D698 ("standard Proctor").
- E. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- F. Frequency of Tests: Each 1-foot lift of every 2,500 sf of compacted area for mass grading, pavement subgrade, and aggregate base course; Each lift for every 100 linear feet of compacted wall backfill.
- G. Proof roll subgrade surfaces upon completion of site grading. Correct areas that show visible movement.

3.08 REPAIR AND RESTORATION

- A. All exposed soil areas must be stabilized per the North Dakota Pollutant Discharge Elimination System (NDPDES) permit for this site, if applicable.
- B. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

3.09 CLEANING

- A. Remove unused stockpiled topsoil. Grade stockpile area to prevent standing water.
- B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION

SECTION 31 23 33

TRENCHING AND BACKFILLING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Trenching, Backfilling, and compacting for utilities outside of the building footprint to utility main connections.
- B. Reference Standards (The current standard as of the date noted on the plans shall be utilized, unless noted otherwise):
 - 1. North Dakota Department of Transportation (NDDOT) Standard Specifications for Road and Bridge Construction.
 - 2. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials.
 - 3. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 4. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 - 5. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)).
 - 6. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 - 7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
 - 8. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- C. Reference Reports:
 - 1. Report of Geotechnical Exploration, if available.

1.02 SUBMITTALS

- A. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- B. Compaction Density Test Reports.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. General Fill - Subsoil that is relatively sandy in texture and easy to compact that is excavated on-site or that is imported.
- B. Structural Fill – Subsoil below buildings and foundations and their 1H:1V oversize areas shall be per the Geotechnical Report and/or structural Plans and Specifications.
- C. Granular Fill – Gravel Class 2 per Section 816 of the North Dakota DOT Standard Specifications - AASHTO M47, Grade & Sieve as recommended by soils report; with

a liquid limit of not more than 25 and a plasticity index of not more than 5 in accordance with ASTM D4318.

- D. Sand - Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.
- E. Topsoil - Topsoil from existing pile at southeast corner of the property.

2.02 SOURCE QUALITY CONTROL

- A. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site and obtain Architect's approval of fill material.
- B. If tests indicate materials do not meet specified requirements, change material and retest.
- C. Provide materials of each type from same source throughout the Work.

2.03 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles per the following requirements:
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.
 - 4. Do not place stockpiles in standing water or locations where water will drain.
 - 5. Place in a location that does not adversely affect the work being performed on-site.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey benchmarks and intended elevations for the work are as indicated.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.

3.03 TRENCHING

- A. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- B. Slope banks of excavations deeper than 4-feet to angle of repose or less until shored.
- C. Do not interfere with 45° bearing splay of foundations.
- D. Cut trenches wide enough to allow inspection of installed utilities.
- E. Hand trim excavations. Remove loose matter.

- F. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.
- G. Remove excavated material that is unsuitable for re-use from site.
- H. Stockpile excavated material to be re-used within the site disturbance limits.
- I. Remove excess excavated material from site.

3.04 PREPARATION FOR UTILITY PLACEMENT

- A. Cut out soft areas of sub-grade not capable of compaction in place. Backfill area with granular fill if below utility, and general fill if above utility.
- B. Compact sub-grade to density equal to or greater than requirements for subsequent fill material.
- C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.05 BACKFILLING

- A. Backfill to contours and elevations indicated using unfrozen materials.
- B. Employ a placement method that does not disturb or damage other work.
- C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen, or spongy sub-grade surfaces.
- D. Place in lifts with a maximum compacted thickness of 8-inches.
- E. Maintain moisture during compaction to within the following tolerances attain required compaction density, unless otherwise noted by the geotechnical report:
 - 1. Clay: -1% to +3% of optimum moisture content
 - 2. Sand: $\pm 3\%$ of optimum moisture content
- F. Maintain the following minimum compaction densities relative to the soils maximum dry density as determined using the Standard Proctor per ASTM D698, unless otherwise noted by the geotechnical report::
 - 1. Under foundations: 98%
 - 2. Under paving, slabs-on-grade, and similar construction: 95%
 - 3. Under landscape surfaces: 90%
- G. Correct over-excavated areas.
 - 1. Use granular fill, flush to required elevation, compacted to minimum 98% of maximum dry density.
- H. Reshape and re-compact fills subjected to vehicular traffic.
- I. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

3.06 BEDDING AND FILL AT SPECIFIC LOCATIONS

- A. Use structural fill below buildings and foundations and their 1H:1V oversize areas
- B. Use granular fill for any fill below utilities in utility excavations.

- C. Use general fill unless in all other areas, unless otherwise specified or indicated.

3.07 FIELD QUALITY CONTROL

- A. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D3017, or ASTM D6938.
- B. Evaluate results in relation to compaction curve determined by testing backfill material in accordance with ASTM D698 ("Standard Proctor").
- C. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- D. Frequency of Tests: Test backfill at 2-foot depth intervals for every 100 linear feet of utility trench.

3.08 CLEANING

- A. Remove unused stockpiled materials. Leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- B. Replace topsoil at surface of trench in landscape areas per **Section 31 22 00 - Grading**.

END OF SECTION

SECTION 32 11 23

AGGREGATE BASE COURSE

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Aggregate Base Course for site pavements.
- B. Reference Standards (The current standard as of the date noted on the plans shall be utilized, unless noted otherwise):
 - 1. North Dakota Department of Transportation (NDDOT) Standard Specifications for Road and Bridge Construction.
 - 2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 3. AASHTO T11 – Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing.
 - 4. AASHTO T27 – Sieve Analysis of Fine and Coarse Aggregates.
 - 5. AASHTO T 191 – Density of Soil In-Place by the Sand Cone Method.
 - 6. ASTM D 2167 – Density and Unit Weight of Soil in Place by the Rubber-Balloon Method.
 - 7. AASHTO T 310 – In-Place Density and Moisture Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
 - 8. AASHTO T 265 – Laboratory Determination of Moisture Content of Soils.
 - 9. ASTM D 4643 – Determination of Moisture Content of Soil by the Microwave Oven Method.
- C. Reference Reports:
 - 1. Report of Geotechnical Exploration, if available.

1.02 SUBMITTALS

- A. Results of Aggregate Composition laboratory tests on proposed and actual materials used to verify that they meet all specified requirements.
- B. Compaction Density Test Reports.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on-site in advance of need.
- B. Aggregate Storage, General:
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Class 5 Aggregate Base: Shall meet NDDOT Standard Specification Section 816.01-02 for Class 5 Aggregate.

2.02 SOURCE QUALITY CONTROL

- A. Perform aggregate testing as specified, herein.
- B. If tests indicate materials do not meet specified requirements, change material and retest.
- C. Provide materials of each type from same source throughout the Work, unless otherwise approved.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey benchmarks and intended elevations for the work are as indicated.
- B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.02 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting until there is no visible movement under loaded equipment.
- B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.03 PLACEMENT

- A. Under Bituminous Paving:
 - 1. Place Class 5 Aggregate Base to a total compacted thickness as specified by the Plans.
 - 2. Compact to 98%, minimum, of maximum Standard Proctor dry density.
- B. Under Portland Cement Concrete Paving:
 - 1. Place Class 5 Aggregate Base a total compacted thickness as specified by the Plans.
 - 2. Compact to 98%, minimum, of maximum Standard Proctor dry density.
- C. Place aggregate in maximum 6-inch layers and roller compact to specified density at a moisture content of $\pm 3\%$ of the aggregate's optimum moisture.
- D. Level and contour surfaces to elevations and gradients indicated.
- E. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.04 FIELD QUALITY CONTROL

- A. Results will be evaluated in relation to compaction curve for each material used determined by testing un-compacted material in accordance with ASTM D698 ("Standard Proctor"). Density testing shall be performed using the sand-cone method (AASHTO T191), rubber balloon method (ASTM D2167), or nuclear gage method (AASHTO T310). Moisture content shall be obtained by laboratory determination method (AASHTO T265), microwave method (ASTM D4643), or nuclear gage method (AASHTO T310).

- B. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- C. Frequency of Compaction Tests: 1 per 2,000 SF for each compacted lift of material placed.
- D. Coarse and Fine Aggregate Sieve Analysis: 1 per 1,500 ton of material placed.

3.05 CLEANING

- A. Remove unused stockpiled materials and leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Hot asphaltic concrete paving components, mixing, hauling and placement.
- B. Reference Standards:
 - 1. ASTM D946 – Penetration-Graded Asphalt Cement for Use in Pavement Construction.
 - 2. TAI – (The Asphalt Institute) – MS-2 Mix Design Methods for Asphalt Concrete and Other Hot Mix Types.
 - 3. TAI – (The Asphalt Institute) – MS-3 Asphalt Plant Manual.
 - 4. TAI – (The Asphalt Institute) – MS-8 Asphalt Paving Manual.
 - 5. TAI – (The Asphalt Institute) – MS-19 Basic Asphalt Emulsion Manual.
 - 6. TAI – (The Asphalt Institute) – MS-22 Principals of Construction of Hot Mix Asphalt Pavements.
 - 7. North Dakota Department of Transportation (NDDOT) Standard Specifications for Road and Bridge Construction.

1.02 SUBMITTALS

- A. Provide asphaltic concrete mix design no less than 15-days prior to beginning construction.
- B. Provide plan for maintenance of traffic (if required).
- C. Provide Field Quality Control Test Results.

1.03 QUALITY ASSURANCE

- A. Provide Architect with Manufacturer's written certification that each transport load of asphalt cement (AC) meets the requirements of the specification.
- B. Asphalt Cement (AC) Content: 5-8% of asphalt cement by weight in mixture.
- C. Mixing Plant: Conform to NDDOT Standard Specifications, Section 154.
- D. Obtain asphaltic mix materials (aggregate and bitumen) from same source throughout entire project. Provide new mix design any time a change in source is made.

1.04 REGULATORY REQUIREMENTS

- A. Conform to North Dakota Department of Health Clean Air Standards and Surface Water Runoff Standards.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle aggregate and bitumen in a way that will prevent contamination or separation.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Do not place asphalt when ambient air temperature is less than 40° F or surface is wet or frozen.
- B. Dispose of all waste material or reject material in an approved landfill.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Asphalt Cement: PG 58-28 that conforms to the requirements of Section 818 of the NDDOT Standard Specifications. Higher grades of asphalt cement shall also be allowed.
- B. Aggregate for Mix: Conform to the requirements of NDDOT Specification Section 430.03 for Superpave FAA 42 or higher.
- C. Tack Coat: Must meet the requirements of NDDOT Specification Section 401.03 B.

2.02 ASPHALT PAVING MIX

- A. Mix Design: Obtain Architect's approval of mix design prior to paving.
- B. For batch or continuous mix plants, heat and dry aggregate to reduce the total moisture content to one-half of 1% or less, based on the dry weight of the aggregate.
- C. When the drum dryer mixer is used, do not allow the moisture content of the bituminous mixture to exceed 1%.
- D. Assure accurate proportioning into the mixer by feeding stockpiled aggregate in two or more compartments that can be accurately controlled to supply the proper mixture of aggregate.
- E. Introduce all materials uniformly into the mixing plant or the drum dryer in the proportions necessary to produce the required quality.
- F. Introduce the required quantities of aggregate and bitumen into the mixer and mix until a uniform and complete coating of aggregate is obtained.
- G. The temperature of the bituminous mixture at discharge from the mixer must not exceed 300° F.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Verify that compacted subgrade and/or granular base is ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct prior to beginning of any paving operations.
- C. Verify structure castings are properly adjusted prior to beginning paving operations.

- D. Verify all appropriate actions such as subgrade repair, tack coating, and surface sweeping are completed prior to beginning paving operations.

3.02 TOLERANCES

- A. Flatness: Maximum variation of 1/4-inch measured with 10-foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/4-inch.
- C. Variation from Staked Elevation: Within 1/8-inch.
- D. Asphalt cement content within 0.24% of approved mix design as determined by daily cutoff report.
- E. Adjacent surface match: New finished surface must be 1/4-inch above any adjacent surface.

3.03 ASPHALT PLACEMENT

- A. Maintain a mix laydown temperature of no less than 230° F when ambient temperature is 60° F or higher. When ambient temperature is below 60° F, Architect will determine laydown temperature.
- B. Spread and finish all mixtures with a self-propelled, bituminous paver, to the required section, leaving the mixture uniformly dense, smooth, and free from irregularities. In locations where it is impractical to use self-propelled bituminous pavers, or other types of laydown equipment, a road grader or maintainer may be used if approved by the Architect.
- C. Control the speed of paver to place the mixture uniformly and continuously without tearing or gouging. Do not exceed the Manufacturer's recommendation and coordinate the paver speed with the output of the plant to provide for a smooth, continuous operation, minimizing starting and stopping.
- D. Level, fill or rake all transverse and longitudinal joints, high or low areas, and surface irregularities, prior to compaction. Immediately remove material dropped on previously compacted lanes.
- E. Sweep and tack previously placed layer or surface before spreading the next layer.
- F. Place tack along vertical faces that will abut asphalt pavement and between all pavement lifts. Tack shall be diluted 50/50 with water and applied uniformly at a diluted rate of 0.10 gal/sy.
- G. Tack all joints and coordinate vertical construction joints in successive courses so the joints do not fall on the same vertical place.
- H. Place pavement uniformly against the surface or edge of curb, gutters, manholes, or similar structures, and at such an elevation so that the pavement is 1/4-inch higher than the edge of the structure after the pavement has been compacted.
- I. Correct any low or high defective areas immediately. Correction can be accomplished by patching or cutting out the surface and replacing with fresh, hot bituminous mixture, or by milling the surface.

- J. The sequence of rolling operations as well as the type and number of rollers must be commensurate with production, and must be adequate to obtain the specified density before the mat temperature falls below 185° F.
- K. Begin rolling at the edges and proceed parallel to the road centerline, each trip overlapping the previous roller pass. On paving an echelon or abutting a previously placed lane, the longitudinal joint should be rolled first, followed by the regular rolling procedure. Begin rolling at the low elevation and progress to the high elevation by overlapping of longitudinal passes, paralleling the centerline. Immediately correct any displacement resulting from reversing the direction of a roller for from other causes.
- L. Thoroughly compact with hand or other mechanical tampers approved by the Architect any areas not accessible to standard asphalt rollers.
- M. Remove and replace any mixture that becomes loose, broken, becomes mixed with dirt, shows any excess deficiency of bitumen, or is defective in any manner.
- N. Do not place hot bituminous mix on a frozen subgrade, or when weather conditions prevent the proper handling or finishing of the bituminous mixtures. Presence of frost particles in or on the subgrade or base course is considered a frozen subgrade.
- O. Compact bituminous pavement sloughs with rollers capable of providing a smooth, finished, compacted slough that is free of tire marks and unevenness or drop off.
- P. If the daily bitumen cutoff as measured deviates from the approved percentage by more than 0.24 percentage points, supply written explanation to the Architect as to what caused the deviation and what corrective measures were taken prior to beginning the next day's operation.
- Q. The Owner may conduct field observation and testing as deemed necessary by the Architect. Failing tests will be considered sufficient evidence to reject a full day's work.
- R. Adjust any casting that is not ¼-inch below the top of the finished surface. Adjust casting upward if greater than ¼-inch below the top of the finished surface.

3.04 ASPHALT PLACEMENT DENSITY (ORDINARY COMPACTION)

- A. Initial or breakdown rolling, intermediate rolling, and final or finish rolling with rollers meeting all requirements of NDDOT Standard Specifications Section 151.
- B. Do not place lifts greater than 3-inches in depth or less than 1.5-inches in depth.
- C. Follow the NDDOT requirements for Ordinary Compaction found in Section 430.04 I.3.

3.05 FIELD QUALITY CONTROL

- A. Perform testing and control of asphalt paving mixture per NDDOT Standard Specification Section 430.04 E.2, 430.04 E.4, and 430.04 E.5 at intervals of one test per 1,500 tons of asphalt pavement produced, or a minimum of one test per lift per day. If production does not exceed 250 tons in a day, testing is not required for that day.

3.06 CLEANUP AND PROJECT CLOSEOUT

- A. Return all disturbed areas to a condition equal to that prior to construction. Clean, remove, and dispose of all debris and residue.

3.07 PROTECTION

- A. Immediately after placement, protect pavement from mechanical injury until surface temperature is less than 140° F (60° C).
- B. Do not allow traffic on the completed surfacing until the lift has been compacted and has cooled sufficiently to prevent damage.

END OF SECTION

SECTION 32 13 13

CONCRETE PAVING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Concrete parking lot, sidewalks, integral curbs, gutters, median barriers, valley gutters, and driveways.
- B. Reference Standards (The current standard as of the date noted on the plans shall be utilized, unless noted otherwise):
 - 1. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International.
 - 2. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International.
 - 3. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International.
 - 4. ACI 305R - Hot Weather Concreting; American Concrete Institute International.
 - 5. ACI 306R - Cold Weather Concreting; American Concrete Institute International.
 - 6. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - 7. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 8. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
 - 9. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimen.
 - 10. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
 - 11. ASTM C150/C150M - Standard Specification for Portland Cement.
 - 12. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
 - 13. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
 - 14. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - 15. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
 - 16. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
 - 17. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (nonextruding and Resilient Bituminous Types).
 - 18. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
 - 19. North Dakota Department of Transportation (NDDOT) Standard Specifications for Road and Bridge Construction.

1.02 SUBMITTALS

- A. Provide a concrete mix design prepared by an independent testing laboratory.
- B. Provide manufacturers' product data.

- C. If requested by Architect, provide written explanation from Ready-Mix Supplier as to how concrete will be delivered and what, if any, special measures will be required.
- D. A meeting with the contractor, ready-mix supplier, testing firm and Architect in attendance, is required. The meeting shall be held a minimum of 10-day prior to the beginning of construction. Topics to be addressed will include mix design, specifications, expectations, delivery communications, and testing requirements.
- E. Prior to pouring concrete in cold weather, a written request outlining the use of accelerating admixture shall be submitted to the Architect for approval.
- F. Prior to pouring concrete in hot weather, a written request outlining the use of set retarding admixture shall be submitted to the Architect for approval.

1.03 QUALITY ASSURANCE

- A. Acquire cement and aggregate from same source for all work.
- B. Provide written documentation for cement, listing manufacturer, and certifying that cement meets specifications.
- C. Concrete shall not be poured when the air temperature may fall below 35° F during the pouring or within 24-hours unless preparations are made and precautions taken to prevent any damage to the concrete from the low temperature. Obtain Architect's approval prior to any concrete pours when air temperature may fall below 35° F.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver and place concrete in a manner that provides minimum segregation.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Avoid over spraying with curing compound.
- B. Properly dispose of all excess curing compound.
- C. Utilize appropriate protection against inclement weather.
- D. Designate concrete wash area that all trucks delivering concrete to the site shall use. Area must not impact public property, watercourses, water bodies, or wetlands.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Form Materials: Shall conform to ACI 301.

2.02 CEMENT

- A. Cement shall be an approved and established brand of Portland Cement Type I, Type II, Type IA, or Type IB. Different brands of cement, or the same brand of cement from different mills, shall not be mixed during use without permission from the Architect.
- B. Cement shall be stored in a suitable manner to prevent moisture damage; cement which is partially set or which contains lumps or cakes shall be rejected.

- C. The vendor shall provide backup documentation and certifications that the cement used meets these requirements.

2.03 FLYASH

- A. Fly Ash shall be Class F and meet requirements of AASHTO M-295 for Portland Cement Concrete.
- B. Fly Ash will be allowed as a cement replacement on a 1:1 ratio, up to a maximum of 29% by weight. Fly ash content of mixes will be reduced to a maximum of 15% replacement of cement in cold weather concrete conditions. Cold weather exists when the air temperature has fallen to or is expected to fall below 40°F (4°C) during the protection period, which is defined as the time required to prevent concrete from being affected by exposure to cold weather. High-Early Strength concrete mixes may include up to 15% direct replacement of cement with fly ash.

2.04 AGGREGATES

- A. Aggregate mixes shall meet the requirements of NDDOT Standard Specification Section 802.01 C.

2.05 WATER

- A. Water for concrete shall be clean and free from oil, acid, alkali, and vegetable substances. Water from non-potable sources shall be tested according to AASHTO T-26.

2.06 ADMIXTURES

- A. Air Entrainment: Shall conform to AASHTO M154. Shall be targeted for 6% but must be between 5% and 8% as measured at the point of placement.
- B. Chemical Entrainment: Shall conform to AASHTO M194.
- C. Color Additives: Shall conform to ASTM C979, be resistant to lime and other alkali, and be resistant to sunlight. Color additives shall be mixed per the manufacturer's recommendations and until additives are uniformly dispersed throughout the mix. Dosage rate of admixtures shall not exceed 10% of weight of cementitious materials in the mix. Color shall be approved by the Architect prior to finalizing the mix design.

2.07 JOINT MATERIAL

- A. Expansion Joints
 1. If expansion or isolation joints are required, they shall be as indicated in the drawings or details. Joint material thickness will be as specified and/or approved, or per manufacturer's recommendation. It shall extend the full width of the pavement slab and curb, and any concrete at the ends when the forms are removed shall be chipped away. The dowel support, where required, shall securely and rigidly hold the dowel bars and pre-molded filler in correct position during the paving operation. All expansion/isolation joint faces shall be cleaned and sealed with silicone sealant or equal to produce a slightly concave surface ¼ inch below the concrete surface.
 2. The entire expansion joint assembly shall be of a type approved by the Architect.
- B. Poured Joint Filler may be polymeric or silicone.
 1. Polymeric Sealant: The material for filling poured expansion and contraction joints and cracks shall be hot poured elastic type and shall conform to the requirements of ASTM D-

1190. The material shall be composed of a homogeneous blend of virgin polymers, plasticizers, special fillers and asphalt compounded specifically for the sealing of cracks in asphalt or concrete pavement. Ground cured rubber scrap shall not be used.
2. Silicone Joint Sealant: The Silicone sealant shall be a Low Modulus Silicone Sealant meeting the requirements of the NDDOT Specification Section 826.02 B. Self-leveling silicone sealants will not be allowed.

2.08 CURING COMPOUNDS

- A. All curing compounds shall be applied in accordance with the manufacturer's recommendations.
- B. Mainline Paving: White pigmented liquid curing compound conforming to the requirements of AASHTO M148 Type 2, Class B or AASHTO M 148 Type 2.
- C. Separate Curb and Gutter: White pigmented liquid curing compound conforming to the requirements of AASHTO M148 Type 2.

2.09 MIX REQUIREMENTS

- A. A mix design shall be provided to the approved Architect a minimum of 48-hours before pouring. Any revisions to the mix design must be approved by the Architect.
- B. One cubic yard of mixed concrete in place shall contain not less than 564 lbs. minimum of cementitious materials.
- C. The water-cement ratio shall not exceed 0.45.
- D. The slump shall not exceed four (4) inches for formed paving, or two (2) inches for slip-form paving.
- E. 28-day compressive strength shall be 4000 psi minimum for standard concrete
- F. Entrained air content shall be targeted for 6% and will be between 5% and 8%.

2.10 HIGH-EARLY STRENGTH CONCRETE

- A. High-early strength concrete may be obtained by the following method:
1. When Type I, Type IA, or Type II cement is used, the cement content shall be increased to 7.2 sacks of cement per cubic yard (676 pounds). No flyash is allowed. Water-cement ratios will be shown in NDDOT Table 802.01B.1 for the class of concrete shown.
 2. The use of non-chloride accelerators for high-early strength concrete is allowed.
- B. The use of hydration stabilizers to preserve workability of high-early strength concrete in route to the project is allowed.
- C. High-early strength concrete shall be used when specified in the Contract Documents.
- D. When the Contractor requests and obtains permission from Architect to use high-early strength concrete. No additional payment will be made for any extra costs incurred in producing and placing the high-early strength concrete.
- E. Contractor shall provide environment to ensure that high-early strength concrete mixes will attain field strength of 3000 psi compressive strength prior to opening to

public traffic. At no time may concrete exceed 90°F in temperature while under blankets or other protection devices, nor fall below 60°F during the 24-hour period.

2.11 MIXING AND TRANSPORTING CONCRETE

- A. Procedures shall conform to NDDOT Section 155.03 and 155.04.

2.12 AUXILIARY FINISHING EQUIPMENT AND MATERIAL

- A. Straight Edge: Two or more ten (10) foot straight edges of an approved type shall be used. Extra blades shall be provided and used when previously used edges become wavy and warped.
- B. Float: Approved long handled floats, each having a blade at least 0.5-feet in length and 6-inches in width.
- C. Master Straight Edge: All straight edges shall be tested by the master straight edge before being used and shall be tested frequently during their use.
- D. Final Surface Finish: The final surface and the concrete pavement shall have a uniform gritty texture, free from excessive harshness and true to the graded and cross sections shown on the plans. Before brooming or burlap dragging is complete, and before the concrete has taken its initial set, the edges of the slab shall be carefully finished with an edger having a ¼" radius.

2.13 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M Grade 60 deformed billet steel bars; epoxy coated finish.
- B. Steel Welded Wire Reinforcement: Plain type, ASTM A185/A185M; in flat sheets; unfinished.
- C. Tie Bars: ASTM A615/A615M Grade 60; deformed billet steel bars; unfinished finish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify compacted sub-grade and/or sub-base are acceptable and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

3.02 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Notify Architect minimum 24-hours prior to commencement of concreting operations.

3.03 FORMING

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.04 REINFORCEMENT

- A. When required, place rebar reinforcement 2-inches from top of slabs-on-grade and a minimum of 2-inches from slab edges.
- B. Interrupt reinforcement at contraction and expansion joints.
- C. Place dowels to achieve pavement and curb alignment as detailed.

3.05 COLD WEATHER POURING

- A. Prior to pouring in cold weather, a written request must be made and approved by the Architect. Any concrete damaged by freezing shall be replaced by the Contractor at his own expense. Temperature of the concrete when deposited in the forms shall be between 60° and 90°F and maintained at a minimum temperature of 40°F for at least 5 days after placing, or until the concrete attains a compressive strength of 3000 psi. Concrete shall not be placed on a frozen subgrade or base. Any part of pavement damaged from traffic or other causes occurring prior to the acceptance of the pavement shall be repaired to the satisfaction of the Architect at the Contractor's expense.
- B. Admixtures for curing or temperature control shall be used only as permitted or directed by the Architect. The admixtures shall not be considered as a substitute for any specified curing requirement.

3.06 JOINTS AND SAWING

- A. Joints in concrete pavement shall be of the design specified and shall be constructed at the spacing shown on the Plans. The contractor shall establish the joint locations in the field from the plans or standard details. All joints shall be sawed along a true and straight line established by the Contractor and shall not deviate at any point by more than 1-inch from the established line.

3.07 CONTRACTION JOINTS AND SAWING

- A. The location of each contraction joint shall be marked in a manner satisfactory to the Architect, prior to placement of the concrete and, in the case of joints that are to be sawed. The markings shall be transferred to the fresh concrete as soon as the final finishing operations have been completed. All contraction joints shall be sawed to a sufficient depth to control cracking, but in no case to a depth less than $\frac{1}{4}$ of the thickness of the pavement. Joints constructed in the pavement shall be sawcut through the integral or separate curb. The Contractor shall be responsible for sawing to a depth that will prevent uncontrolled cracking. A sufficient number of saw cuts shall be made as soon as possible to relieve the contraction joint tension in the slab. Remaining saw cuts must be made within 24-hours after pouring.
- B. The initial sawing shall be accomplished as soon as the condition of the concrete will permit without raveling and before random cracking occurs. The sequence of initial sawing shall be at the Contractor's option. The sawing shall be immediately delayed if any raveling occurs. Water under nozzle pressure shall be used to remove the sawing residue from each joint and the pavement surface immediately after completing the sawing of that joint. Widening the joints to full width as per dimensions shown on the jointing/sealing detail shall not be performed until the

concrete has cured for at least 24-hours and shall be delayed longer when the sawing causes joint raveling.

- C. The early entry dry saw "Soft Cut" method of sawing will only be allowed with the Architects approval for the initial saw cutting. If uncontrolled cracking occurs, removal and replacement of damaged concrete will be at the Contractor's expense. Concrete is to be removed at the nearest planned joint. The removal and replacement method shall be approved by the Architect.

3.08 EXPANSION JOINTS

- A. Expansion joints shall be spaced as shown on the Plans and shall be of the preformed type and shall extend entirely through the depth and width of the pavement and through all integral curbs. No concrete shall be left above the expansion material or across the joint but shall be cut away after the forms are removed.
- B. The expansion material and dowel assembly, where required, shall be accurately and firmly staked to the subgrade. The top edge of the filler shall be set 2-inches below the pavement surface. During the placing of the concrete, the top edge of the filler shall be protected by a removable channel cap. After the concrete has been placed and finished, the cap shall be removed and the joint edged to the specified radius. All expansion/isolation joints shall be cleaned and sealed with silicone or hot pour sealant to produce a slightly concave surface approximately 1/4-inch below the concrete surface.
- C. Before the pavement is opened to permanent traffic, the joint shall be cleaned so that there is a clear space of the specified width for the full depth and width of the pavement. It shall then be filled with joint filler which, when cooled, shall be 1/4-inch below the surface of the pavement. Any sealant material on the surface of the pavement shall be removed at the Contractor's expense.

3.09 CONSTRUCTION JOINTS

- A. Construction joints shall be constructed at the end of each day and whenever the placing of the concrete is suspended for more than 45 minutes. When the work is suspended near the proper location for an expansion joint, the expansion joint shall be installed in the manner previously specified, except that the concrete shall only be placed on one side of the header. When work is resumed, it shall be placed on the other side.
- B. When work is suspended at other locations, a contraction joint shall be formed by securely staking in place, at right angles to the subgrade and centerline of the pavement, a bulkhead of wood or metal cut to the cross section of the pavement and then depositing concrete against it. Before the work is resumed, the bulkhead shall be removed and concrete placed against the face of the older concrete.
- C. Construction joints shall only be constructed at planned joint locations.
- D. Dowel bars shall be installed for load transfer across the joint if specified by the plans. The bars shall be smooth 1/2" x 24" dowels spaced at 18" on center across the length of the joint. The dowel bars shall be either installed with the construction joint or later drilled in place. If installed with construction joint they shall be held in place midway across the joint, parallel to both the surface and the centerline of the slab by a dowel splicer basket assembly, self-supported dowel sleeve, or other supporting device approved by the Architect. The dowel bars shall be installed within the

tolerances specified above for placing reinforcement. One end of the dowel shall be painted or coated with an approved lubricant.

3.10 PAVEMENT FINISHING

- A. Strike-off and compaction shall be done by both vibration and screed processes. Separate power machines may be used for each process or both processes may be combined in the same machine, provided controls exist enabling the operator to apply either operation separately or both combined.
- B. When weather conditions cause rapid drying of the pavement surface a fine mist or fog spray applied to the concrete surface shall be permitted only if approved by the Architect. Using any other method to apply water to the concrete surface will not be permitted and will result in non-payment, replacement, and/or repair of the wetted area as determined by the Architect.
- C. Forms shall be left in place for at least 12-hours after placing the concrete, and the method of removing them shall not damage or mar the concrete.
- D. The finished surface of the pavement must conform to the grade, alignment, and contour shown on the plans. Immediately following the floating operation, the Contractor shall test the slab surface for trueness with a 10-foot straight edge. The straightedge shall be placed parallel to the pavement centerline and passed over the slab to reveal any high areas or depressions. The high areas or depressions shall be cut or filled as necessary with the long-handled floats and the area checked again with the straight edge. Successive advances of the straight edge shall overlap by $\frac{1}{2}$ the length of the straightedge. The entire surface shall be checked until all variations in excess of $\frac{1}{2}$ " in 10' have been eliminated. Special care shall be taken at all headers to ensure this variation is held to a minimum.

3.11 CURB FINISHING

- A. Curb and Gutter shall be constructed using a slip-form machine or fixed forms. Fixed forms shall be full depth.
- B. No grout shall be used to finish the face of the curb. After the concrete is poured into the forms, it shall be puddled, vibrated and spaded to ensure a thorough, dense mixture, eliminate air pockets, and create uniform and smooth sides. Any honeycombing voids, or exposed aggregate on the back of the curb shall be grouted.
- C. When weather conditions cause rapid drying of the pavement surface, a fine mist or fog spray applied to the concrete surface shall be permitted only if approved by the Architect. Using any other method to apply water to the concrete surface will not be permitted and will result in non-payment, replacement, and/or repair of the wetted area as determined by the Architect.
- D. Before the curb concrete has thoroughly set, and while the concrete is still green, the forms shall be removed and the front and top side finished with a float or steel trowel to make a uniform finished surface.
 - 1. Rounding Corners: Whenever corners are to be rounded, special steel trowels shall be used while the concrete is still workable and the corners constructed to the dimensions herein specified. For combined curb and gutter, the top and side of the curb and gutter may be finished by means of a special shaped trowel or by a curb and gutter machine which spaces the entire surface in accordance with the specified dimensions. This trowel shall be used immediately upon removing the front form while the concrete is still workable but firm enough to stand up.

2. Smoothness: The top and face of the curb and also the top of the apron on combined curb and gutter must be finished true to line and grade without any irregularities of surface noticeable to the eye. No portion of the surface or face of the curb or gutter section shall depart for more than ½-inch from a straight edge 10-feet in length, placed on the curb parallel to the center line of the street, nor shall any part of the exposed surface present a wavy appearance.
- E. All joints shall be formed and placed at the specified intervals. When constructed adjacent to concrete pavement, joints shall match the pavement joints. Joint sealing shall be as specified.
- F. Concrete shall cure for 72-hours. All surfaces not protected by forms during this period shall be covered with a curing compound.

3.12 PAVEMENT FINAL SURFACE FINISH

- A. The edges of the pavement shall be left smooth and true to line and finished at about the time and concrete takes its initial set.
- B. After surface irregularities have been removed and before the concrete attains an initial set, the pavement shall be uniformly textured using a seamless strip of artificial grass, burlap, or brooming.
- C. In case that an extruding paving machine is used, the texturing material being pulled longitudinally shall be mounted to a self-propelled bridge, operated off of the paving string line, and shall not deviate at any point by more than ½-inch from the established alignment.
- D. Formed paving brooms shall be drawn across the surface at right angles to the centerline of the pavement, with the stroke of the broom slightly overlapping adjacent strokes. The brooming operation shall apply a uniform texture with 1/16-to-1/8-inch deep striations. Brooms shall be washed and dried at frequent intervals during the day. Any long or coarse bristles that may cause surface irregularities shall be trimmed or cut out, and any brooms that have become worn out shall be discarded.
- E. Upon completion of the final finishing the surface texture shall be uniform in appearance and free of surface water, rough or porous spots, irregularities, depressions, and other objectionable features.

3.13 CURING AND PROTECTION

- A. Normal Pavement: As soon as the concrete has been textured, the Contractor shall start curing operations. The finished surface shall be sprayed with an approved curing agent on all exposed faces. Sufficient curing compound shall be applied at a rate of approximately 200 sf/gal to ensure a coating as white as a sheet of paper. In lieu of curing agent, the concrete may be cured by wet burlap or other methods approved by the Architect. When wet burlap or plastic film is used for curing, the curing period shall be at least 5 days. The concrete surface must not be pitted from or damaged from application of water or incidental rain. The Contractor shall protect all concrete from weather conditions, traffic damage, or any other causes occurring prior to its final acceptance. Any damaged section shall be repaired at the Contractor's expense.
- B. Colored Pavement: Colored pavement shall be cured with an approved clear curing compound generally defined as a dissipating cure or a wax-based cure matching the

color of the decorative concrete. Curing procedures should generally follow the guidelines of the color admixture supplier for the concrete in the pavement.

- C. Timing of Curing Compound Application: Curing procedures should be undertaken within ½-hour of completion of finishing operations or before the wet sheen on the surface or the concrete disappears, whichever occurs first. Evaporation retarders shall be used for interim protection whenever hot, windy or dry conditions quantified by evaporation rates exceeding 0.2 lb/sf/hr exist and shall be used in accordance with manufacturer's recommendations. Evaporation retarders shall not be used as a finishing aid.

3.14 JOINT FILLING AND SEALING

- A. Joints shall be filled within 10-days after placement and before opening pavement to traffic.
- B. All vertical joint faces shall be cleaned. Oil, asphalt, curing compound, paint, rust, and other foreign materials shall be completely removed. Just before the joints are sealed, the Contractor shall clean the joints with compressed air at a working pressure of at least 90 psi. The joints shall not be sealed when the air temperature is below 40° F.
- C. Backer rod shall be used in all joints to control the depth of the filler/sealer material. Rod backer is not required on hot pours to achieve the desired shape of the material and support the material against indentation and sag. The backer rod shall be compatible with the filler/sealer and not subject to the absorption of water. Clean all surfaces of excess filler and sealant.
- D. Contraction/Construction joints constructed in the pavement shall be widened and sealed through the integral or separate curb.
 - 1. Hot Pour Sealant: The joint filler shall be forced into the joint with a pressure type applicator capable of filling the joint from the bottom up to a height approximately ¼-inch below the pavement surface, without any overflow or spillage onto the pavement surface. Clean all surfaces of excess sealant.
 - 2. Silicone Sealant: Silicone joint sealer may be used in lieu of hot pour elastic filler. The sealant shall be tooled to produce a slightly concave surface approximately ¼-inch below the pavement surface. Self-leveling sealant will not be allowed.

3.15 PROTECTION OF PAVEMENT

- A. The newly-placed concrete shall be protected from traffic by employing watch persons, if necessary, and by the erection and maintenance of barricades, fences, warning signs, and lights.
- B. When the temperature is expected to fall below 35°F, suitable measures shall be taken to maintain the concrete surface temperature above 40°F for 5 days. Admixtures for curing or temperature control shall be used only as permitted or directed by the Architect. The admixtures shall not be considered as a substitute for any specified curing requirement.
- C. Any concrete pavement damaged before final acceptance, including damage by frost action, shall be repaired or removed and replaced at the Contractor's expense.
- D. When bituminous pavement or any colored concrete is applied adjacent to concrete pavement, the adjacent concrete pavement shall be protected from spills and smears. Discolored concrete pavement shall be cleaned at the Contractor's expense.

3.16 LOCATION OF EXISTING UTILITIES

- A. Known locations of existing manholes, gate valves, and stop boxes have been shown on the Plans to direct the Contractor's attention to their existence. The Contractor is cautioned that not all utilities may be shown and their location is not guaranteed. The Contractor is responsible for determining the exact location of existing utilities that affect the installation of the paving.

3.17 MANHOLE CASTINGS TO GRADE

- A. This item includes all labor, materials, and equipment necessary to adjust the various castings to the proper line and grade. Note that wood shims to adjust rings and castings are not allowed. Changes in grade shall be made as follows:
 - 1. With Concrete Adjustment Rings: The maximum height of adjustment is 6-inches. Adjustment shall be made with a maximum of two (2) precast adjusting rings whenever possible. For fine adjustments of less than 2-inches, steel shims shall be used to temporarily support the casting. In any case, the castings shall be laid in a full bed of mortar. The rings and cone section shall be cleaned to assure a flat seating surface and the rings installed in alignment with no noticeable offsets. Broken pieces and partial sections of adjusting rings are not allowed. Adjusting rings must be one continuous piece.
 - 2. With Polyethylene Adjusting Rings: Adjustments shall be made with polyethylene adjustment rings. The cone shall be cleaned and the rings dry stacked to determine the best ring height and slope ring combination to obtain the proper height and slope match. Once this is determined, the rings shall be marked with a vertical line for future reference and disassembled. A ¼-inch beach of butyl caulk shall be applied to the cone surface and the first ring placed on the cone section. Another head of butyl caulk shall be placed on the bottom of the next ring as close as possible to the male lip and this ring installed interlocking with the first and aligning the vertical line. This procedure is repeated for each adjustment ring, including caulking the joint between the ring and the casting.
- B. Care shall be taken to adjust the casting to the proper grade so the final riding surface is smooth and free of bumps and it conforms to the alignment and grade of the adjoining concrete. Any castings not satisfying these requirements shall be redone to the satisfaction of the Architect. Castings should be set flush to ¼-inch below the pavement surface.
- C. The casting to grade item also includes cleaning all construction debris or dirt from the manhole or inlet bottom and installing a wiped mortar finish around the inside circumference of the precast concrete adjusting rings.

3.18 GATE VALVE BOXES TO GRADE

- A. This item shall include all labor, material, and equipment necessary to raise or lower water gate boxes to the final grade. Care shall be taken to adjust the valve box to the proper grade so the final riding surface is smooth and free of bumps and that it conforms to the grade of the adjoining concrete. The alignment shall be checked to ensure that the box is straight and that the valve is operable. Any valve boxes not satisfying these requirements shall be redone to the satisfaction of the Architect. Valve boxes should be set within ¼-inch of the finished pavement surface. The gate box to grade item also includes cleaning all construction debris or dirt from the box, insuring that the box is straight and undamaged, and insuring that the valve is operable.

3.19 TOLERANCES

- A. Maximum Variation of Surface Flatness: $\pm\frac{1}{2}$ -inch in 10-feet.
- B. Maximum Variation from True Position: $\pm\frac{1}{2}$ -inch.

3.20 FIELD QUALITY CONTROL

- A. Contractor shall provide a testing firm to complete fresh concrete and compression testing as required herein.
- B. When casting cylinders, provide the following:
 - 3. Field Cure - as required to determine when pavement can be opened to traffic
 - 4. 2 - 7 Day (lab cured)
 - 5. 2 - 28 Day (lab cured)
 - 6. 2 - Extras (lab cured)
- C. Testing is required at 100 cubic yard intervals for pours that exceed 100 cubic yards. For pours that are less than 100 cubic yards, testing will be done on every pour. A Field Technician will be required to obtain batch tickets from the delivery driver on every test cylinder that is to be tested. A Field Technician shall complete slump and air testing at the project location. Concrete test specimens for compression strength tests will be made and cured according to accepted ASTM procedures. The Contractor shall cooperate in the making of such tests. Any retesting required due to failing tests will be paid for by the contractor.
- D. Material Testing Firms shall comply with ACI 318 in regard to supplying Architect, Contractors, concrete suppliers and other designated individuals with notification of concrete field test results such as slump, water content and air content immediately, and compression strength test results within 48-hours after test completion.

3.21 OPENING TO TRAFFIC

- A. Newly constructed pavement shall not be opened to public traffic until all joints are sealed and the concrete has attained a flexural strength of 450 psi or a compressive strength of 3,000 psi, as determined by breaking test cylinders cured in the field in a manner that replicates as closely as possible the curing conditions of the pavement. The Contractor shall erect and maintain suitable barricades and lights to protect the pavement from traffic. Any part of the pavement damaged from traffic or other causes occurring prior to the acceptance of the pavement shall be repaired to the satisfaction of the Architect at the Contractor's expense.

END OF SECTION

SECTION 32 17 23 PAVEMENT MARKING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Parking lot markings, including parking bays, crosswalks, arrows, handicapped symbols, and curb markings.
- B. Reference Standards (The current standard as of the date noted on the plans shall be utilized, unless noted otherwise):
 - 1. MPI (APL) – Master Painters Institute Approved Products List; Master Painters and Decorators Association; www.paintinfo.com.
 - 2. FHWA MUTCD – Manual of Uniform Traffic Control Devices for Streets and Highways; U.S. Department of Transportation, Federal Highway Administration; <http://mutcd.fhwa.dot.gov>.

1.02 SUBMITTALS

- A. Submit manufacturer's data sheet for each product to be used that includes, at a minimum, the following information:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver paint in containers of at least 5 gallons accompanied by batch certificate.
- B. Store products per manufacturer's recommendations in manufacturer's unopened packaging until ready for installation.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.04 FIELD CONDITIONS

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Line and Zone Marking Paint: MPI No. 32 Traffic Marking Paint; color(s) as indicated.
 - 1. Parking Lots: White or Yellow.
 - 2. Handicapped Symbols and Parking Spaces: Blue.
- B. Temporary Marking Tape: Preformed, reflective, pressure sensitive adhesive tape in color(s) required; Contractor is responsible for selection of material of sufficient durability as to perform satisfactorily during period for which its use is required.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Clean surfaces thoroughly prior to installation. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods.
- D. Where oil or grease are present, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application. After cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint.
- E. Establish survey control points to determine locations and dimensions of markings. Provide templates to control paint application by type and color at necessary intervals.
- F. When required, apply temporary markings of the color(s), width(s), and length(s) as indicated or directed.
 - 1. After temporary marking has served its purpose, remove temporary marking by carefully controlled sandblasting, approved grinding equipment, or other approved method so that surface to which the marking was applied will not be damaged.
 - 2. At Contractor's option, temporary marking tape may be used in lieu of temporary painted marking. Remove unsatisfactory tape and replace with painted markings at no additional cost to the Owner.

3.03 INSTALLATION

- A. Begin pavement marking as soon as practicable after surface has been cleaned and dried.
- B. Do not apply paint if temperature of surface to be painted or the atmosphere is less than 50° F or more than 95° F, or per the manufacturer's recommendations. Follow the more stringent requirement for application.
- C. Apply in accordance with manufacturer's instructions using an experienced technician that is thoroughly familiar with equipment, materials, and marking layouts.
- D. Comply with FHWA MUTCD manual (<http://mutcd.fhwa.dot.gov>) for details not shown.
- E. Apply markings in locations determined by measurement from survey control points.

- F. Apply uniformly painted markings of color(s), lengths, and widths as indicated on the drawings with true, sharp edges and ends.
 - 1. Apply paint in one coat only.
 - 2. Wet Film Thickness: 15 mils.
 - 3. Width Tolerance: $\pm 1/8$ -inch.
- G. Parking Lots: Apply parking space lines, entrance and exit arrows, painted curbs, and other markings indicated on drawings. Mark the International Handicapped Symbol at indicated parking spaces. Hand application by pneumatic spray is acceptable.
- H. Symbols: Use a suitable template that will provide a pavement marking with true, sharp edges and ends, of the design and size indicated.

3.04 DRYING, PROTECTION, AND REPLACEMENT

- A. Protect newly painted markings so that paint is not picked up by tires, smeared, or tracked.
- B. Provide barricades, warning signs, and flags as necessary to prevent traffic crossing newly painted markings.
- C. Allow paint to dry at least the minimum time specified by the applicable paint standard and not less than that recommended by the manufacturer.
- D. Remove and replace markings that are applied at less than minimum material rates, deviate from true alignment, exceed length and width tolerances, or show light spots, smears, or other deficiencies or irregularities.
- E. Remove markings in manner to avoid damage to the surface to which the marking was applied, using carefully controlled sand blasting, approved grinding equipment, or other approved method.
- F. Remove and replace unacceptable markings at no additional cost to Owner.

END OF SECTION

SECTION 32 31 13
STAGGERED ALUMINUM PLANK SCREENING

PART 1 – GENERAL

1.1. DESCRIPTION

- A. This section describes the following fence system:
 - 1. Semi-private staggered panels fabricated with extruded aluminum planks and structural aluminum profiles including extruded aluminum fence posts and aluminum panel gates, offset front to back to create shadowbox. Semi-private panel security screening and gates shall be furnished and installed as shown on the plans and specified herein, overall height of semi-private screening shall be 6'-0" tall.

1.2. REQUIREMENTS

- A. Furnish materials, labor, expertise and equipment necessary to complete all work specified in this section and as shown on the drawings.
- B. Structural Performance: Provide product and installation capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
 - i. Uniform pressure of 30 lbf/sq. ft. acting inward or outward.
 - ii. Thermal Movements resulting from a temperature change (range) of 120 degrees Fahrenheit ambient and 180 degrees Fahrenheit material surfaces.

1.3. SUBMITTALS

- A. Shop drawings and manufacturer's literature: Provide specifications and construction detail drawings to substantiate quality of materials and provide details of fabrication and installation.
- B. Submittals shall be in accordance with standard construction practices to include complete detailed layout of all panels, posts, gates. Submittals shall include plan layout, elevations and section views of panels, posts and gates.
- C. Certificate: manufacturer's certification that materials meet specification requirements.

1.4. REFERENCES

- A. ASTM B 209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- B. ASTM B 221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
- C. ASTM D3363 – Standard Test Method for Film Hardness by Pencil Test.
- D. ASTM D2794 – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation.
- E. ASTM B117 – Standard Practice for Operating Salt Spray Apparatus.
- F. ASTM D822 – Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- G. AWS D1.2 Structural Welding Code – Aluminum.

1.5. QUALITY ASSURANCE

- A. Installation of fence and materials shall conform to the requirements of the fence manufacturer.
- B. The fence shall be warranted from any defects in materials and workmanship for a period as specified in the relevant section of the contract documents.

PART 2 – PRODUCTS

2.1. MATERIALS

- A. Semi-private panel security fence:
1. Approved Architectural Semi-private Screening System, Manufacturer:
 - a. PalmSHIELD
 - b. Substitution: Approved Equal.
 2. Material Descriptions:
 - a. Extruded Aluminum: ASTM B 221, Alloy 6063 – Temper T-6.
 - b. Sheet Aluminum: ASTM B211, Alloy 6063 – Temper T6.
 - c. Powder Coating Material Hardness: ASTM 3363 2H.
 2. Panel Description:
 - a. Panel Height: 5'-10"
 - b. Panel Width: Not to exceed 60"
 - c. Semi-private system consisting of horizontal planks fabricated with extruded aluminum framing structural profiles and supported by extruded aluminum fence posts. Planks are offset front to back to create shadowbox.
 - a. Infill. Alternating 1" x 5" x .090" tubular extruded aluminum sections. Planks are offset front to back to create shadowbox.
 - b. Vertical Framework: 4" wide x 2" deep x 1/8" tapered aluminum channel compression profile. Patent pending.
 - c. Horizontal Top Cap: 4" x 3" x 1/8" aluminum channel.
 - d. Horizontal Bottom Cap: 4 inch x 3 inch x 1/8" aluminum channel.
 - e. Cross Bar: 1 inch x 1/8 inch aluminum flat bar.
 3. Fence Posts:
 - a. Panel posts shall be 4 inch deep x 3" wide I-Beam Post. Patent pending. extruded tubular aluminum sections with solid aluminum caps. Length as specified on the contract drawings.
 1. 5/16" double walled webbing with 5/8" wide cavity.
 2. 5/16 flanges
 3. Inner flange mechanically fastened to webbing with 3/8" stainless steel fastener.
 4. Outer flange and webbing form one extrusion.
 - b. On center post spacing shall be as specified by manufacturer.
 - c. All fence posts to be plated with 10" x 10" x 3/4" aluminum plates with four 3/4" hole for anchors.
 4. Fittings and accessories: All fittings and accessories shall be stainless steel and sized as specified by the fence manufacturer. Fence panels to be attached to posts with 1/4" x 1" stainless steel screws. Panels and posts are predrilled to support level installation.
 5. Anchor Bolts: Anchor bolts shall be adequate to support loads based on screening height, exposures and loading.
 6. Factory Finish: Aluminum fence panels, posts and gates shall receive polyester powder coating.
 - a. Polyester powder coating: Electrostatically applied colored polyester powder coating heat cured to chemically bond finish to metal substrate.
 - b. Color shall be as selected by Architect.
 - c. Minimum hardness measured in accordance with ASTM D3363 2H.
 - d. Direct impact resistance tested in accordance with ASTM D2794. Withstand 160 inch-pounds.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Verify that final grading in fence location is completed and without irregularities which will interfere with fence installation. Fence needs to be installed on a level surface. Variations in height, slopes shall be shown on contract drawings and on submittal drawings.
- B. Field verify all fence dimensions and layout prior to commencing installation.
- C. Do not commence work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install fence in accordance with manufacturer's installation instructions.
- B. Install fence plumb and level. Posts are plated and mounted to top of surface.
- C. Do not install bent, bowed or otherwise damaged panels. Remove damaged components from site and replace.
- D. Secure fence panels with stainless with ¼" x 1" stainless steel screws to fence posts. All posts and panels will be predrilled to support level installation.

SECTION 32 84 23

UNDERGROUND SPRINKLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe and fittings, valves, sprinkler heads, emitters, bubblers, and accessories.

1.02 REFERENCE STANDARDS

- A. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings; 2004 (Reapproved 2011).
- B. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2015.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work with site backfilling, landscape grading and delivery of plant life.
- B. Preinstallation Meeting: Convene one week prior to commencing work of this Section.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component and control system and wiring diagrams.
 - 1. Water regulators.
 - 2. Water hammer arresters.
 - 3. General-duty valves.
 - 4. Control-valve boxes.
 - 5. Sprinklers.
 - 6. Controllers, include wiring diagrams.
 - 7. Control cables, include splice kits.
 - 8. Backflow preventer.
- C. Shop Drawings: Indicate piping layout to water source, irrigation system piping (locations, types, sizes, capacities, and flow characteristics), location of sleeves under pavement, location and coverage of sprinkler heads, components (water meters, backflow preventers, valves, piping, sprinklers and devices, controls), plant and landscaping features, site structures, schedule of fittings to be used. Show wire size and number of conductors for each control cable.
- D. Operation and Maintenance Data:
 - 1. Provide instructions for operation and maintenance of system and controls, seasonal activation and shutdown, and manufacturer's parts catalog.
 - 2. Provide schedule indicating length of time each valve is required to be open to provide a determined amount of water.
- E. Maintenance Materials: Provide the following for Owner's use in maintenance of project.
 - 1. Extra Sprinkler Heads: One of each type and size.
 - 2. Extra Valve Keys for Manual Valves: One.

3. Extra Valve Box Keys: One.
4. Extra Valve Marker Keys: One.
5. Wrenches: One for each type head core and for removing and installing each type head.

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.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience.

1.06 REGULATORY REQUIREMENTS

- A. Conform to applicable code for piping and component requirements.

1.07 DEFINITIONS

- A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.
- B. Drain Piping: Downstream from the circuit-piping drain valves. Piping is not under pressure.
- C. Irrigation Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.
- D. The following industry abbreviations for plastic Materials:
 1. ABS: Acrylonitrile-butadiene-styrene.
 2. FRP: Fiberglass-reinforced plastic.
 3. PA: Polyamide (nylon) plastic.
 4. PE: Polyethylene plastic.
 5. PP: Polypropylene plastic.
 6. PTFE: Polytetrafluoroethylene plastic.
 7. PVC: Polyvinyl Chlorine plastic.
 8. TFE: Tetrafluoroethylene plastic.

1.08 PERFORMANCE REQUIREMENTS

- A. Design head to head water-coverage irrigation system for lawns and exterior plants indicated.
- B. Location of Sprinklers and Specialties: Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100 percent water coverage of turn and planting areas indicated.
- C. Provide necessary components to properly winterize the irrigation system.
- D. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties, unless otherwise indicated.
 1. Irrigation Main Piping: 200 psig
 2. Circuit Piping: 100 psig
 3. Drain Piping: 100 psig
- E. Maximum Run Time: All zones shall be run within an 8-hour time frame.
- F. All turf areas shall be on separate zones from planting beds.

PART 2 PRODUCTS

2.01 IRRIGATION SYSTEM

- A. Manufacturers:
 - 1. Rain Bird Sales, Inc: www.rainbird.com.
 - 2. Toro Company: www.toro.com.
 - 3. Weathermatic: www.weathermatic.com.
 - 4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PIPES, TUBES, AND FITTINGS

- A. Mainline: Class 200 PVC continuously marked with manufacturer's name, class, and size.
- B. Lateral lines not under constant pressure: Flexible, 4710, non-toxic, polyethylene pipe rated for 100 psi minimum working pressure.
- C. Sleeves: Class CL160 PVC.
 - 1. Place under all concrete or asphalt paving where irrigation lines must be installed.
 - 2. Sleeve shall be twice the nominal size of the pipe being installed.
 - 3. Provide a separate 1-1/4 inch sleeve for irrigation wiring.

2.03 GENERAL-DUTY VALVES

- A. Electronic valves shall be compatible with the irrigation controller.
- B. Electronic valves shall have an electronic solenoid that is normally open.
- C. Electronic valves shall be buried underground in a valve box with a cover.

2.04 SPRINKLERS

- A. Sprinkler heads shall be fully adjustable that will provide uniform coverage over designated watering area.
- B. Rotary heads shall not have pop up spray heads on the same zone unless they are equipped with a rotary nozzle.
- C. Pop up spray heads shall be a minimum of 4-inches in height.

2.05 COMMUNICATIONS CIRCUITRY

- A. Electric control lines from each controller to the automatic valve shall be direct burial wire. Minimum size - #18. Connection shall be installed using blazing BVS1 or BVS2 connectors and be waterproof.
- B. All wire splicing shall be in a valve box.

2.06 AUTOMATIC – CONTROL SYSTEM

- A. Provide and install an automatic controller that has a visible readout display that is compatible with a rain shut off device. It must be able to have multiple programs and multiple start times.
- B. Must be programmable for 7 days of watering and a custom watering schedule with an automatic start and shutdown.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that required utilities are available, in proper location, and ready for use.

3.02 PREPARATION

- A. Piping layout indicated is diagrammatic only. Route piping to avoid plants, ground cover, and structures.
- B. Layout and stake locations of system components.
- C. Review layout requirements with other affected work. Coordinate locations of sleeves under paving to accommodate system.

3.03 TRENCHING

- A. Trench to accommodate grade changes and slope to drains.
- B. Maintain trenches free of debris, material, or obstructions that may damage pipe.

3.04 INSTALLATION

- A. Install pipe, valves, controls, and outlets in accordance with manufacturer's instructions.
- B. Main line pipe which is under constant pressure, shall be installed with a minimum depth of cover of 12 inches. Other pipe shall be installed with a minimum cover of 8 inches.
- C. Piping shall be securely capped at the end of each day's work to prevent entrance of foreign material.
- D. Set outlets and box covers at finish grade elevations.
- E. Provide for thermal movement of components in system.
- F. Wiring shall be installed with main line piping in the same trench. At each connection to the valve 2' slack shall be provided to facilitate future service. Underground splices shall be waterproofed with the wire connectors and direct bury splice kit (3M DBY) as manufactured by 3M company.
- G. Install control tubing in accordance with manufacturer's instructions. Provide 10-inch (250 mm) expansion coil in irrigation piping at each valve to which controls are connected, and at 100 ft (30 m) intervals. Bury control tubing beside pipe.
- H. Mark valves with neoprene valve markers containing locking device. Set valve markers in pipe risers extending from top of valve to finish grade.
- I. After piping is installed, but before outlets are installed and backfilling commences, open valves and flush system with full head of water.

3.05 FIELD QUALITY CONTROL

- A. Prior to backfilling, test system for leakage at main piping to maintain 80 psi (690 kPa) pressure for one hour.

- B. System is acceptable if no leakage or loss of pressure occurs and system self-drains during test period.
- C. Location of the irrigation system heads, piping and valves shall be marked to avoid damage by others during completion of the landscape work. Sprinkler heads shall be set plumb and level to finish grade and shall be readjusted after landscape areas are completed to assure proper operation.

3.06 BACKFILLING

- A. Backfill trench and compact to specified subgrade elevation. Protect piping from displacement.

3.07 SYSTEM STARTUP

- A. Prepare and start system in accordance with manufacturer's instructions.
- B. Adjust control system to achieve time cycles required.
- C. Adjust head types for full water coverage as directed.

3.08 CLOSEOUT ACTIVITIES

- A. Instruct Owner's personnel in operation and maintenance of system, including adjusting of sprinkler heads. Use operation and maintenance data as basis for demonstration.
- B. As-Built Plan: Furnish an "as-built" drawing showing sprinkler heads, valves, drains, and pipe lines to scale with dimensions where required.

3.09 MAINTENANCE

- A. Provide a separate maintenance contract for specified maintenance service.
- B. Provide one complete spring start-up and a fall shutdown by installer, at no extra cost to Owner. For a period of one year from date of final acceptance of work performed under this contract, the irrigation contractor shall promptly furnish, without cost to owner, all parts and labor which prove to be defective in material and workmanship.

END OF SECTION

SECTION 32 92 19

SEEDING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Grass seeding and fertilizing.

1.02 REFERENCES

- A. FS O-F-241 - Fertilizers, Mixed, Commercial.

1.03 QUALITY ASSURANCE

- A. Seed and seeding mixture shall be free of all prohibited noxious weed seed and will not contain more than 0.5% by weight of restricted noxious weed seeds.
- B. Origin of the native seed harvest shall be limited to: North Dakota, South Dakota, northern Nebraska, eastern Wyoming, eastern Montana, western Minnesota and southern Manitoba, Canada.
- C. All seed shall be tested by a commercial seed testing laboratory within 9 months prior to the planting.
- D. The seed bags shall be delivered to the project bearing a tag which shows the following information:
 - 1. Name and address of supplier.
 - 2. Supplier's lot number for each kind of seed in the mixture.
 - 3. Origin (where grown) for each kind of seed.
 - 4. Purity and germination for each kind of seed.
 - 5. Date last tested.
 - 6. Pounds of bulk seed of each kind of seed in each bag.
 - 7. Total pounds of bulk seed mixture in each bag.
 - 8. Total pounds of pure live seed of each kind of seed in each bag.
 - 9. Total pounds of pure live seed mixture in each bag.
 - 10. Provide certificate of compliance from authority having jurisdiction indicating approval of seed mixture.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver seed mixture in sealed containers. Seed in damaged packaging is not acceptable.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of Manufacturer.

PART 2 PRODUCTS

2.01 ACCESSORIES

- A. Fertilizer: FS O-F-241; recommended for grass, with 50% of the elements derived from organic sources to the following proportions: Nitrogen 20%, phosphoric acid 20%, soluble potash 10%.
- B. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.

2.02 SEED MIXTURE

- A. Type 1: Irrigated Seed Mix:
 - 1. Arc Kentucky Bluegrass: 25%
 - 2. Fielder Kentucky Bluegrass: 25%
 - 3. Park Kentucky Bluegrass: 10%
 - 4. Shoreline Slender Fescue: 15%
 - 5. Maxima 1 Creeping Red Fescue: 15%
 - 6. Fine-Leaf Perennial Ryegrass: 10%
 - 7. Application Rate: 6 pounds per 1,000 square feet.
- B. Type 2: Non-Irrigated Seed Mix - General
 - 1. Chewings Fescue: 25%
 - 2. Hard Fescue: 25%
 - 3. Sheeps Fescue: 25%
 - 4. Creeping Red Fescue: 25%
 - 5. Application Rate: 6 pounds per 1,000 square feet.
- C. Type 3: Non-Irrigated Seed Mix – Detention Ponds & Slopes:
 - 1. Kentucky Bluegrass: 40%
 - 2. Fine-Leaf Perennial Ryegrass: 20%
 - 3. Brome: 15%
 - 4. Sheeps Fescue: 10%
 - 5. Switchgrass: 5%
 - 6. Slender Wheatgrass: 5%
 - 7. Timothy: 5%
 - 8. Application Rate: 6 pounds per 1,000 square feet.

2.03 SEED SUPPLIERS

- A. Chesak Seed House, Bismarck, ND
- B. Rivards Company, Argyle, MN
- C. Southwest Grain, Dickinson, ND
- D. Twin City Seed Company, Minneapolis, MN
- E. Warne Chemical and Equipment Company, Rapid City, SD
- F. Approved Equals

PART 3 EXECUTION

3.01 EXAMINATION

- A. Prepare subgrade in accordance with Section 31 22 00 – Grading.
- B. Place topsoil in accordance with Section 31 22 00 – Grading.
- C. Verify topsoil is spread to a smooth uniform depth over area to be seeded.
- D. Verify that prepared topsoil is ready to receive the Work of this Section.

3.02 FERTILIZING

- A. Apply fertilizer at a rate of 15 pounds/10,000 square feet to all areas requiring seeding.
- B. Apply after smooth raking of topsoil.
- C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- D. Mix thoroughly into upper 2-inches of topsoil.
- E. Lightly water to aid dissipation of fertilizer.

3.03 NORMAL GRASS SEEDING

- A. Seed shall be uniformly distributed with a turfgrass drill seeder in two approximately perpendicular passes, at a rate of 3 pounds/1,000 SF per pass.
- B. Immediately following seed placement, all seeded areas shall be culti-packed or rolled with a roller not exceeding 112 pounds. Avoid over-compacting soil.
- C. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- D. Following germination, immediately re-seed areas without germinated seeds that are larger than 4x4-inches.

3.04 PLANTING SEASON

- A. Non-irrigated grass seeding shall be installed between May 1st and September 1st, and before the ground freezes, unless otherwise approved by the Architect.
- B. Do not sow immediately following rain, when ground is too dry, or during windy periods.

3.05 QUALITY CONTROL

- A. All equipment is subject to Architect's approval before it is used.

END OF SECTION

SECTION 32 94 88

TREES, PLANTS, AND GROUND COVER

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Preparation of topsoil, types and rates of fertilizer application and requirements for new trees and shrubs.
- B. Reference Standards:
 - 1. ANSI Z60.1 - Nursery Stock.

1.02 DEFINITIONS

- A. Weeds: Any plant life not specified or scheduled.
- B. Plants: Living trees, plants, and ground cover specified in this Section, and described in ANSI Z60.1.

1.03 SUBMITTALS

- A. Maintenance Data: Include cutting and trimming method; types, application frequency, and recommended coverage of fertilizer.
- B. Submit list of plant life sources.

1.05 QUALITY ASSURANCE

- A. Nursery Qualifications: Company specializing in growing and cultivating the plants.
- B. Installer Qualifications: Company specializing in installing and planting the plants.
- C. Maintenance Services: Performed by Contractor through project acceptance.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect and maintain plant life until planted.
- B. Deliver plant life materials immediately prior to placement. Keep plants moist.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Do not install plant life when ambient temperatures may drop below 35° F or rise above 90° F.
- B. Do not install plant life when wind velocity exceeds 30 mph.

1.08 COORDINATION

- A. Install plant life after and coordinate with installation of underground irrigation system piping and watering heads, where applicable.

PART 2 PRODUCTS

2.01 TREES, PLANTS, AND GROUND COVER

- A. Trees and Plants: Species and size identifiable in plant schedule, grown in climatic conditions similar to those in locality of the Work.

2.02 SOIL AMENDMENT MATERIALS

- A. Water: Clean, fresh, and free of substances or matter that could inhibit vigorous growth of plants.
- B. Fertilizer: Contain 50 percent of the elements derived from organic sources; to the following proportions:
 - 1. Nitrogen – 18 percent
 - 2. Phosphoric acid – 46 percent
 - 3. Soluble potash – 0 percent
- C. Peat Moss: shredded loose, sphagnum moss; free from lumps, roots, inorganic material or acidic materials; minimum of 85 percent organic material measured by oven dry weight, pH range 4 to 5; moisture content of 30 percent.

2.03 MULCH MATERIALS

- A. Bark Mulch: Shall consist of oak or other hardwood bark mulch, double shredded, and substantially free of noxious weed seeds and objectionable foreign material.

2.04 ACCESSORIES

- A. Wrapping Materials: Burlap
- B. Stakes: Softwood lumber, pointed end.
- C. Cable, Wire, Eye Bolts: Noncorrosive, of sufficient strength to withstand wind pressure and resulting movement of plant life.
- D. Plant Protectors: Rubber sleeves over cable to protect plant stems, trunks, and branches.
- E. Tree Protectors: Plastic
- F. Landscape Fabric:
 - 1. Type I - Equal to US 90NW as manufactured by US Fabrics.
 - 2. Type II - Black polypropylene weighing 3.25 ounces. per square yard (SY), a tensile strength of 193x114 pounds, a burst psi of 350, a puncture capacity of 83 pounds, permeability of 12.4 gallons per square foot (SF) per minute, 18 mil minimum thickness and a 5 year written guarantee against UV deterioration.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared subsoil is ready to receive work.
- B. Saturate soil with water to test drainage.
- C. Verify that required underground utilities are available, in proper location, and ready for use.

3.02 PLACING TOPSOIL

- A. Place topsoil to a depth of ± 6 inches in areas to be grassed.
- B. Place topsoil to a depth of ± 12 inches in areas where trees, shrubs and plants are to be placed.

3.03 PLANTING

- A. Dig planting pits 6 inches larger than the root system.
- B. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.
- C. Place plants for best appearance for review and final orientation by Architect.
- D. Set plants vertical.
- E. Remove non-biodegradable root containers.
- F. Set plants in pits same depth as plants being planted. Remove burlap, ropes, and wires, from root ball.
- G. Saturate soil with water when the pit or bed is half full of topsoil and again when full.

3.04 INSTALLATION OF MULCH

- A. Place Bark Mulch around all existing and proposed trees: 6 foot diameter, 3 inches thick, unless otherwise noted.

3.05 INSTALLATION OF ACCESSORIES

- A. Install landscape border vertically and flush with the adjacent grass turf.
- B. Place landscape fabric above the topsoil with cutouts around plantings.
- C. Wrap deciduous shade and flowering tree trunks and place tree protectors.

3.06 PLANT SUPPORT

- A. Brace plants vertically with plant protector wrapped guy wires and stakes to the following:

<u>TREE CALIPER</u>	<u>TREE SUPPORT METHOD</u>
1 inch	1 stake with one tie
1 - 2 inches	2 stakes with two ties
2 - 4 inches	3 guy wires
Over 4 inches	4 guy wires

3.07 FIELD QUALITY CONTROL

- A. Plants will be rejected if the ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

3.08 WARRANTY

- A. Provide one-year written warranty with no exceptions for one continuous growing season from date of project acceptance for replacement of dead or unhealthy plants. Warranty shall cover all costs for materials and installation.

- B. Replacement plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

END OF SECTION

SECTION 33 11 16

SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Pipe and fittings for water mains and service lines, including domestic water lines and fire water lines.
- B. Reference Standards (The current standard as of the date noted on the plans shall be utilized, unless noted otherwise):
1. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
 2. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
 3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
 4. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 5. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
 6. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 7. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 8. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
 9. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
 10. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings; American Water Works Association (ANSI/AWWA C104/A21.4).
 11. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association (ANSI/AWWA C105/A21.5).
 12. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings.
 13. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association (ANSI/AWWA C111/A21.11).
 14. AWWA C115/A21.15 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 15. AWWA C153/A21.53 - Ductile-Iron Compact Fittings.
 16. AWWA C502 - Dry-Barrel Fire Hydrants.
 17. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Servic.
 18. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.
 19. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
 20. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.
 21. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service.
 22. UL 246 - Hydrants for Fire-Protection Service.
 23. Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers - Recommended Standards For Water Works.
 24. NSF/ANSI 61 - Drinking Water System Components - Health Effects.

1.02 SUBMITTALS

- A. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
- B. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.03 QUALITY ASSURANCE

- A. Perform Work in accordance with utility company requirements.

PART 2 PRODUCTS

2.01 GENERAL

- A. All products or materials that may come into contact with water intended for use in a public water system shall meet the National Sanitary Foundation International (NSF)/American National Standards Institute (ANSI) Standard 61.
- B. The Contractor shall notify and obtain permission from the Fire Department having jurisdiction at least 24 hours prior to the shutting down service to any hydrant and shall notify the Fire Department when service is restored. The Contractor shall notify and coordinate shutting down any water lines with the municipality having jurisdiction.

2.02 WATER PIPE - 3 INCH AND LARGER:

- A. Polyvinyl Chloride Pipe: Polyvinyl Chloride Pipe shall meet the requirements of AWWA C900 or C905, or the latest revision thereof, and shall be furnished in Cast Iron Pipe equivalent outside diameters with elastomeric joints. Pressure rating shall be 235 psi (DR18). All water main fittings shall be ductile iron.
 - 1. Ductile Iron Fittings: Ductile Iron fittings shall be manufactured by Harco, Trinity Valley, or approved equal, and shall have a working pressure of 350 pounds per square inch conforming with AWWA/ANSI C153/A21.53 or AWWA/ANSI C110/A21.10. All Ductile Iron fittings shall be cement mortar lined and contain an exterior bituminous seal conforming with AWWA/ANSI C104/A21.4. All fittings shall be mechanically restrained and have thrust blocking. Thrust blocking shall be of adequate size to prevent movement of pipe and appurtenances when under pressure. Minimum bearing area shall be 2 square feet.
 - 2. Mechanical joints shall be manufactured in accordance with AWWA/ANSI C111/A21.11.
 - 3. Mechanical Joint Bolt Requirements: Bolts for mechanical joint fittings, valves, and hydrants shall be alternated with one-half stainless steel and one-half low alloy steel. Low alloy steel bolts shall contain a maximum content of carbon at 0.2 percent, manganese at 1.25 percent, sulphur at 0.5 percent, minimum content of nickel at 0.25 percent, and a combined content of nickel, copper, and chromium at 1.25 percent. Stainless steel bolts shall be Grade 304.
 - 4. Pipe Coupling: ASTM A283 Grade C Steel with fusion-bonded epoxy coating and stainless steel nuts and bolts.
 - a. 12" & Smaller: Romac MACRO HP or approved equal.
 - b. Larger than 12": Ford, Dresser, Mueller, Hymax, or approved equal.

2.03 WATER PIPE - LESS THAN 3 INCH

- A. Manufacturers:
 - 1. Pipe: Centennial Plastics or JM Eagle for polyethylene and Halstad or Reading for copper tubing, or approved equals.

2. Service Connection: Double bolt, stainless steel.
 - a. Romac - Saddle Style 306 SS
 - b. Ford - Service Saddle, Style FS 303
 - c. Mueller - Corporation Stop, Style H-15005 for IPS PE plastic pipes and for IPS PE plastic pipe.
 - d. Ford - Corporation Stop, Style FB-1001.
 - e. McDonald - Corporation Stop, Style 4701B-33
3. Curb Stop and Box:
 - a. Mueller - Curb stop and box - Style H-15156 for IPS PE pipe and H-15155 for copper tubing.
 - b. Ford - Curb stop and box - Style FB 66444M for IPS PE pipes and FB 22444M for copper tubing.
 - c. McDonald - Style 6104 - 33 on 5614 riser.

B. Materials:

1. Polyethylene Pipe: HDPE 4710 conforming to ASTM D2239, DR-9 (IPS) with a pressure rating of 250 psi.
2. Copper Tubing: Type K meeting ASTM B-88.
3. Service Connection: Double bolt, stainless steel.
4. Curb Stop and Box: Each box shall be equipped with a stationary rod, lid and plug. Curb boxes shall be Minneapolis Pattern (thread type).
5. All fittings shall be red brass (no lead brass).
6. All corporations and curb stops shall be ball style valves.
7. All fittings for copper lines shall be compression.
8. Service lines sizes in 1¼ inch or 3 inch will not be allowed.

2.04 VALVES

A. Gate Valves: Manufacturer's name and pressure rating marked on valve body.

1. The gate valve furnished shall be of a quality equal to that manufactured by American Flow control under the minimum requirements in design, material, and workmanship conforming to the latest AWWA Standard C515.
2. The metals used shall be in accordance with AWWA and ASTM Standards.
3. Unless otherwise designated, all gate valves shall have a non-rising stem, O-ring stem seals, 2-inch operating nuts, and open counterclockwise.
4. All gate valves shall be equipped with a stem extension rod, extending to within 3-feet of finished grade. Extension rod shall not be connected to the gate valve operating nut.
5. The gate valve shall have a resilient synthetic rubber coating seat attached to the wedge, manufactured and designed in accordance with the latest AWWA Standard C515. Resilient-Seated Gate Valve body and bonnet shall be coated, inside and out, with a fusion bonded epoxy in accordance with AWWA C550. The waterway shall have a full unobstructed flow without recesses in the bottom. All bonnet bolts shall be stainless steel.
6. All gate valves 16-inch and larger shall be equipped with a bevel gear actuator.
7. All gate valves shall be equipped with a gate valve box adapter as manufactured by "Adaptor Inc.", or approved equal.

B. Valve Boxes: The valve boxes furnished shall be of a quality equal to that manufactured by Tyler Pipe Model 6860 or Star Pipe Products Cast Iron Heavy Duty Model "G" with bases and dimensions of each section to be as follows:

1. No. 6 round base for 24-inch and smaller gate valves.
2. Cover shall be marked "WATER" on all valves, including valves on hydrant leads, except for fire service lines to buildings, which shall be marked "FIRE".
3. Top Section 25-1/2 inches long. Extension pieces as required.
4. All valve boxes shall be capable of a minimum 6-inch top adjustment in either direction, up or down, to or from, the finished curb grades shown in the plans.

5. Include any valve box extension pieces are required to make the above-mentioned adjustment.
6. All new and reset valve boxes shall be equipped with a debris plug, as manufactured by Infact Corporation, or approved equal.
7. All new and reset valve boxes shall be equipped with a gate valve box adapter as manufactured by "Adaptor Inc.", or approved equal.

2.05 HYDRANTS

- A. Hydrants: All hydrants shall be manufactured in accordance with the requirements of AWWA C502 and shall be equipped with break-away type traffic flanges and two (2) 2-1/2" hose connections and one (1) 4-1/2" pumper connection. Hydrants shall be 5-1/4" Waterous Pacer Model WB-67U-250, 5-1/4" or Approved Equal. Hydrants shall have an 8-foot minimum bury depth and all stainless-steel nuts and bolts on the base flange.
- B. Hydrant Threads: Threads must be compatible with the local Fire Department equipment.
- C. Hydrant Markers: All hydrants shall be equipped with a hydrant marker approved by the City.
- D. Every Hydrant shall have an auxiliary gate valve located on the hydrant lead, 1 foot from the hydrant tee. Valve Box for auxiliary valve shall have stationary rod and a lid marked "WATER".

8.

2.06 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Section 31 23 33 – Trenching and Backfilling.
- B. Cover: As specified in Section 31 23 33 – Trenching and Backfilling.

2.07 ACCESSORIES

- A. Insulation Boards: The insulation shall have a thermal conductivity of not more than 0.28 BTU per hour per square foot per degree Fahrenheit per inch of thickness as tested in accordance with ASTM C177. The insulation shall not absorb moisture to an extent greater than 2.5 percent by volume as tested in accordance with ASTM D2127. The compression strength of the insulation shall be greater than 20 psi as tested in accordance with ASTM D-1621. The density of the insulation shall be between 0.9 and 1.3 pounds per cubic feet as tested in accordance with ASTM D-1622. The insulation shall be specifically designed for protection of underground utilities.
- B. Polyethylene Encasements: All ductile iron and cast-iron pipe, valves, valves boxes, fittings, couplings and hydrants shall be encased with 8-mil linear low- density (LLD) polyethylene film in accordance with ANSI/AWWA C105/A21.5.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that connection sizes, locations, and inverts are as indicated.

- B. Notify utility companies before digging. Verify all related work is at appropriate stage of completion.
- C. Before any City watermain is cut, measure the outside diameter (O.D.) of the pipe with an O.D. tape to make sure contractor has the correct fittings to complete the job. The contractor shall be responsible for any damages or delays caused by not having the correct fittings available.

3.02 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

3.03 TRENCHING

- A. Prepare trench in accordance with Section 31 23 33 Trenching and Backfilling.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Form and place concrete pipe thrust restraints per details.
- D. See Section 31 23 33 Trenching and Backfilling for backfilling and pipe bedding requirements.

3.04 3.04 UTILITY CROSSINGS

- A. Separation between water and sanitary sewer piping shall be provided as follows:
 - 1. Provide a minimum horizontal separation of 10 feet measured from edge of water pipe to edge of sanitary sewer pipe.
 - 2. Provide a minimum vertical separation of 18 inches measured from edge of water pipe to edge of sanitary sewer pipe.
 - 3. At all crossings, both water pipe and sanitary sewer pipe shall be installed with a full pipe section centered over a full pipe section. Sewer joints shall be installed equidistant and as far as possible from water pipe joints. Where water pipe crosses under a sewer, adequate structural support shall be provided for the sewer to maintain line and grade.
 - 4. Minimum separation between water and sanitary sewer lines shall be 18 inches at all crossings, whether water is over or under sewer.
 - 5. If it is impossible to obtain proper horizontal and vertical separation as stipulated above, reviewing agency approval must be obtained on a case by case basis to utilize one of the following methods:
 - a. Sanitary sewer shall be designed and constructed to water pipe standards and shall be pressure tested at 150 psi for a period of one hour to assure water tightness.
 - b. Either the water main or the sewer line may be encased in a watertight carrier pipe which extends 10 feet on both sides of the crossing, measured perpendicular to the water main. The carrier pipe shall be of materials specified for use in water main construction.

3.05 INSTALLATION - PIPE

- A. Establish elevations of buried piping to ensure not less than 7'-6" ft (2.3 m) of cover to crown. See plans for invert elevations, if applicable.

- B. Install pipe to indicated elevation to within tolerance of 1/2 inch (13 mm).
- C. Route pipe in straight line. Joint deflections shall not exceed manufacturers recommendations.
- D. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- E. Install insulation if indicated on the plans.
- F. Slope water pipe and position drains at low points.

3.06 INSTALLATION - VALVES

- A. Set valves on concrete block 6 inches thick and 12 inches square or larger.
- B. Install gate valve box adapter over valve operating nut. Center and plumb valve box over valve. Set box cover 0.04 feet below finished grade.

3.07 FIELD QUALITY CONTROL

- A. Perform trench backfill testing in accordance with Section 31 23 33.

3.08 PROJECT RECORD DOCUMENTS

- A. Accurately record location of pipe runs, connections, and termination points on "as constructed" plans.
- B. Identify, describe and show approximate location of newly discovered utilities during excavation.
- C. Furnish all operational data, including Manufacturer's instructions, parts lists, and maintenance data to Architect.

END OF SECTION

SECTION 33 31 00
SANITARY UTILITY SEWERAGE PIPING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Exterior sanitary sewerage drainage piping, fittings, and accessories.
- B. Reference Standards (The current standard as of the date noted on the plans shall be utilized, unless noted otherwise):
 - 1. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - 2. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
 - 3. ASTM D2466 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 - 4. ASTM 2729 – Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 5. ASTM D3034 – Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 6. ASTM F477 – O-ring rubber gaskets for PVC sewer pipe joints.
 - 7. North Dakota State Plumbing Code.
 - 8. North Dakota State Department of Health Rules and Regulations (10 State Standards).

1.02 SUBMITTALS

- A. Product Data: Provide data indicating pipe, pipe accessories.
- B. Project Record Documents:
 - 1. Record location of pipe runs, connections, catch basins, cleanouts, and invert elevations.
 - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

- A. Provide products that comply with applicable code(s) and local ordinances.
- B. Gravity Pipe (less than 20-feet deep):
 - 1. ASTM D1785, Schedule 40, Poly(Vinyl Chloride) (PVC) material, bell and spigot style solvent sealed joint end.
 - 2. SDR-35, gasketed bell and spigot
- C. Gravity Pipe (Greater than or equal to 20-feet deep): SDR-26, gasketed bell and spigot
- D. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required. Shall meet requirements of ASTM D3034.
- E. Force mains: Schedule 40 PVC

2.02 BEDDING AND COVER MATERIALS

- A. Pipe Bedding Material: As specified in **Section 31 23 33 – Trenching and Backfilling**.
- B. Pipe Cover Material: As specified in **Section 31 23 33 – Trenching and Backfilling**.

PART 3 EXECUTION

3.01 GENERAL

- A. Perform work in accordance with applicable code(s).

3.02 TRENCHING AND BACKFILLING

- A. See Section **31 23 33 – Trenching and Backfilling** for requirements.

3.03 INSTALLATION - PIPE

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
- C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.
- D. Flush pipe when laying operations are completed.
- E. Maintain separation of water lines from sewer piping as follows:
 - 1. Parallel Installation:
 - a. Watermains shall be laid at least 10-feet horizontally from any existing or proposed gravity sanitary or storm sewer, septic tank, or subsoil treatment system. The distance shall be measured edge to edge.
 - b. In cases where it is not practical to maintain a 10-foot separation, the reviewing authority may allow deviation on a case-by-case basis, if supported by data from the design engineer.
 - 2. Crossings:
 - a. Watermains crossing sewers shall be laid to provide a minimum vertical distance of 18-inches between the outside of the watermain and then outside of the sewer. This shall be the case where the watermain is either above or below the sewer with preference to the watermain located above the sewer.
 - b. At crossings, one full length of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required.
 - 3. Exception: When it is impossible to obtain the minimum specified distance, the reviewing authority must specifically approve any variance. Where sewers are being installed the following methods of installation may be used:
 - a. Such deviation may allow installation of the watermain closer to a sewer, provided that the watermain is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the watermain is at least 18-inches above the top of the gravity sewer.
 - b. The sewer materials shall be water works grade 150 psi (1.0 Mpa) pressure rated pipe meeting AWWA standards or pipe approved by the reviewing authority and shall be pressure tested to ensure water tightness.

4. Force mains: There shall be at least a 10-foot horizontal separation between watermain and sanitary sewer force mains. There shall be an 18-inch vertical separation at crossings as required in item 2 – Crossings.
5. Sewer Manholes: No water pipe shall pass through or come in contact with any part of a sewer manhole. Watermain should be located at least 10-feet from sewer manholes.

3.04 INSTALLATION - CLEANOUTS

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.
- C. Establish elevations and pipe inverts for inlets and outlets as indicated.
- D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.05 FIELD QUALITY CONTROL

- A. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.06 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations of piping, valves, connections, and invert elevations where applicable on "as constructed" plans.
- B. Identify and describe the discovery of uncharted utilities.
- A. Provide Architect with a complete set of "as constructed" plans showing ties to all connections and termination points of all piping and appurtenances prior to final payment.

END OF SECTION

SECTION 33 47 21

STORM SEWAGE SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Storm sewer drainage piping, fittings, inlets, basins, and accessories.

B. Reference Standards:

1. ASTM A48 – Cast Iron Grates and Frames.
2. ASTM C14 – Non-reinforced Concrete Pipe.
3. ASTM C76 – Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
4. ASTM C175 – Mortar Cement.
5. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
6. ASTM C478 – Precast Reinforced Concrete Manhole Sections.
7. ASTM C497 – Methods of Testing Concrete Pipe, Manhole Sections or Tile.
8. ASTM C506 – Reinforced Concrete Arch Culvert, Storm Drain and Sewer Pipe.
9. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
10. ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe.
11. ASTM D2729 – Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
12. ASTM D3034 – Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
13. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals; 2007 (Reapproved 2013).
14. ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe & Fitting Materials.
15. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe; 2014.
16. ASTM F679 – Poly (Vinyl Chloride) AC Large Diameter Plastic Gravity Sewer Pipe and Fittings.
17. ASTM F2306 / F2306M - Standard Specification for 12 to 60 in. Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Gravity Flow Storm Sewer and Subsurface Drainage Applications; 2015.
18. ASTM F2648 - Standard Specification for 2 to 60 inch [50 to 1500 mm] Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications; 2013.
19. ASTM F2736 - Standard Specification for 6 to 30 in. (152 To 762 mm) Polypropylene (PP) Corrugated Single Wall Pipe And Double Wall Pipe; 2013 (Editorial Change 1, 2014).
20. ASTM F2881 - Standard Specification for 12 to 60 in. [300 to 1500 mm] Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications; 2011 (Reapproved 2015).
21. AASHTO M-196 – Corrugated Aluminum Alloy Pipe.
22. ASHTO M-246 – Polymeric-Coated (Pre-Coated) Corrugated Metal Pipe.
23. AASHTO M-252 and M-294 Standard Specifications for Corrugated Polyethylene Pipe 12 inch to 36 inch.
24. North Dakota State Department of Health Rules and Regulations (10 State Standards).

1.02 SUBMITTALS

- A. Provide Manufacturer's data indicating pipe specifications, pipe accessories, fittings and appurtenances.
- B. Indicate special procedures required to install products specified.
- C. Certify that products supplied meet or exceed specified requirements.

1.03 QUALITY ASSURANCE

- A. Stamp each section of pipe and all fittings with the following minimum information:
 - 1. Concrete Pipe:
 - a. Class of Pipe.
 - b. Date of Manufacture.
 - c. Name or Trademark of Manufacturer.
 - 2. PVC Pipe:
 - a. Name of Manufacturer.
 - b. Nominal Pipe Size.
 - c. PVC Cell Classification.
 - d. PSM, PS and SDR Value.
 - e. Applicable ASTM and Code number.
 - 3. Corrugated Polyethylene Pipe:
 - a. Name of Manufacturer.
 - b. Size.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. North Dakota Concrete Products for concrete pipe, manholes and inlets.
- B. Certainteed, Northern Pipe Products for PVC.
- C. Advanced Drainage Systems, Inc. (ADS) and HANCOR for polyethylene and polypropylene pipe products.
- D. Neenah Foundry Company, East Jordan Iron Works, or approved equal, for grates and castings.
- E. Approved Equals

2.02 MATERIALS

- A. Reinforced Concrete Storm Sewer Pipe: Conform to the requirements of ASTM C76. Unless otherwise Specified, all pipe shall be Class III for 24-inch and smaller and Class II for 27-inch and larger in accordance with ASTM C76, Wall B. All pipe sections shall be cast in sections 8 feet, 6 feet, or 4 feet long, except that the variable length sections may be cast in order to match at manholes and inlets.
- B. Polyvinyl Chloride Storm Sewer Pipe: Polyvinyl chloride storm sewer (PVC) pipe 15-inches or smaller shall conform to the requirements of ASTM D3034 for type PSM, PVC sewer pipe and shall have an SDR of 35, all of which shall be stamped on the pipe. Polyvinyl chloride sewer pipe 18-inches or larger shall conform to the

requirements of ASTM F679-PS46. PVC sewer shall have the elastomeric gasket type joint providing a watertight seal.

1. Schedule 40 PVC pipe conforming to ASTM D1785 and ASTM D2665 shall be considered an "or equal" substitution for SDR 35 PVC pipe.
- C. Corrugated Polyethylene Pipe: Corrugated Polyethylene Pipe shall be N-12 WT IB per ASTM F2648 as manufactured by ADS, Inc. or approved equal, with integral bell and spigot joints.
1. 4- through 60-inch joints shall be watertight according to the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.
 2. 12- through 60-inch diameters shall have a reinforced bell with a polymer composite band. The bell tolerance device shall be installed by the manufacturer.
 3. Fittings shall conform to ASTM F2306. Bell and spigot connections shall utilize a spun-on or welded bell and valley or saddle gasket meeting the watertight joint performance requirements of ASTM F2306.
- D. Polypropylene Pipe: Corrugated Polypropylene Pipe shall be ADS HP Storm as manufactured by ADS, Inc. or approved equal, with smooth interior walls and gasketed, integral bell and spigot joints.
1. 12- through 30-inch (300 to 750 mm) pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2736 and AASHTO M330.
 2. 36- through 60-inch (900 to 1500 mm) pipe shall have a smooth interior and annular exterior corrugations and meet or exceed ASTM F2881 and AASHTO M330.
 3. Pipe shall be joined with a gasketed integral bell & spigot joint meeting the requirements of ASTM F2736 or F2881, for the respective diameters.
 4. 12- through 60-inch (300 to 1500 mm) pipe joints shall be watertight according to the requirements of ASTM D3212. Spigots shall have gaskets meeting the requirements of ASTM F477. Gasket shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly. Pipe bells shall be reinforced with a polymer composite band, installed by the manufacturer.
 5. Fittings shall conform to ASTM F2736, ASTM F2881 and AASHTO M330, for the respective diameters. Bell & spigot connections shall utilize a spun-on, welded or integral bell and spigot with gaskets meeting ASTM F477. Bell & spigot fittings joint shall meet the watertight joint performance requirements of ASTM D3212. Corrugated couplings shall be split collar, engaging at least 2 full corrugations.
 6. Polypropylene compound for pipe and fitting production shall be impact modified copolymer meeting the material requirements of ASTM F2736, Section 4, ASTM F2881, Section 5 and AASHTO M330, Section 6.1, for the respective diameters.
- E. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tees, bends, elbows, cleanouts, reducers, traps and other configurations.
- F. Pipe Bedding and Backfill: As specified in Section 31 2333.
- G. Pipe bedding and installation shall conform to all manufacturer's requirements.
- H. Pipe Joints:
1. Concrete – Tongue and Groove.
 2. PVC – Integral Bell and Spigot.
 3. High Density Polyethylene – Integral Bell and Interlock.

4. Steel and Aluminum - Coupling bands which overlap a minimum of 2 corrugations on each end of the pipe. All anchor bolts must be type 304 stainless steel.
- I. Mortar Mix: Composed on 1 part by volume Type 1A Portland Cement and 2 parts of mortar sand.
- J. Inlet Structures: Round, square or rectangular as shown on the plans. May be precast or cast in-place. Includes concrete base, invert, casting and two adjusting rings.
- K. Inlet Castings and Grates: Single, double, or triple casting which solidly fits on inlet structures and does not rock or rattle when traffic crosses. Manufactured from Class 35B Gray (Cast) Iron.
 1. Provide curb and/or gutter inlet frames and grates of a quality equal to the Neenah Foundry, East Jordan Iron Works or approved equal. Provide castings as indicated by the Plans.
- L. Manhole Frames and Lids: Equal to Neenah R 1733 or Municipal Casting 306. Lids equal to Neenah Type "K" manufactured from Class 35B Gray (Cast) Iron. Lid and casting must fit on manhole in a solid manner without rocking or rattling when traffic crosses.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that all area utilities have been located and marked.
- B. Verify that excavations are ready to receive Work, and dimensions, and elevations are as indicated on drawings.
- C. Verify that pipe and manholes needed are on site and free of defects.

3.02 INSTALLATION

- A. Strip all topsoil to a depth of at least 4-inches and stockpile away from excavation and backfill material.
- B. Perform excavation to the required elevations.
- C. Maintain a trench width 24-inches (12-inches on each side of pipe centered in trench) greater than outside diameter of pipe.
- D. Install pipe, manholes, fittings, and accessories in accordance with the line and grade established in the field and manufacturer's instructions. Seal joints watertight.
- E. Maintain separation of water lines from sewer piping as follows:
 1. Parallel Installation:
 - a. Watermains shall be laid at least 10-feet horizontally from any existing or proposed gravity sanitary or storm sewer, septic tank, or subsoil treatment system. The distance shall be measured edge to edge.
 - b. In cases where it is not practical to maintain a 10-foot separation, the reviewing authority may allow deviation on a case-by-case basis, if supported by data from the Design Engineer.
 2. Crossings:

- c. Watermains crossing sewers shall be laid to provide a minimum vertical distance of 18 inches between the outside of the watermain and the outside of the sewer. This shall be the case where the watermain is either above or below the sewer with preference to the watermain located above the sewer.
 - d. At crossings, one full length of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required.
 - 3. Exception: When it is impossible to obtain the minimum specified distance, the reviewing authority must specifically approve any variance. Where sewers are being installed the following methods of installation may be used:
 - a. Such deviation may allow installation of the watermain closer to a sewer, provided that the watermain is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the watermain is at least 18-inches above the top of the gravity sewer.
 - b. The sewer materials shall be water works grade 150 psi (1.0 Mpa) pressure rated pipe meeting AWWA standards or pipe approved by the reviewing authority and shall be pressure tested to ensure water tightness.
 - 4. Force mains: There shall be at least a 10-foot horizontal separation between watermains and sewer force mains. There shall be an 18-inch vertical separation at crossings as required in item 2 - Crossings.
 - 5. Sewer Manholes: No water pipe shall pass through or encounter any part of a sewer manhole. Watermain should be located at least 10-feet from sewer manholes.
- F. Install appropriate bedding (per manufacturer's specifications) for type of pipe being installed.
- G. Install haunching for the width of the trench up to the center (springline) of the pipe in no more than 6-inch lifts and thoroughly compact each lift before placing the next lift.
- H. Check and maintain compacted density in pipe haunching.
- I. Keep all pipe, manholes and inlets clean and free of dirt and debris.
- J. If unexpected or unmarked utility lines are encountered immediately notify Architect.
- K. Backfill and compact remainder of pipe trench. Do not allow equipment to cross pipe until pipe has a minimum of 12-inches of compacted cover.
- L. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.
- M. Install inlet grates, flap gates, headwalls, riprap and other appurtenant items as required by plans.
- N. Evenly distribute topsoil or roadway surfacing as required when all backfilling and compacting has been completed.

3.03 TOLERANCES

- A. Install all gravity pipe to the following tolerances:
 - 1. Vertical tolerances – plus or minus 0.05-feet of staked grade line.
 - 2. Horizontal tolerance – plus or minus 0.05-feet of staked alignment.
 - 3. Separation tolerance – minimum of 10-feet outside diameter between mains

3.04 FIELD QUALITY CONTROL

- A. Place pipe by utilizing either a laser or a batter board system.
- B. Notify Architect prior to placing cover over pipe.
- C. Employ an experienced, knowledgeable person to oversee the setting of grades, pipe handling, placement and backfilling.

3.05 MANUFACTURER'S FIELD SERVICES

- A. If pipe installation involves special trench protection, has special loading concerns, or requires special bedding and haunching, contact supplier who shall request assistance from Manufacturer as needed.

3.06 CLEANUP AND PROJECT CLOSEOUT

- A. When all installation is complete, clean the site of all debris, left over pipes, fittings, and equipment.
- B. Remove all debris from pipe and flush pipe. Dispose of debris.

3.07 PROJECT RECORD DOCUMENTS

- A. Accurately record all installed items on "as-constructed" plans.
- B. Identify, describe and show any previously uncharted underground

END OF SECTION