SANTAQUIN CITY CORPORATION

SANTAQUIN WRF PHASE 3 UPGRADES

VOLUME II
TECHNICAL SPECIFICATIONS

Agency Review

February 2025

Prepared by

J-U-B ENGINEERS, Inc.
392 East Winchester Street, Suite 300
Salt Lake City, UT 84107

REGISTERED PROFESSIONAL ENGINEER
#7279300-2202
GARY MICHAEL VANCE
2-3-2025
STATE OF UTAH

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THALMANN ARCHITECT

skm

Project No 93-24-001

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SANTAQUIN CITY

SANTAQUIN WRF PHASE 3 UPGRADES

VOLUME II
TECHNICAL SPECIFICATIONS
(DIVISIONS 01 TO 46)

Agency Review

February 2025

Funded By:
Santaquin City

Prepared By:
J-U-B Engineers, Inc.
392 East Winchester Street, Suite 300
Salt Lake City, Utah 84107
Project No. 93-24-001

For:
Santaquin City
110 S. Center Street
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SECTION 01 10 00
SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Project Summary

B. Regulatory Requirements and Permits

C. Work by Owner

D. Contractor Use of Site and Premises

E. Project Sign

F. Owner Occupancy

G. Work by Others

H. Owner-Furnished Equipment Coordination

I. Site and Climatic Conditions

J. Abbreviations

1.2 PROJECT SUMMARY

A. This project consists of construction of the Phase 3 upgrades to the existing Santaquin Water Reclamation Facility (WRF), including the Center St. lift station, biological nutrient removal process tanks, membrane bioreactor (MBR) basins, blower room, ultraviolet (UV) disinfection system, reclaimed water pump station, dewatering building, winter storage ponds, site work, yard piping, electrical and instrumentation, HVAC and plumbing, and all other equipment and infrastructure to make the upgraded facilities complete and operational.

B. This project also includes the construction of new solids handling facilities at the existing WRF, including installation of a new solids handling support building and new solids holding tank to also include electrical, HVAC and plumbing, and all other equipment and infrastructure to make the solids handling facilities complete and operational.

C. This project includes all labor, mobilization, equipment, materials, installation, startup and commissioning, and all related appurtenances as shown on the drawings and described in the specifications.

1.3 REGULATORY REQUIREMENTS AND PERMITS

A. Comply with all Federal, State, and local laws, regulations, and ordinances applicable to the Work.

B. References in the Contract Documents to local codes shall mean the codes in effect in the State of Utah, Utah County, and Santaquin City.

C. Owner shall obtain and pay for the building permit(s). The permit(s) shall be assigned to the Contractor, and the Contractor shall coordinate inspections and execute permit requirements, as necessary.

D. Contractor shall coordinate with utilities (power, natural gas and water) for connection to systems and shall coordinate inspections and execute any and all requirements by the utilities. Owner shall pay-for connection fees related to power, natural gas and water for elements incorporated into the facility, but not for Contractor's use during construction.

E. Contractor shall obtain and pay for right-of-way permits from Santaquin City and Utah County prior to executing work within the right-of-way, as applicable. The permit shall be obtained and paid-for by the Contractor, and the Contractor shall coordinate inspections and execute permit requirements, as necessary.

F. Contractor shall apply for, pay for, and execute all other permits applicable to the work.

G. Other standards and codes that apply to the work are designated elsewhere in the Contract Documents.

1.4 CULTURAL RESOURCES

A. The Contractor's attention is directed to the National Historic Preservation Act of 1966 (54 U.S.C. 300101) and 36 CFR Part 800 "Protection of Historic Properties" which provides for the preservation of potential historical architectural, archeological, or cultural resources (hereinafter called "cultural resources").

B. The Contractor shall conform to the applicable requirements of the National Historic Preservation Act of 1966 as it relates to the preservation of cultural resources and fair compensation to the Contractor for delays resulting from such cultural resources investigations.

C. In the event potential cultural resources are discovered during subsurface excavations at the site of construction, the following procedures shall be instituted:

1. The Contractor shall immediately cease all construction operations at the location of such potential cultural resources find and notify the Owner and Engineer.

2. A Stop Work Order shall be effective until such time as a qualified archeologist can be called to assess the potential cultural resources and make

recommendations to the State Archeologist. Any Stop Work Order shall contain a clear description of the work to be suspended.

3. If the archeologist determines that the potential find is a bona fide cultural resource, at the direction of the State Archeologist and State Historic Preservation Office, the Owner/Engineer shall extend the duration of the Stop Work Order in writing, and the Contractor shall suspend work at the location of the find.

4. Equitable adjustment of the construction contract time shall be made in the following manner: If the work temporarily suspended is on the "critical path" as determined by the Contractor's most recent work progress schedule submitted to the Engineer prior to the find, the total number of days for which the suspension is in effect shall be added to the number of allowable contract days.

1.5 WORK BY OWNER

A. Normal day-to-day operations of the existing facility will be ongoing. Construction shall not isolate or interrupt existing wastewater conveyance and treatment activities, including, but not limited to, Owner's staff operation, maintenance, and repair except as specifically described herein.

B. Whenever existing systems and equipment are scheduled to be taken out of service, the Owner will operate all valves and equipment to shut off and isolate the system from plant flow stream. Reference Section 01 32 17 Work Sequence for shutdown/outage requirements.

1.6 CONTRACTOR USE OF SITE AND PREMISES

A. Limit use of site and premises to allow:

1. Access by property owners.

2. Work by others and work by Owner.

3. Always maintain access for facility traffic.

B. Contractor shall have access to the 'Staging Area' as generally depicted in the Plans, or as agreed upon between the Owner and the Contractor. Contractor shall grade and prepare the area as necessary for Contractor's use. At completion of the project, the area shall be graded to match existing site contours and returned to an equal or better condition compared to the beginning of construction.

C. Contractor's traffic paths, gate locations, and parking areas shall be coordinated with and approved by the Owner prior to construction taking place.

D. Owner's activities (including hauling biosolids, equipment deliveries, chemical deliveries, maintenance, etc.) requires uninterrupted use of the facility's access road(s) unless specifically noted otherwise in Section 01 32 17 Work Sequence. Access road(s) shall be one lane, 12' wide minimum, and gravel surfaced (until final surface repair is provided). Short-term closures limited to one to two days may be permitted, provided a request is made 14 days prior, Owner is able to reschedule activities requiring use of the road, and upon written acceptance by the Owner.

E. Construction operations shall be limited to rights-of-way, easements, and property lines of Owner's property.

F. Time Restrictions for Performing Work:

1. Contractor's (and Subcontractor's) work shall be limited to the hours of 7:00 am to 7:00 pm, local time, on weekdays only unless otherwise approved by the Owner, or as described in the General Conditions and Supplementary Conditions. No work shall be performed outside these hours, on weekends, or on Owner-recognized holidays unless authorized in writing by the Owner. Requests for alterations to the allowable working hours or days shall be submitted in writing to the Owner seven working days prior to the requested start date of the modifications. Contractor shall state the circumstances that warrant this request. This request shall include any additional measures to mitigate noise generated by construction activity if deemed necessary by the Engineer.

2. If an emergency occurs that warrants extended hours, the Contractor shall notify the Engineer and Owner immediately upon determining the need for this work.

G. Santaquin City has a noise ordinance that the contractor will need to comply with. Allowable noise levels vary based on the time of day.

H. Contractor shall secure temporary power from the utility with a separate metered connection. Use of Owner's power is not permitted.

1.7 OWNER OCCUPANCY

A. Owner will occupy the premises during the entire period of construction for normal operation of the facility. Cooperate with Owner in all construction activities including, but not limited to, startups, testing, and demonstration period operation to minimize conflict and to facilitate Owner usage.

B. Owner's personnel will be responsible for operating the existing facility throughout the execution of this Contract. Equipment presently installed in the facility must be available to Owner's personnel at all times for use, maintenance, and repairs, unless specifically noted otherwise in the Contract Documents.

C. Contractor shall schedule the Work to accommodate Owner occupancy.

1.8 WORK BY OTHERS

A. Additional work by other Contractors may be performed at the facility site under separate contract and will require coordination and scheduling by Contractor with those separate efforts, at no additional cost.

1. Additional work on site under separate contract includes:

a. Owner-Provided programming (portions of the facility) and SCADA development.

b. Central Utah Water Conservancy District – Santaquin Reach Project

B. Contractor shall coordinate with other contractors on site as noted above, or as required during this project, during all work phases, including, but not limited to shutdowns, equipment installation, startups, testing, and demonstration period operation in order to minimize conflicts and to facilitate usage of facility by Owner.

1.9 OWNER-FURNISHED ITEMS

A. Owner-furnished items are noted in the Contract Documents.

B. Owner shall:

1. Furnish shop drawings, product data, and samples (as available and applicable) to the Contractor upon receipt of written request from the Contractor.

2. Unless noted otherwise, Owner shall have the equipment available on-site and available for inspection by Contractor.

C. Contractor shall inspect Owner-furnished items prior to beginning the associated work and notify Owner promptly of any deficiencies associated with the items for review by Owner and Engineer.

D. Once Contractor takes possession of Owner-furnished items, Contractor is responsible for storage, handling, and protection of the items.

1.10 PRE-PROCURED EQUIPMENT

A. Reference Specification 01 60 25 Pre-Procured Equipment Coordination.

1.11 SITE ELEVATION AND CLIMATIC CONDITIONS

A. The Project site is at an elevation of approximately 4,810 feet above mean sea level.

B. Climate conditions are described as follows:

	Range of Conditions
Winter Outdoor Low Temperatures	-20˚F to 30˚F
Summer Outdoor High Temperatures	80˚F to 105˚F

1.12 ABBREVIATIONS

A. Wherever the following abbreviations are used, they shall have the meanings indicated, unless specifically noted otherwise:

AASHTO	American Association of the State Highway and Transportation Officials
ACI	American Concrete Institute
AGA	American Gas Association
AGMA	American Gear Manufacturers' Association
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron & Steel Institute
AITC	American Institute of Timber Construction
ANSI	American National Standards Institute
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
AREA	American Railway Engineering Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASQC	American Society for Quality Control
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
CBM	Certified Ballast Manufacturers
CLFMI	Chain Link Fence Manufacturers Institute
CRSI	Concrete Reinforcing Steel Institute
DIPRA	Ductile Iron Pipe Research Association
ETL	Electrical Test Laboratories
FHWA	Federal Highway Administration
IBC	International Building Code

ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
IPCEA	Insulated Power Cable Engineers Association
ISA	Instrument Society of America
ISO	Insurance Services Office
ITE	Institute of Transportation Engineers
MUTCD	Manual on Uniform Traffic Control Devices
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
OSHA	Occupational Safety and Health Act of 1970
PCA	Portland Cement Association
SAE	Society of Automotive Engineers
SEPA	State Environmental Policy Act
SSPC	Steel Structures Painting Council
UBC	Uniform Building Code, International Conference of Building Officials
UL	Underwriters' Laboratories, Inc.
UPC	Uniform Plumbing Code
WAC	Washington Administrative Code
WCLIB	West Coast Lumber Inspection Bureau
WCRSI	Western Concrete Reinforcing Steel Institute
WRI	Wire Reinforcement Institute
WWPA	Western Wood Products Association

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

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SECTION 01 10 10
GEOTECHNICAL REPORT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The Geotechnical Engineering Evaluation(s) used for this project immediately follow this section and include the following:

1. Geotechnical Investigation, Santaquin Water Reclamation Facility Project, RB&G Engineering, Inc., May 2010

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

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GEOTECHNICAL INVESTIGATION

SANTAQUIN WATER RECLAMATION FACILITY PROJECT

Santaquin, Utah

Prepared for:
J-U-B Engineers, Inc.

May 2010

RB&G
ENGINEERING, INC.

201001-008

RB&G
ENGINEERING, INC.

May 28, 2010

Trevor R. Lindley, P.E.
J-U-B Engineers, Inc.
466 North 900 West
Kaysville, UT 84037

Re: Santaquin Water Reclamation Facility Project

Dear Mr. Lindley:

A Geotechnical Investigation has been completed for the proposed Utah Santaquin Water Reclamation Facility Project to be located in Santaquin, Utah. The results of the study are summarized in the report transmitted herewith.

We appreciate the opportunity of providing this service for you. If there are any questions relating to the information contained herein, please call.

Sincerely,

RB&G ENGINEERING, INC.

Bradford E. Price, P.E.

bep/jal

1435 WEST 820 NORTH, PROVO, UTAH 84601-1343
PROVO 801-374-5771 SALT LAKE CITY 801-521-5771 FAX 801-374-5773

Geotechnical Investigation

Santaquin Water Reclamation Facility Project

Santaquin, Utah

Prepared for:
J-U-B Engineers, Inc.

May 2010

RB&G ENGINEERING, INC.

RB&G ENGINEERING, INC.

SANTAQUIN WATER RECLAMATION FACILITY
Santaquin, Utah

Geotechnical Investigation

INTRODUCTION

This report outlines the results of a geotechnical investigation performed for the proposed Santaquin Water Reclamation Facility to be located on the west side of Center Street (Utah County 5600 West), between the Strawberry Canal Road and Union Pacific Railroad at the north edge of Santaquin, Utah, as shown on the Vicinity map in Figure 1.

The purpose of this investigation was to determine the characteristics of the subsurface material throughout the site so that satisfactory substructures can be designed to support the proposed facilities.

The information contained in the report is discussed under the following headings: (1) Geological and Existing Site Conditions, (2) Field and Laboratory Testing Procedures, (3) Subsurface Soil and Water Conditions, (4) Foundation Considerations and Recommendations, (5) Site Preparation and Compacted Fill Requirements, and (6) and Flexible Pavement Design.

I. GEOLOGICAL AND EXISTING SITE CONDITIONS

The natural surface materials in this general area have been mapped as Quaternary age deposits including (1) recent stream alluvium, alluvial fans, and localized mudflows and colluviums, (2) Pleistocene age Provo Formation and younger lake bottom sediments of clays, silts, sand, and localized offshore sand bars, and (3) Alpine Formation offshore facies of clay, silt and fine sand in thin beds (Davis, 1983).

The Wasatch Fault Zone is located approximately 2 miles east of the site. Utah County Natural hazards maps identify this area as having very low liquefaction potential.

The topography throughout the site is relatively flat, sloping gently down to the north. The site has formerly been used as an orchard. The trees have been recently removed and the vegetative

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cover consists predominately of grasses up to 3 feet high. Small trees are scattered throughout the site. The Strawberry Canal is located along the north side of the site, and the Union Pacific railroad tracks are located along the south side of the field.

No structures are located in the immediate vicinity of the site from which foundation performance can be inferred.

Other than the information provided above, no conditions appear to exist at this site which would adversely affect foundation performance.

II. FIELD AND LABORATORY TESTING PROCEDURES

Borings were drilled using a CME 55 rotary drill rig with hollow stem auger or a tri-cone rock bit, NW casing and water as the drilling fluid used to advance the boring. Test pits were excavated using a CASE 580 backhoe. During the subsurface investigation, sampling was performed at one- to five-foot intervals throughout the depth investigated. Both disturbed and undisturbed samples were obtained during the field investigations.

Disturbed samples were obtained in the borings by driving a 2-inch split spoon sampling tube through a distance of 18 inches using a 140-pound weight dropped from a distance of 30 inches. The number of blows to drive the sampling spoon through each 6 inches of penetration is shown on the boring logs. The sum of the last two blow counts, which represents the number of blows to drive the sampling spoon through 12 inches, is defined as the standard penetration value. The standard penetration value, corrected for overburden and hammer energy, provides a good indication of the in-place density of sandy material; however, it only provides an indication of the relative stiffness of the cohesive material, since the penetration resistance of materials of this type is a function of the moisture content. Considerable care must be exercised in interpreting the standard penetration value in gravelly-type soils, particularly where the size of the granular particle exceeds the inside diameter of the sampling spoon. If the spoon can be driven through the full 18 inches with a reasonable core recovery, the standard penetration value provides a good indication of the in-place density of gravelly-type material.

It will be noted that it was not possible to drive the sampling spoon through the full 18 inches at some sampling locations. Where the sampling tube could not be driven through the full 18 inches, the number of blows to drive the spoon through a given depth of penetration is shown on the boring logs.

Undisturbed samples were obtained at select locations in the borings by pushing a thin-walled sampling tube into the subsurface material using the hydraulic pressure on the drill rig. Undisturbed samples were obtained by carving blocks from the sidewalls of the test pits. The location at which the undisturbed samples were obtained is shown on the boring and test pit logs.

Miniature vane shear tests, which provide an indication of the undrained shearing strength of cohesive materials, were performed on samples of the clay soil during the field investigations. The results of these tests are shown on the logs as the torvane value in tsf.

Each sample obtained in the field was classified in the laboratory according to the Modified Unified Soil Classification System. The symbol designating the soil type according to this system, is presented on the logs. A description of the Modified Unified Soil Classification System is presented in the appendix, and the meaning of the various symbols, shown on the logs, can be obtained from this figure.

Laboratory tests performed during this investigation to define the characteristics of the subsurface material throughout the proposed site included in-place dry unit weight, natural moisture content, Atterberg Limits, mechanical analyses, consolidation, pH, resistivity, sulfate and chloride tests. Testing was performed following procedures outlined in the American Society for Testing and Materials (ASTM) standards.

III. SUBSURFACE SOIL AND WATER CONDITIONS

The characteristics of the subsurface material were evaluated by drilling six borings and excavating four test pits at locations identified by JUB Engineers as shown in Figure 2. The initial scope included 7 borings; however Boring 6 was eliminated due to access problems. The borings extended to depths of between 21 and 61 feet, and the test pits extended to depths of between 12 and 13 feet.

The logs for the test holes are presented in the appendix, and it will be observed that the subsurface profile consists of a surface zone of lean clay and sandy silt varying in depth from 6 to 13 feet. This zone exhibited a pinhole-type structure indicative of moisture sensitive collapsible soils. Collapsible soils have sufficient binder to form a strong bond with sand particles in a loose, open structure after deposition. When the soil becomes wet, it loses its

strength, and the soil structure collapses, resulting in settlement. The surface zone is underlain by relatively dense silty sand and gravel with layers of sandy silt and lean clay.

No groundwater was encountered within the depth investigated at the time the field investigations were performed (March, April & May 2010).

A percolation test was also performed in the gravel layer that starts at 6.4 feet below the ground surface and extends to 9.2 feet below the ground surface in Test Pit No. 4. A final stabilized percolation rate of 0.82 minutes per inch was obtained. This is equivalent to a hydraulic conductivity of 146 ft/day.

The results of classification, density and moisture tests are presented on the boring logs, and the results of all laboratory tests, with exception of the consolidation tests, are summarized in Table 1, Summary of Test Data in the appendix. It will be noted from Table 1 that the in-place dry unit weight of the cohesive soil varies from 77.5 to 100.8 pcf, and that the natural moisture content ranges from 6.2 to 19.1%. The liquid limit of the cohesive soil ranges from 22 to 31, and the plasticity index varies from 3 to 13. The plastic silts and clays have 0 to 19% gravel size particles, 15 to 41% sand, and 47 to 82% silt and clay. The gravelly soil has 48 to 72% gravel, 23 to 39% sand, and 5 to 23% silt size particles. The non-plastic silt and sand has 0 to 27% gravel, 33 to 59% sand, and 14 to 67% silt.

The compressibility characteristics of the subsurface and subsurface materials were evaluated by performing 12 consolidation tests on samples obtained at the locations tabulated below:

Hole No.	Depth (ft)
Boring 10-1	23 – 24.5
Boring 10-2	3 – 4.5
Test Pit 1	2 – 3 5 – 6 8.5 – 9
Test Pit 2	2 – 3 5 – 5.5 8 – 9 11 – 11.5
Test Pit 3	2 – 3 5 – 5.5 10 – 10.5

The results of these tests are also presented in the appendix. During performance of the consolidation tests, each sample was loaded at the natural moisture content until a load intensity of 0.58 tsf had been reached. At this point in the loading cycle, each sample was permitted to absorb water without any increase in the load intensity. Soils having collapsible characteristics

always settle without any increase in the load when they become wet or saturated. It will be noted that all samples in the upper 12 feet of the soil profile collapsed upon wetting. The sample from Boring 10-1 at 23 feet did not collapse.

It will be observed from the Summary of Test Data that the surface soils have relatively low resistivity and are considered to have poor to fair corrosion resistance. These soils have low percentages of water soluble sulfate. It is recommended that Type II cement be used for concrete in contact with the native soils due to its increased resistance to sulfate attack.

IV. FOUNDATION CONSIDERATIONS AND RECOMMENDATIONS

A. FOUNDATION TYPES AND BEARING CAPACITIES

It is our understanding that this phase of the Water Reclamation Facility will include (1) the MBR Process Building, (2) the Reclaimed Water Pump Station, and (3) the Headworks Building. Section views with boring data and elevations of each of the structures were provided by J-U-B Engineers and are included in the appendix. The exact magnitude of the structural loads are not known as of the preparation of this report; however, it is assumed that column loads will not likely exceed 150 kips and that wall loads will not exceed 4 klf.

We recommend that all exterior foundations be located at a depth below finished grade sufficient to provide frost protection, which is about 2.5 feet in this area, and that interior footings in heated areas be located at least 1 foot below floor level. As discussed above, each of the test holes encountered collapsible soils in the upper portion of the soil profile. The thickness of collapsible soils ranged from 5 to 13.5 feet.

It is recommended that no footings be supported on the collapsible soils. Methods of mitigating sites with collapsible soils include (1) removing the collapsible soils from beneath the structures and replacing with compacted fill, (2) extending structural support below the collapsible soils, (3) using deep dynamic compaction to collapse the soils prior to construction, and (4) pre-wetting and surcharging to collapse the soils prior to construction. Each of these options is discussed below as follows:

(1) Removing the Collapsible Soils From Beneath the Structures

This option requires excavating the collapsible soils from beneath the structure footprints, with the excavations extending approximately 5 feet beyond the footing perimeter. The

excavated soil can be used to as backfill, provided that it is moisture conditioned to within about 2% of optimum, placed in lifts not exceeding 8 inches in thickness, and compacted to at least 95% of the maximum density as determined by ASTM D 1557. It should be noted that the lean clay is several percent below optimum and will require substantial moisture conditioning to achieve compaction. Compaction should be performed with a sheepsfoot or tamping type roller. It may be more efficient to replace the excavated cohesive soils with imported granular fill. If imported fill is used, we recommend that the fill have a maximum size of 6 inches with less than 30% passing the No. 200 sieve. The fines should have a Liquid Limit less than 30 and a Plastic Index less than 6. The granular fill should be placed in lifts not exceeding 12 inches and compacted to at least 95% of the maximum density indicated above.

It is recommended that the fill within 1 foot of the footing subgrade consist of relatively well graded sandy gravel having a maximum size of 3 inches, with less than 15% fines. This material should also be compacted to the density requirements outlined above.

To ensure that compaction requirements are met, each lift should be tested, with testing performed at 50 foot intervals along continuous footing lines and at each spot footing. Testing should be performed in accordance with ASTM D 6938 (nuclear method), or ASTM D 1556 (sand cone method).

If the above recommendations are complied with, footings can be designed using an allowable bearing capacity of 4,000 psf assuming the on-site cohesive soils are used as backfill. If imported granular fill is used, 4,000 psf can be used for 2 to 3 foot wide footings, 5,000 psf for 4 to 6 foot wide footings, and 6,000 psf for 7 to 12 foot wide footings. It is recommended that an allowable bearing capacity of 4,000 psf be used for the native granular soils underlying the collapsible soils.

MBR Process Building

The section view for the MBR Process Building shows finished grade will be at elevation 4809 feet, approximately 3 to 5 feet above existing grade. The tanks on the southerly side of the structure, as shown in the section view, will extend to about

elevation 4790 feet. Each of the three borings drilled within the footprint of this structure encountered collapsible soils, extending to elevation 4793 feet in Borings 10-1 and 10-4, and elevation 4798 feet in Boring 10-7. Removal of the collapsible soils will require excavations of between 6 and 13 feet below the building footprint.

Reclaimed Water Pump Station

The section view for this structure shows the lower floor of the pump station to be at about elevation 4790 feet. Boring 10-3 and Test Pit 4 show the collapsible soils extending to between 4793 and 4795.5 feet. It appears that the collapsible soils will be removed to achieve subgrade level for this structure.

Headworks Building

The existing ground elevation at Boring 10-2, located within the building footprint, was about 4808 feet. Collapsible soils extend to approximately 4803 feet in this boring, requiring about 5 feet of removal. The section view for this structure shows the floor to be at about elevation 4816 feet, requiring several feet of fill above natural grade.

If foundations for the proposed facilities are designed in accordance with the recommendations outlined above, the maximum settlement of any footing should not exceed one inch and differential settlement throughout the structures should not exceed 0.5 inch.

(2) Extending Structural Support Below the Collapsible Soils

Extending piers or stone columns through the collapsible soils and into the underlying dense granular soils is considered a viable option for foundation support. The floors would also need to be supported to prevent excessive settlement. This option would require a Specialty Contractor to design and install the piers or stone columns based upon their means and methods. It is anticipated that allowable bearing capacities in the order of 4,000 psf can be achieved with aggregate piers or stone columns. Specialty Contractors in the area include Nicholson Construction, Hayward Baker and Geopier. It is recommended that we review the Specialty Contractor's design and provide Quality Assurance inspection and testing during installation if this option is used.

Due to the required excavations to accommodate subgrade levels in the process and pump station buildings, and the shallow depth of collapsible soils in the vicinity of the headworks

building, it is our opinion the Option 1 represents the most efficient method to mitigate the collapsible soils at this site. Specific recommendations relative to Options 3 and 4 can be provided upon request.

B. SEISMIC CONSIDERATIONS

The site is classified as Site Class D, as per Section 1613 of the 2006 International Building Code. The site is located at latitude 39.9950° North and longitude 111.7896° West. Probabilistic peak ground acceleration (PGA) values are tabulated below:

Probabilistic ground motion values in %g.

	10%PE in 50 yr	2%PE in 50 yr
PGA	16.58	58.85
0.2 sec SA	39.18	134.25
1.0 sec SA	13.32	57.07

The allowable soil bearing pressure indicated above may be increased by one-third where seismic forces are involved in the structural loads. If the frictional resistance of the footings and floor slabs are used to resist seismic forces, we recommend a coefficient of friction of 0.40 be used to calculate these forces. See Section C below for recommendations related to resistance provided by passive earth pressures.

Since the material in the upper 60 feet of the soil profile consists of either cohesive soil or relatively dense granular soil, and since the groundwater level is at a substantial depth below the surface, problems associated with liquefaction during a seismic event are unlikely at this site, and no special mitigation of the foundation soils is required.

C. LATERAL EARTH PRESSURES

It is anticipated that earth-retaining structures will be required for the proposed facilities. If backfilling is performed using granular material, and if the backfill behind the wall is horizontal, we recommend that the earth pressures be calculated using the following equation, along with the earth pressure coefficient outlined below:

$$P = \tfrac{1}{2}\, \gamma\, K\, H^2$$

Where P = total lateral force on wall, plf
K = earth pressure coefficient
γ = unit weight of soil (125 pcf)
H = height of retained soil against wall

The earth pressure coefficient used in designing the walls will depend upon whether the wall is free to move during backfilling operations, or whether the wall is restrained during backfilling. If the wall is free to move during backfilling operations and the backfill material is granular soil, we recommend an active earth pressure coefficient of 0.30 be used in the above equation to calculate the lateral earth pressures. If the walls are restrained from any movement during backfilling and the backfill material is granular soil, we recommend an at-rest earth pressure coefficient of 0.45 be used to calculate the lateral earth pressure. If cohesive soils are used as backfill, we recommend that the active earth pressure coefficient be increased to 0.36 and the at rest coefficient to 0.53. Passive pressures can be calculated using the above equation and a passive earth pressure coefficient of 3.2 for granular soils and 2.7 for cohesive soils.

The additional active earth pressure due to ground acceleration equal to 2/3's of the MCE may be estimated using a coefficient of 0.23 (granular fill) and 0.27 (cohesive fill). The seismic ground motion will reduce the available passive resistance. This reduction may be accounted for as an earth pressure acting in the direction opposite the passive resistance, and computed using a coefficient of 0.60. The pressure diagrams for these forces may be roughly approximated as inverted triangles, such that the resultant forces of the seismic components act at heights of approximately 2H/3 above the base of the wall.

For non-yielding walls, the increase in earth pressure corresponding to the seismic event may be estimated using the equation $P_{EQ} = a_h \gamma H^2$, where a_h is a seismic coefficient of 0.39. This force is in addition to the at-rest pressure, and acts at a height of about 0.53H above the base of the wall.

It should be recognized that the pressures calculated by the above equation are earth pressures only and do not include hydrostatic pressures. Where hydrostatic pressures may exist behind a retaining structure, we recommend either the wall be designed to resist hydrostatic pressure, or that a drainage system be placed behind the wall to prevent the development of hydrostatic pressures.

V. SITE PREPARATION AND COMPACTED FILL REQUIREMENTS

As indicated above, the vegetative cover throughout the site consists of native grass, weeds and a few small trees. We recommend that the upper 6 inches be stripped from the area and that tree roots be grubbed to remove the excess organic matter in the upper portion of the soil profile.

It is anticipated that significant grading will be required throughout the site. The on-site cohesive soils can be used to establish final grade, provided that the soils are moisture conditioned to within about 2% of optimum, placed in lifts not exceeding 8 inches and compacted to at least 95% of the maximum density (ASTM D 1557) beneath building areas and 92% of the maximum density outside of building areas. We recommend that imported fill used to establish final grade throughout the site consist of granular soil having a maximum size of 6 inches with less than 30% passing a No. 200 sieve. We recommend that the material passing a No. 200 sieve have a plasticity index less than 6. The imported fill should also be compacted to an in-place density equal to at least 95% of the maximum density as determined by ASTM D 1557 in building areas and 92% outside of building areas. Structural fill beneath foundations should meet requirements outlined in Section IV.A.

In areas where sidewalks, driveways, and roadways are located, we recommend that these areas be over-excavated and replaced with compacted fill. The depth of over excavation should be a function of the acceptable risk. As stated earlier in this report, the soils in the upper 5 to 13 feet have collapsible potential and will experience settlement if they become wet. We recommend that a minimum of 3 feet of this material be excavated and replaced. The width of the excavation should extend at least 2 feet beyond the limits of the driveways and roadways. The excavated material should then be moisture conditioned to within 2% of optimum, placed in lifts not exceeding 8 inches, and compacted to 92% of the maximum density indicated above. It is our opinion that the pavement will serve as an impervious membrane for these areas and reduce the likelihood of water entering into the collapsible soils below the treated areas. Positive drainage should be provided to prevent water from ponding adjacent to the paved areas.

Backfilling of utility trenches should be carefully controlled such that the fill does not act as a conduit for water to enter into the underlying collapsible soils. Free-draining gravels should not be used. If gravel bedding is required, clay cutoffs should be installed at regular intervals.

Grading around each structure should be performed in such a manner that all surface water will flow freely from the area and that no ponding will occur adjacent to the structure which will permit deep percolation into the foundation area. Roof drains should extend well beyond the building lines to prevent seepage into the foundation soils. Sprinkler heads located adjacent to the building should be directed away from the structure to prevent the percolation of water into the foundation zone.

Backfilling around foundation walls should be densified to an in-place unit weight equal to at least 92% of the maximum laboratory density indicated above.

VI. FLEXIBLE PAVEMENT DESIGN

In providing recommendations for flexible pavement design for driveways and parking areas, an equivalent single axle load (ESAL) of 10,000 has been used. This value is comparable to 600 passenger cars and light trucks per day and 10 heavy trucks per month over a design life of 20 years. For access roadways, an ESAL of 100,000 has been used. This is equivalent to 10 heavy trucks per day over a design life of 20 years. The flexible pavement thickness has been determined using the AASHTO Structural Number Procedure. The following additional assumptions have been made in determining the flexible pavement thickness:

Design E-18's	= 10,000 (100,000)
Reliability	= 85%
Overall Deviation	= 0.45
Resilient Modulus	= 6,000 psi (15,000)
Initial Serviceability	= 4.2
Terminal Serviceability	= 2.0

The results of the analysis indicates that a flexible pavement consisting of 2.5 inches of an asphalt surface course plus 6 inches of untreated granular base will be adequate to support the contemplated traffic in driveways and parking areas. For access roadways, a pavement section consisting of 4 inches of asphalt surface course over 8 inches of untreated granular base provides adequate support. In performing the analyses, it has been assumed that the subgrade will consist of at least 1 foot of cohesive fill compacted to an in-place unit weight equal to at least 92% of the maximum laboratory density, as determined by ASTM D 1557, resulting in a CBR value of at least 4.0. If the fill is imported granular material with a CBR of at least 10, the section can be reduced to 3 inches of asphalt over 6 inches of untreated granular base.

The flexible pavement design indicated above is adequate to support the traffic distribution as indicated. It should be recognized, however, that if construction is performed during periods when the subsurface material throughout the site is in a wet condition, the subsurface material will not be capable of supporting the wheel loads associated with construction equipment. As a consequence of this condition, the pavement cannot be constructed as designed. It is recommended, therefore, that the pavement for the development be constructed during the summer months when the surface moisture content is at a minimum. If the pavement must be constructed during periods when the surface moisture is high, it may be necessary to stabilize the

subgrade prior to construction of the pavement section. Stabilization techniques are dependent upon the conditions encountered and construction methods. An additional 1-foot of granular subbase plus a geotextile fabric may be required if wet conditions exist at the subgrade level such that compaction of the subgrade is not feasible.

All base material should be densified to an in-place unit weight equal to 95% of the maximum laboratory density indicated above and all untreated granular base should conform to Utah Department of Transportation Specifications. Mineral aggregates used in the asphalt surface course should conform to Section 02741 of the standard specifications of the Utah State Department of Transportation. Mixing, placing, and densification of all asphalt materials should also conform to UDOT standards.

VII. LIMITATIONS

The conclusions and recommendations presented in this report are based upon the results of the field and laboratory tests which, in our opinion, define the characteristics of the subsurface material throughout the site in a satisfactory manner. It should be recognized that soil materials are inherently heterogeneous and that conditions may exist throughout this site which could not be defined during this investigation.

It is recommended that a soils engineer observe the foundation excavations prior to placement of fill or footings. Since the bearing capacity for foundation design is dependent upon adequate compaction of fill, it is requested that testing of the fill be performed under the direct supervision of the soils engineer. If during construction, conditions are encountered which appear to be different than those presented in this report, it is requested that we be advised in order that appropriate action may be taken.

The information contained in this report is provided for the specific location and purpose of the client named herein and is not intended or suitable for reuse by any other person or entity whether for the specified use, or for any other use. Any such unauthorized reuse, by any other party is at that party's sole risk and RB&G Engineering, Inc. does not accept any liability or responsibility for its use.

Figures

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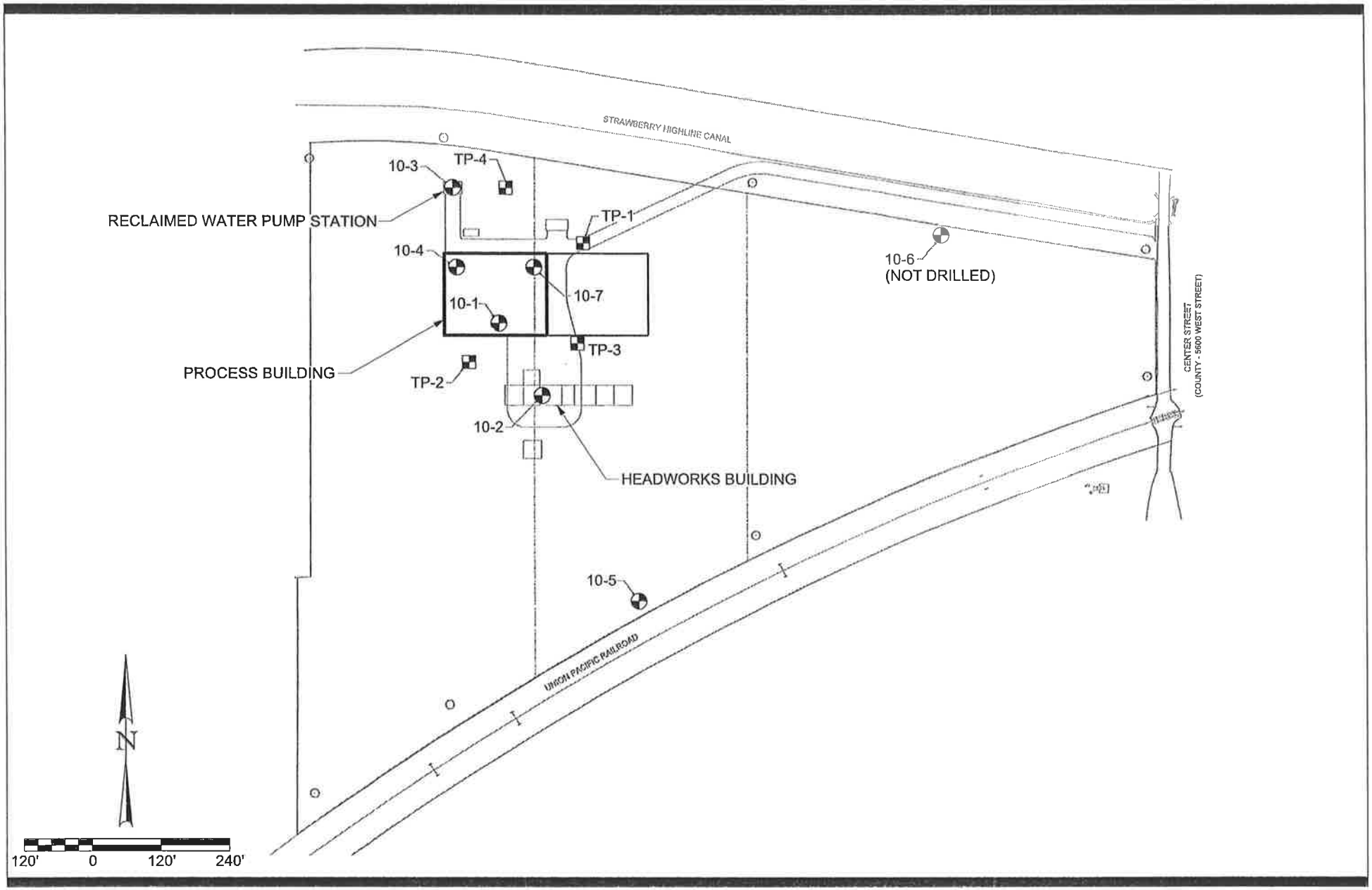
Figure 1 SITE PLAN & TEST HOLE LOCATIONS

Santaquin Water Reclamation Facility

Santaquin, Utah



RB&G ENGINEERING, INC.

Figure 2 SITE PLAN & TEST HOLE LOCATIONS

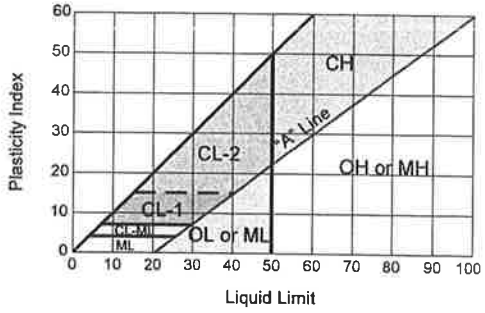
Santaquin Water Reclamation Facility

Santaquin, Utah

Appendix

Unified Soil Classification System

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria		
COARSE-GRAINED SOILS *more than half of material is larger than No. 200 sieve*	Gravels *more than half of coarse fraction is larger than No. 4 sieve size*	Clean Gravels *little or no fines*	GW	Well graded gravels, gravel-sand mixtures, little or no fines	*For laboratory classification of coarse-grained soils*	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels With Fines *appreciable amount of fines*	GM* d / u	Silty gravels, poorly graded gravel-sand-silt mixtures	Determine percentage of gravel and sand from grain-size curve. Depending on percentage of fines (*fraction smaller than No. 200 sieve size*), coarse-grained soils are classified as follows: **Less than 5%** GW, GP, SW, SP **More than 12%** GM, GC, SM, SC **5% to 12%** Borderline cases requiring use of dual symbols**	Atterberg limits below "A" line, or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring uses of dual symbols
			GC	Clayey gravels, poorly graded gravel-sand-clay mixtures		Atterberg limits above "A" line, or PI greater	
	Sands *more than half of coarse fraction is smaller than No. 4 sieve size*	Clean Sands *little or no fines*	SW	Well graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with Fines *appreciable amount of fines*	SM* d / u	Silty sands, poorly graded sand-silt mixtures		Atterberg limits below "A" line, or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring uses of dual symbols
			SC	Clayey sands, poorly graded sand-clay mixtures		Atterberg limits above "A" line, or PI greater	
FINE-GRAINED SOILS *more than half of material is smaller than No. 200 sieve*	Silts and Clays *liquid limit is less than 50*		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	*For laboratory classification of fine-grained soils*		
			CL 1 / 2	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL	Organic silts and organic silt-clays of low plasticity			
	Silts and Clays *liquid limit is greater than 50*		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH	Inorganic clays of high plasticity, fat clays			
			OH	Organic clays of medium to high plasticity, organic silts			
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils			



Plasticity Chart

NOTE: USCS Modified to include CL-type subcategories

*Division of GM and SM groups into subdivisions of d and u for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when liquid limit is 28 or less and the PI is 6 or less, the suffix u used when liquid limit is greater than 28.

**_Borderline classification_: Soils possessing characteristics of two groups are designated by combinations of group symbols. (For example GW-GC, well graded gravel-sand mixture with clay binder.)

DRILL HOLE LOG

BORING NO. 10-1

SHEET 1 OF 2

PROJECT: SANTAQUIN WATER RECLAMATION FACILITY
CLIENT: J-U-B ENGINEERS, INC.
LOCATION: N:7,167,109 E:1,559,056 (SEE SITE PLAN)
DRILLING METHOD: 08-CME-55 / N.W. CASING TO 39'
DRILLER: T. KERN
DEPTH TO WATER - INITIAL: ▽ N.M. **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 201001.008
DATE STARTED: 3/29/10
DATE COMPLETED: 3/30/10
GROUND ELEVATION: 4806.0'
LOGGED BY: J. OLSEN, J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
4805															
				13	4,3,4,(15) *0.40*	CL	dk. brown, moist, firm — Organics in top 12" LEAN CLAY pinhole structure								
	5														
4800				13	11,9,8,(36)	CL	brown, moist, very stiff — SANDY LEAN CLAY W/GRAVEL pinhole structure								Chem.
	10														
4795				9	4,4,5,(16)	ML	brown, moist, med. dense — SANDY SILT slight pinhole structure, slightly plastic								Chem.
	15														
4790				13	22,25,21,(62)	GP-GM	brown, moist, dense — GRAVEL W/SILT & SAND possible cobbles		4.7		NP	72	23	5	
	20														
4785				8	6,5,5,(12) *0.35*	CL-1	brown, moist, firm — SANDY LEAN CLAY		17.7	28	10	0	31	69	
				13	Pushed	ML	brown, moist — SANDY SILT	93.7	16.4		NP	0	33	67	CT
	25			11	10,18,20,(43)	ML / GP-GM	brown, moist — brown, moist, med. dense								
4780				11	16,21,22,(44)	GP-GM	brown, moist, med. dense — GRAVEL W/SILT & SAND possible cobbles								
	30			15	30,53,36,(87)	GP-GM	brown, moist, very dense								
4775															
				15	*0.30* 7,16,47,(59)	CL / GP-GM	brown, moist, firm — SANDY LEAN CLAY; brown, moist, dense — GRAVEL W/SILT & SAND possible cobbles								

DH_LOGV1 SANTAQUINWRF.GPJ US EVAL.GDT 6/1/10

RB&G ENGINEERING, INC.

LEGEND:

DISTURBED SAMPLE: 2,3,2,(6) ← Blow Count per 6" / $(N_1)_{60}$ Value; *0.45* ← Torvane (tsf)

UNDISTURBED SAMPLE: PUSHED; *0.45* ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
HYD = Hydrometer
SS = Soluble Salt
DC = Dispersive Clay
Chem. = pH, Resistivity, Sulfate, Chloride

DRILL HOLE LOG

BORING NO. 10-1

PROJECT: SANTAQUIN WATER RECLAMATION FACILITY
CLIENT: J-U-B ENGINEERS, INC.
LOCATION: N:7,167,109 E:1,559,056 (SEE SITE PLAN)
DRILLING METHOD: 08-CME-55 / N.W. CASING TO 39'
DRILLER: T. KERN
DEPTH TO WATER - INITIAL: ▽ N.M. **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 201001.008
DATE STARTED: 3/29/10
DATE COMPLETED: 3/30/10
GROUND ELEVATION: 4806.0'
LOGGED BY: J. OLSEN, J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
4770				10	58,50/4.5"	GP-GM	red-brown, moist, very dense GRAVEL W/SILT & SAND possible cobbles		6.7		NP	53	37	10	
	40			13	36,43,40,(69)	GP-GM SM GP-GM	red-brown, moist brown, moist red-brown, moist, dense SILTY SAND								
4765															
	45			8	54,50/3"	GP-GM	red-brown, moist, very dense								
4760															
	50			9	46,50/2"	GP-GM	red-brown, very moist, very dense GRAVEL W/SILT & SAND possible cobbles		8.5		NP	64	29	7	
4755															
	55			10	34,50/1"	GP-GM	red-brown, very moist, very dense								
4750															
	60			10	46,50/4"	GP-GM	red-brown, very moist, very dense								
4745							BOH								
	65														
4740															

DH_LOGV1 SANTAQUINWRF.GPJ US EVAL.GDT 6/1/10

RB&G ENGINEERING, INC.

LEGEND:

DISTURBED SAMPLE — 2,3,2,(6) ← Blow Count per 6" / $(N_1)_{60}$ Value; 0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE — PUSHED; 0.45 ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
HYD = Hydrometer
SS = Soluble Salt
DC = Dispersive Clay
Chem. = pH, Resistivity, Sulfate, Chloride

DRILL HOLE LOG

BORING NO. 10-2

SHEET 1 OF 1

PROJECT: SANTAQUIN WATER RECLAMATION FACILITY
CLIENT: J-U-B ENGINEERS, INC.
LOCATION: N:7,166,991 E:1,559,126 (SEE SITE PLAN)
DRILLING METHOD: 08-CME-55 / H.S. AUGER
DRILLER: T. KERN
DEPTH TO WATER - INITIAL: ▽ DRY' **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 201001.008
DATE STARTED: 3/30/10
DATE COMPLETED: 3/30/10
GROUND ELEVATION: 4808.3'
LOGGED BY: J. OLSEN, J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
				14	2,3,5,(17) *0.35*	CL	dk. brown, moist, firm — Organics in top 6" LEAN CLAY pinhole structure								
4805				14	Pushed *0.90*	CL	brown, slightly moist, stiff — LEAN CLAY W/SAND pinhole structure	83.6	7.4	24	9				CT
	5			12	12,18,12,(62)	GM	brown, slightly moist, dense — SILTY GRAVEL W/SAND possible cobbles		2.3		NP	48	29	23	
4800															
	10			12	12,32,27,(99+)	GP-GM	brown, slightly moist, very dense								
4795				14	26,39,39,(99+)	GP-GM	brown, slightly moist, very dense — GRAVEL W/SILT & SAND possible cobbles		1.8		NP	56	37	7	
	15			9	30,50/5"	GP-GM	brown, slightly moist, very dense								
4790															
	20			14	5,7,10,(20) *0.25*	ML SM	brown, moist, firm/med. dense — SILT W/SAND clay lenses & layers, plastic brown, moist, med. dense — SILTY SAND								
4785															
	25			17	6,8,9,(18)	ML	brown, moist, med. dense — SANDY SILT sand lenses & layers		11.2		NP	0	43	57	
4780							SANDY LEAN CLAY								
	30			15	*0.40* 7,36,50,(83)	CL GP-GM	brown, moist, firm red-brown, moist, very dense — GRAVEL W/SILT & SAND possible cobbles								
4775															
	35			18	6,6,12,(16) *0.38*	CL-1	SANDY LEAN CLAY W/GRAVEL sand lenses & layers brown, moist, firm	100.8	16.8	23	8				
4770							BOH								

DH_LOGV1 SANTAQUINWRF.GPJ US EVAL.GDT 6/1/10

RB&G ENGINEERING, INC.

LEGEND:

DISTURBED SAMPLE — 2,3,2,(6) ← Blow Count per 6" / $(N_1)_{60}$ Value; *0.45* ← Torvane (tsf)

UNDISTURBED SAMPLE — PUSHED; *0.45* ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
HYD = Hydrometer
SS = Soluble Salt
DC = Dispersive Clay
Chem. = pH, Resistivity, Sulfate, Chloride

DRILL HOLE LOG

BORING NO. 10-3

SHEET 1 OF 1

PROJECT: SANTAQUIN WATER RECLAMATION FACILITY
CLIENT: J-U-B ENGINEERS, INC.
LOCATION: 7,167,333 E:1,558,980 (SEE SITE PLAN)
DRILLING METHOD: 08-CME-55 / H.S. AUGER
DRILLER: T. KERN
DEPTH TO WATER - INITIAL: ▽ DRY' **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 201001.008
DATE STARTED: 3/31/10
DATE COMPLETED: 3/31/10
GROUND ELEVATION: 4802.1'
LOGGED BY: J. OLSEN, J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
4800				13	4,4,4,(17) *0.35*	CL	dk. brown, moist, firm — Organics in top 6" LEAN CLAY pinhole structure								
	5			16	Pushed *0.75*	CL-1	brown, slightly moist, stiff — LEAN CLAY W/SAND pinhole structure		10.0	29	11				
4795				18	Pushed *0.30*	SC-SM	brown, moist — SILTY CLAYEY SAND pinhole structure		7.7	22	4	12	41	47	
				7	5,8,6,(28)	SC-SM	brown, moist, med. dense								
				6	Pushed *0.46*	CL	brown, moist, firm — SANDY LEAN CLAY pinhole structure		13.0	27	9				
	10			11	14,13,20,(59)	GP-GM	red-brown, moist, dense								
4790				16	26,34,28,(93)	GP-GM	red-brown, slightly moist, very dense — GRAVEL W/SILT & SAND possible cobbles		2.1		NP	59	34	7	
	15			8	10,10,4,(19)	GP-GM	brown, moist, loose								
4785															
	20			13	3,5,5,(12)	CL-1	brown, moist, stiff — SANDY LEAN CLAY		16.9	27	9				
4780															
	25			10	14,25,22,(49)	GP-GM	red-brown, moist, med. dense — GRAVEL W/SILT & SAND possible cobbles								
4775															
	30			13	15,13,9,(21)	GP-GM	red-brown, moist, loose								
4770							BOH								

DH_LOGV1 SANTAQUINWRF.GPJ US EVAL.GDT 6/1/10

RB&G ENGINEERING, INC.

LEGEND:

DISTURBED SAMPLE: 2,3,2,(6) ← Blow Count per 6" / $(N_1)_{60}$ Value; *0.45* ← Torvane (tsf)

UNDISTURBED SAMPLE: PUSHED *0.45* ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
HYD = Hydrometer
SS = Soluble Salt
DC = Dispersive Clay
Chem. = pH, Resistivity, Sulfate, Chloride

DRILL HOLE LOG

BORING NO. 10-4

SHEET 1 OF 1

PROJECT: SANTAQUIN WATER RECLAMATION FACILITY
CLIENT: J-U-B ENGINEERS, INC.
LOCATION: N:7,167,201 E:1,558,987 (SEE SITE PLAN)
DRILLING METHOD: 08-CME-55 / H.S. AUGER
DRILLER: T. KERN
DEPTH TO WATER - INITIAL: ▽ DRY' **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 201001.008
DATE STARTED: 3/31/10
DATE COMPLETED: 4/1/10
GROUND ELEVATION: 4804.9'
LOGGED BY: J. OLSEN, J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
				11	3,4,4,(17) *0.26*	CL	dk. brown, moist, firm — Organics in top 12" LEAN CLAY pinhole structure								
				4	Pushed *0.90*	CL	brown, moist, stiff								
4800	5			13	3,4,5,(18) *0.35*	CL-1	LEAN CLAY W/SAND pinhole structure; brown, moist, firm	92.0	13.3	27	10				
4795	10			16	Pushed	ML	brown, moist — SANDY SILT no pinhole structure noted		6.5		NP	0	46	54	
				9	2,3,6,(13)	ML	brown, moist, med. dense								
4790	15			16	18,26,31,(77)	GP-GM	red-brown, moist, very dense — GRAVEL W/SILT & SAND possible cobbles								
4785	20			17	5,4,6,(12)	SM	brown, moist, med. dense — SILTY SAND		10.2		NP	0	57	43	
4780	25			18	4,5,4,(9)	SM/ML	brown, moist, loose — SILTY SAND TO SANDY SILT								
4775	30			14	5,5,5,(10) *0.32*	CL-1	lt. brown, moist, firm — SANDY LEAN CLAY W/GRAVEL		14.6	24	9	19	25	56	
4770	35			12	Pushed *0.25*	CL	lt. brown, moist, firm								
				18	*0.30*	CL	lt. brown, moist, firm								
					7,11,31,(37)	SM	red-brown, moist, dense — SILTY SAND W/GRAVEL BOH								

DH_LOGV1 SANTAQUINWRF.GPJ US EVAL.GDT 6/1/10

RB&G ENGINEERING, INC.

LEGEND:

DISTURBED SAMPLE — 2,3,2,(6) ← Blow Count per 6"; $(N_1)_{60}$ Value; *0.45* ← Torvane (tsf)

UNDISTURBED SAMPLE — PUSHED; *0.45* ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
HYD = Hydrometer
SS = Soluble Salt
DC = Dispersive Clay
Chem. = pH, Resistivity, Sulfate, Chloride

DRILL HOLE LOG

BORING NO. 10-5

SHEET 1 OF 1

PROJECT: SANTAQUIN WATER RECLAMATION FACILITY
CLIENT: J-U-B ENGINEERS, INC.
LOCATION: 7,166,652 E:1,559,285 (SEE SITE PLAN)
DRILLING METHOD: 08-CME-55 / H.S. AUGER
DRILLER: T. KERN
DEPTH TO WATER - INITIAL: ▽ DRY' **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 201001.008
DATE STARTED: 4/5/10
DATE COMPLETED: 4/5/10
GROUND ELEVATION: 4815.2'
LOGGED BY: G. PEASLEE, J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
4815															
				12	0,2,6,(17) *0.34*	CL	brown, moist, firm — Organics in top 12" LEAN CLAY pinhole structure								
				18	Pushed *0.43*	CL-1	brown, slightly moist, firm		7.2	26	10	3	15	82	
4810	5						LEAN CLAY W/SAND pinhole structure								
				13	5,9,12,(42) *0.57*	CL	brown, slightly moist, stiff								
4805	10			3	28,60/2.5"	GP-GM	brown, dry, very dense								
				18	40,44,48,(99+)	GP-GM	gray, dry, very dense		1.8		NP	52	38	10	
4800	15						GRAVEL W/SILT & SAND possible cobbles								
				12	20,20,23,(57)	GP-GM	gray-brown, dry, very dense								
4795	20			13	17,30,32,(72)	GP-GM	gray-brown, dry, dense								
							BOH								

DH_LOGV1 SANTAQUINWRF.GPJ US EVAL.GDT 6/1/10

RB&G ENGINEERING, INC.

LEGEND:

DISTURBED SAMPLE: 2,3,2,(6) ← Blow Count per 6" / $(N_1)_{60}$ Value; *0.45* ← Torvane (tsf)

UNDISTURBED SAMPLE: PUSHED *0.45* ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
HYD = Hydrometer
SS = Soluble Salt
DC = Dispersive Clay
Chem. = pH, Resistivity, Sulfate, Chloride

DRILL HOLE LOG

BORING NO. 10-7

SHEET 1 OF 1

PROJECT: SANTAQUIN WATER RECLAMATION FACILITY
CLIENT: J-U-B ENGINEERS, INC.
LOCATION: 7,167,201 E:1,559,113 (SEE SITE PLAN)
DRILLING METHOD: 08-CME-55 / H.S. AUGER
DRILLER: T. KERN
DEPTH TO WATER - INITIAL: ▽ N.M. **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 201001.008
DATE STARTED: 3/31/10
DATE COMPLETED: 3/31/10
GROUND ELEVATION: 4804.3'
LOGGED BY: J. OLSEN, J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
				12	3,3,7,(21) *0.35*	CL	dk. brown, moist, firm — Organics in top 12" LEAN CLAY pinhole structure								
4800	5			13	Pushed *0.40*	CL-1	brown, slightly moist, firm — LEAN CLAY W/SAND pinhole structure		12.5	31	13				Chem.
				13	Pushed	CL	brown, slightly moist								
						SM	brown, dry		1.5		NP	27	59	14	
4795	10			4	13,14,14,(48)	SM	SILTY SAND W/GRAVEL brown, dry, dense								
				16	7,8,8,(24)	SM	brown, slightly moist, med. dense — SILTY SAND		7.0		NP	1	53	46	
4790	15			6	45,32,16,(62)	GP-GM	brown, slightly moist, dense — GRAVEL W/SILT & SAND possible cobbles								
4785	20			2	5,8,7,(18)	ML	SANDY SILT brown, slightly moist, med. dense								
4780	25			17	23,28,31,(62)	GP-GM	brown, slightly moist, dense — GRAVEL W/SILT & SAND possible cobbles		3.0		NP	52	39	9	
4775	30			18	8,5,7,(12) *0.30*	SM	red-brown, moist — SILTY SAND W/GRAVEL								
						CL	brown, moist, firm — SANDY LEAN CLAY								
4770	35			18	4,4,10,(12) *0.25*	CL	SANDY LEAN CLAY W/GRAVEL brown, moist, firm								
4765							BOH								

DH_LOGV1 SANTAQUINWRF.GPJ US EVAL.GDT 6/1/10

RB&G ENGINEERING, INC.

LEGEND:

DISTURBED SAMPLE: 2,3,2,(6) ← Blow Count per 6" / $(N_1)_{60}$ Value; *0.45* ← Torvane (tsf)

UNDISTURBED SAMPLE: PUSHED; *0.45* ← Torvane (tsf)

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
HYD = Hydrometer
SS = Soluble Salt
DC = Dispersive Clay
Chem. = pH, Resistivity, Sulfate, Chloride

TEST PIT LOG

TEST PIT NO. 1

SHEET 1 OF 1

PROJECT: SANTAQUIN WATER RECLAMATION FACILITY
CLIENT: J-U-B ENGINEERS, INC.
LOCATION: N:7,167,242 E:1,559,194 (SEE SITE PLAN)
DIGGING METHOD: CASE 580 BACKHOE
OPERATOR: N/A
DEPTH TO WATER - INITIAL: ▽ DRY' **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 201001.008
DATE STARTED: 4/6/10
DATE COMPLETED: 4/6/10
GROUND ELEVATION: 4803.4
LOGGED BY: J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
	0					CL	bk. brown, very moist, firm — LEAN CLAY organics, pinhole structure								
	1														
	2				0.31	CL-1	brown, moist, stiff — LEAN CLAY W/SAND pinhole structure	93.9	19.1	29	12				CT
4800	3														
	4														
	5				0.56	CL-ML	brown, slightly moist, stiff — SANDY SILTY CLAY pinhole structure	85.9	6.9	22	4				CT
	6														
	7					GM	red-brown, slightly moist — SILTY GRAVEL W/SAND								
	8														
4795	9				0.52	ML	red & gray, slightly moist, firm — SILT W/SAND plastic, pinhole structure	87.9	6.2	22	3				CT
	10				0.47	GP-GM	red-brown, slightly moist — GRAVEL W/SILT & SAND								
	11														
	12					SP-SM	red-brown, slightly moist — SAND W/SILT & GRAVEL no pinhole structure noted								
	13						BOH								
4790	14														

TP_UDOT_LOGV1 SANTAQUINWRF_TP.GPJ US EVAL.GDT 6/1/10

RB&G ENGINEERING, INC.

LEGEND:

DISTURBED SAMPLE — Bucket ← Blow Count per 6"
0.45 ← Torvane (tsf)

UNDISTURBED SAMPLE

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
HYD = Hydrometer
SS = Soluble Salt
DC = Dispersive Clay

TEST PIT LOG

TEST PIT NO. 2

SHEET 1 OF 1

PROJECT: SANTAQUIN WATER RECLAMATION FACILITY
CLIENT: J-U-B ENGINEERS, INC.
LOCATION: N:7,167,045 E:1,559,006 (SEE SITE PLAN)
DIGGING METHOD: CASE 580 BACKHOE
OPERATOR: N/A
DEPTH TO WATER - INITIAL: ▽ DRY' **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 201001.008
DATE STARTED: 4/6/10
DATE COMPLETED: 4/6/10
GROUND ELEVATION: 4807.3
LOGGED BY: J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
	0				0.35	CL	dk. brown, very moist, firm — LEAN CLAY organics, pinhole structure								
4805	2				0.62	CL-1	brown, moist, stiff — LEAN CLAY pinhole structure	96.4	18.6	30	12				CT
	5				0.51	CL-ML	brown, moist, stiff — SILTY CLAY W/SAND pinhole structure	79.4	10.4	24	7				CT
	6					GM	brown, slightly moist — SILTY GRAVEL W/SAND few cobbles								
4800	8				0.42	CL-ML	red & gray, moist, firm — SANDY SILTY CLAY pinhole structure, interbedded w/silty sand lenses & layers to 6" thick	77.5	11.5	25	4				CT
	11				0.47	ML	red & gray, moist, firm — SILT W/SAND plastic, no pinhole structure noted, sand lenses & layers to 6" thick	80.8	11.7	25	3				CT
4795	12					GP-GM	red-brown, slightly moist — GRAVEL W/SILT & SAND few cobbles								
	13						BOH								
	14														

TP_UDOT_LOGV1 SANTAQUINWRF_TP.GPJ US EVAL.GDT 6/1/10

RB&G ENGINEERING, INC.

LEGEND:
DISTURBED SAMPLE — Bucket ← Blow Count per 6"
0.45 ← Torvane (tsf)
UNDISTURBED SAMPLE

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
HYD = Hydrometer
SS = Soluble Salt
DC = Dispersive Clay

TEST PIT LOG

TEST PIT NO. 3

SHEET 1 OF 1

PROJECT: SANTAQUIN WATER RECLAMATION FACILITY
CLIENT: J-U-B ENGINEERS, INC.
LOCATION: N:~7,167,330 E:~1,559,065 (SEE SITE PLAN)
DIGGING METHOD: CASE 580 BACKHOE
OPERATOR: N/A
DEPTH TO WATER - INITIAL: ▽ DRY' **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 201001.008
DATE STARTED: 4/6/10
DATE COMPLETED: 4/6/10
GROUND ELEVATION: ~4806.5
LOGGED BY: J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
	0				0.40	CL	dk. brown, very moist, firm — LEAN CLAY organics, pinhole structure								
4805	1														
	2				0.53	CL-1	brown, moist, stiff — LEAN CLAY pinhole structure	90.5	17.1	30	11				CT
	3														
	4						SILTY CLAY W/SAND pinhole structure								
	5				0.59	CL-ML	brown, moist, stiff	85.0	9.7	27	7				CT
	6					GM	brown, slightly moist — SILTY GRAVEL W/SAND								
4800	7				0.62	CL	brown, moist, stiff — LEAN CLAY pinhole structure								
	8					GP-GM	brown, slightly moist — GRAVEL W/SILT & SAND few cobbles								
	9														
	10				0.30	CL-1	red-brown, slightly moist, firm — SANDY LEAN CLAY pinhole structure	80.5	8.8	27	9				CT
4795	11					GP-GM	red-brown, slightly moist — GRAVEL W/SILT & SAND few cobbles								
	12														
	13						BOH								
	14														

TP_UDOT_LOGV1 SANTAQUINWRF_TP.GPJ US EVAL.GDT 6/1/10

RB&G ENGINEERING, INC.

LEGEND:
DISTURBED SAMPLE — Bucket ← Blow Count per 6"; 0.45 ← Torvane (tsf)
UNDISTURBED SAMPLE

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
HYD = Hydrometer
SS = Soluble Salt
DC = Dispersive Clay

TEST PIT LOG

TEST PIT NO. 4

SHEET 1 OF 1

PROJECT: SANTAQUIN WATER RECLAMATION FACILITY
CLIENT: J-U-B ENGINEERS, INC.
LOCATION: N:~7,167,075 E:~1,559,185 (SEE SITE PLAN)
DIGGING METHOD: CASE 580 BACKHOE
OPERATOR: N/A
DEPTH TO WATER - INITIAL: ▽ DRY' **AFTER 24 HOURS:** ▼ N.M.

PROJECT NUMBER: 201001.008
DATE STARTED: 5/21/10
DATE COMPLETED: 5/21/10
GROUND ELEVATION: ~4802.0
LOGGED BY: J. BOONE

Elev. (ft)	Depth (ft)	Lithology	Sample Type	Sample Rec. (in)	Sample See Legend	USCS (AASHTO)	Material Description	Dry Density (pcf)	Moisture Content (%)	Atter. Liquid Limit	Atter. Plast. Index	Gradation Gravel (%)	Gradation Sand (%)	Gradation Silt/Clay (%)	Other Tests
	0				0.39	CL	dk. brown, moist, firm — LEAN CLAY organics, pinhole structure								
	1														
4800	2				0.46	CL	brown, slightly moist, firm — LEAN CLAY W/SAND pinhole structure								
	3														
	4														
	5				0.39	CL-ML	brown, slightly moist, firm — SANDY SILTY CLAY pinhole structure								
	6														
4795	7														
	8					GP-GM	brown, slightly moist — GRAVEL W/SILT & SAND few cobbles								Perc. Test
	9														
	10														
	11				0.33	ML	brown, slightly moist, firm — SILT W/SAND plastic, no pinhole structure noted								
4790	12						BOH								
	13														
	14														

TP_UDOT_LOGV1 SANTAQUINWRF_TP.GPJ US EVAL.GDT 6/1/10

RB&G ENGINEERING, INC.

LEGEND:
DISTURBED SAMPLE — Bucket ← Blow Count per 6"; 0.45 ← Torvane (tsf)
UNDISTURBED SAMPLE

OTHER TESTS
UC = Unconfined Compression
CT = Consolidation
DS = Direct Shear
UU = Unconsolidated, Undrained
CU = Consolidated, Undrained
HYD = Hydrometer
SS = Soluble Salt
DC = Dispersive Clay

RB&G ENGINEERING INC

Table 1

SUMMARY OF TEST DATA

PROJECT LOCATIO: Santaquin Water Reclamation Facility, Santaquin, Utah

PROJECT NO.: 201001-008

FEATURE: Foundations

HOLE NO.	DEPTH BELOW GROUND SURFACE (ft)	IN-PLACE		UNCONFINED OR UU TRIAXIAL COMPRESSIVE STRENGTH (psf)	ATTERBERG LIMITS			MECHANICAL ANALYSIS			PERCENT FINER THAN 0.005 mm	UNIFIED SOIL CLASSIFICATION SYSTEM / (AASHTO CLASSIFICATION)
		DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY		
10-01	15-16.5		4.7				NP	72	23	5		GP-GM
	20-21.5		17.7		28	18	10	0	31	69		CL-1
	23-24.5	93.7	16.4				NP	0	33	67		ML
	35-36.5		6.7				NP	53	37	10		GP-GM
	50-51.5		8.5				NP	64	29	7		GP-GM
10-02	3-4.5	83.6	7.4		24	15	9					CL-1
	6-7.5		2.3				NP	48	29	23		GM
	12-13.5		1.8				NP	56	37	7		GP-GM
	25-26.5		11.2				NP	0	43	57		ML
	35-36.5	100.8	16.8		23	15	8					CL-1
10-03	3-4.5		10.0		29	18	11					CL-1
	6-7.5		7.7		22	18	4	12	41	47		SC-SM
	9-9.3		13.0		27	18	9					CL-1
	12-13.5		2.1				NP	59	34	7		GP-GM
	20-21.5		16.9		27	18	9					CL-1
10-04	6-7.5	92.0	13.3		27	17	10					CL-1
	9-10.5		6.5				NP	0	46	54		ML
	20-21.5		10.2				NP	0	57	43		SM
	30-31.5		14.6		24	15	9	19	25	56		CL-1
10-05	3-4.5		7.2		26	16	10	3	15	82		CL-1
	12-13.5		1.8				NP	52	38	10		GP-GM
10-07	3-4.5		12.5		31	18	13					CL-1
	6-7.5		1.5				NP	27	59	14		SM
	12-13.5		7.0				NP	1	53	46		SM
	25-26.5		3.0				NP	52	39	9		GP-GM

NP=Non-Plastic

RB&G ENGINEERING, INC.

Table 1

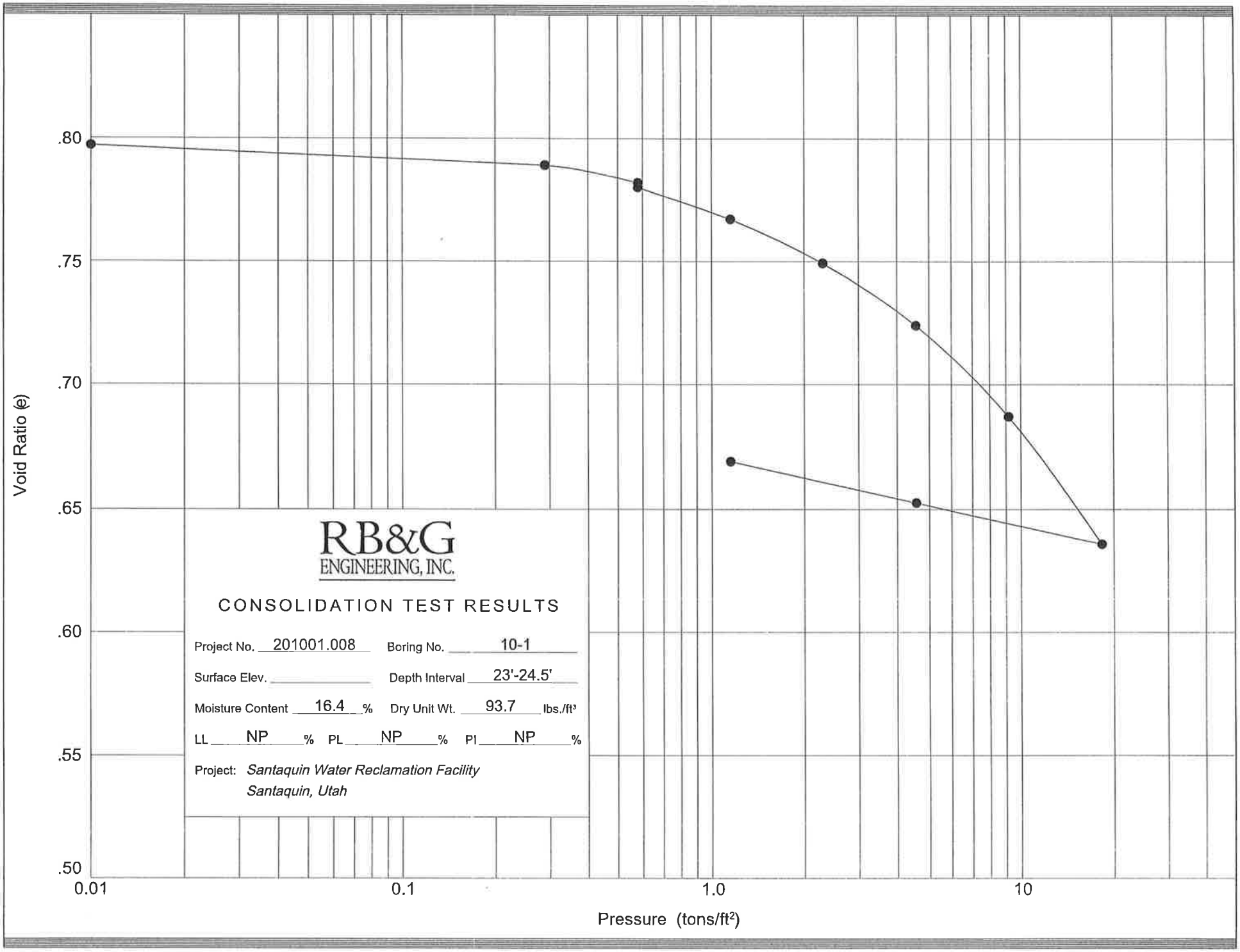
SUMMARY OF TEST DATA

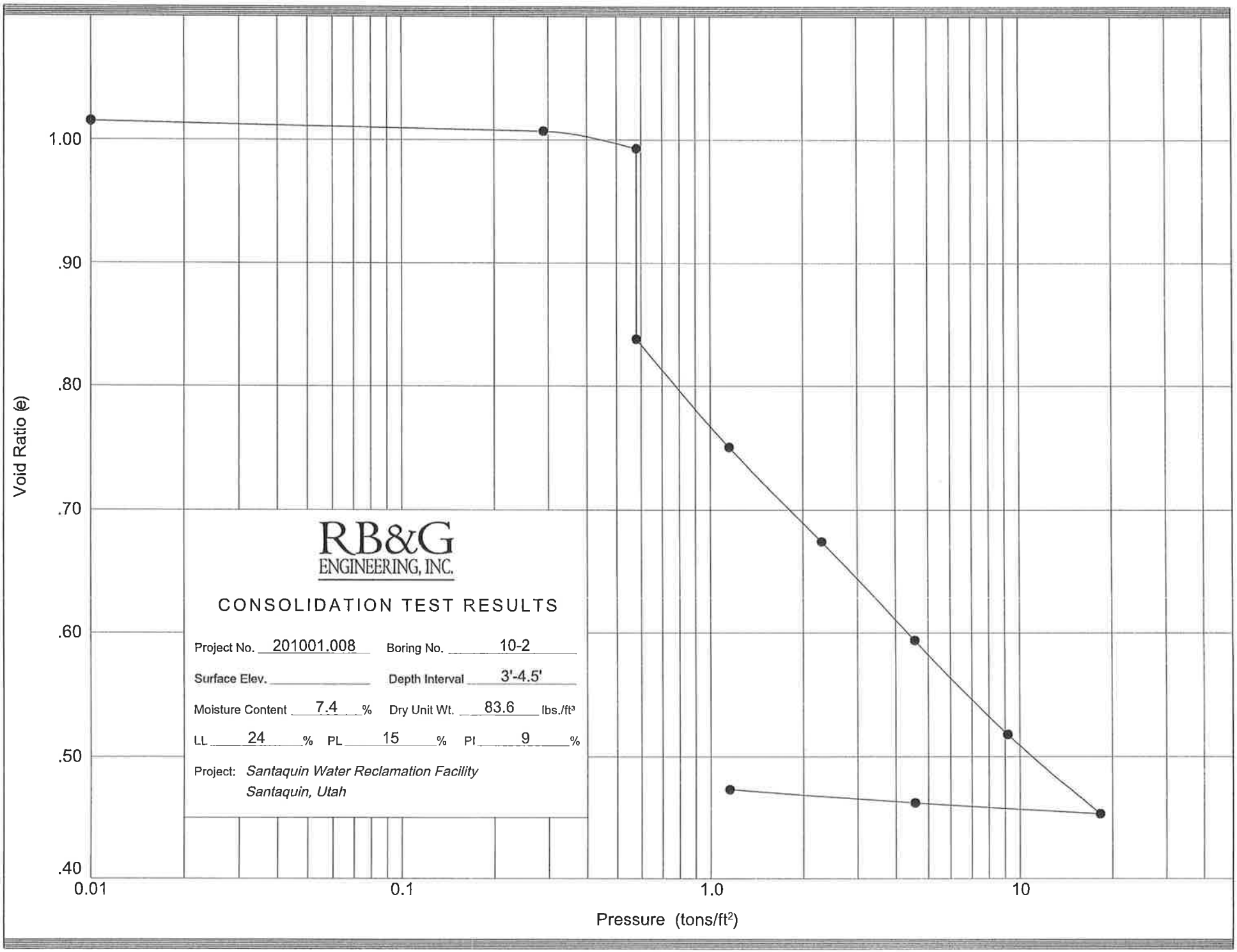
PROJECT Santaquin Water Reclamation Facility
LOCATIO Santaquin, Utah
PROJECT NO. 201001-008
FEATURE Foundations

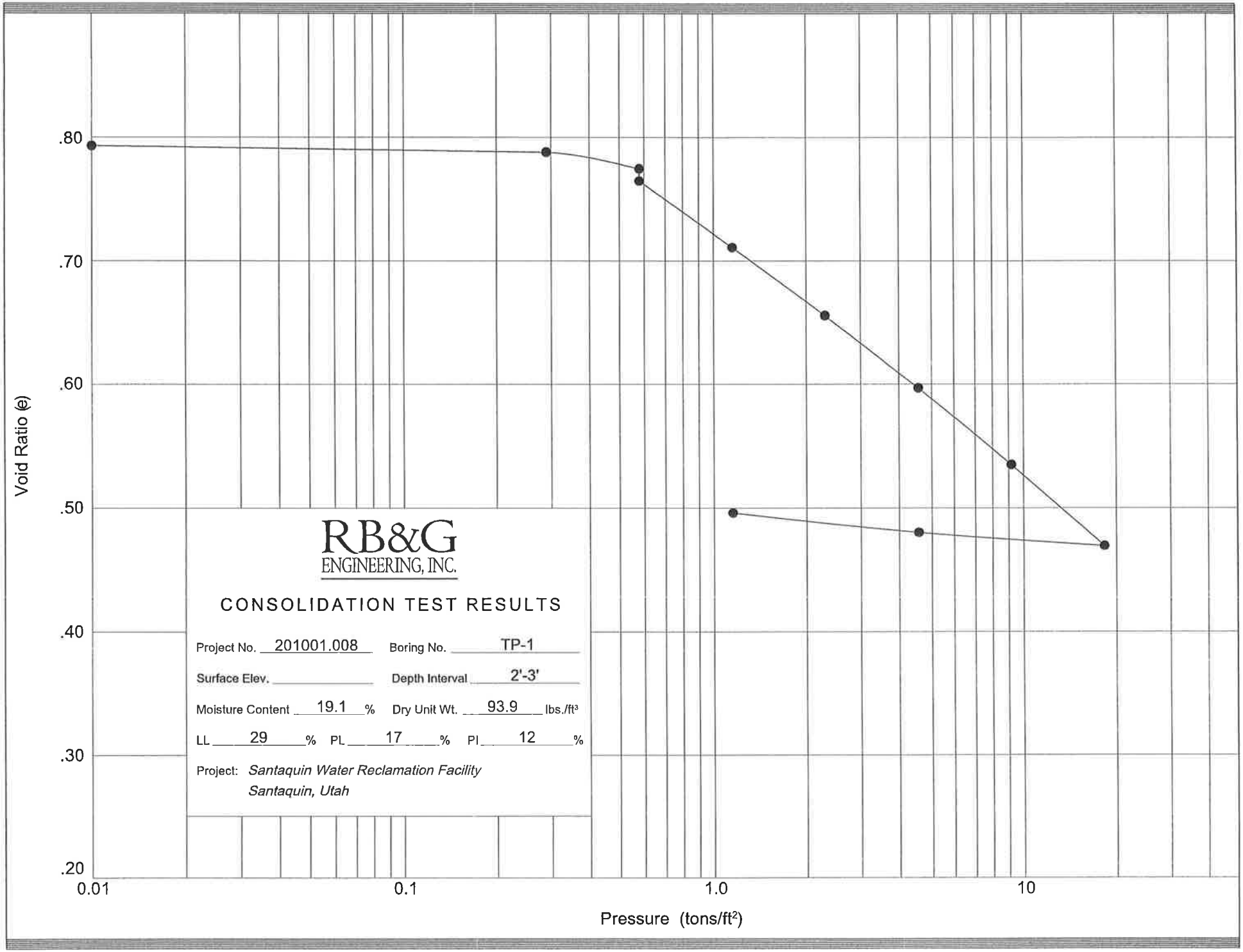
HOLE NO.	DEPTH BELOW GROUND SURFACE (ft)	IN-PLACE		UNCONFINED OR UU TRIAXIAL COMPRESSIVE STRENGTH (psf)	ATTERBERG LIMITS			MECHANICAL ANALYSIS			PERCENT FINER THAN 0.005 mm	UNIFIED SOIL CLASSIFICATION SYSTEM / (AASHTO CLASSIFICATION)
		DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY		
TP-01	2-3	93.9	19.1		29	17	12					CL-1
	5-6	85.9	6.9		22	18	4					CL-ML
	8.5-9	87.9	6.2		22	19	3					ML
TP-02	2-3	96.4	18.6		30	18	12					CL-1
	5-5.5	79.4	10.4		24	17	7					CL-ML
	8-9	77.5	11.5		25	21	4					CL-ML
	11-11.5	80.8	11.7		25	22	3					ML
TP-03	2-3	90.5	17.1		30	19	11					CL-1
	5-5.5	85.0	9.7		27	20	7					CL-ML
	10-10.5	80.5	8.8		27	18	9					CL-1

		pH	Resistivity	Sulfate (mg/kg-dry)	Chloride (m/kg-dry)						
10-01	5-6.5	7.8	1350	140	78						
	10-11.5	7.8	2800	15	6.1						
10-07	3-4.5	8.0	2200	21	7.1						

NP=Non-Plastic


.80
.75
.70
.65
.60
.55
.50
Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G
ENGINEERING, INC.
CONSOLIDATION TEST RESULTS
Project No. 201001.008
Boring No. 10-1
Surface Elev.
Depth Interval 23'-24.5'
Moisture Content 16.4 %
Dry Unit Wt. 93.7 lbs./ft³
LL NP %
PL NP %
PI NP %
Project: Santaquin Water Reclamation Facility
Santaquin, Utah


1.00
.90
.80
.70
.60
.50
.40
Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G
ENGINEERING, INC.
CONSOLIDATION TEST RESULTS
Project No. 201001.008
Boring No. 10-2
Surface Elev.
Depth Interval 3'-4.5'
Moisture Content 7.4 %
Dry Unit Wt. 83.6 lbs./ft³
LL 24 % PL 15 % PI 9 %
Project: Santaquin Water Reclamation Facility
Santaquin, Utah



RB&G ENGINEERING, INC.

CONSOLIDATION TEST RESULTS

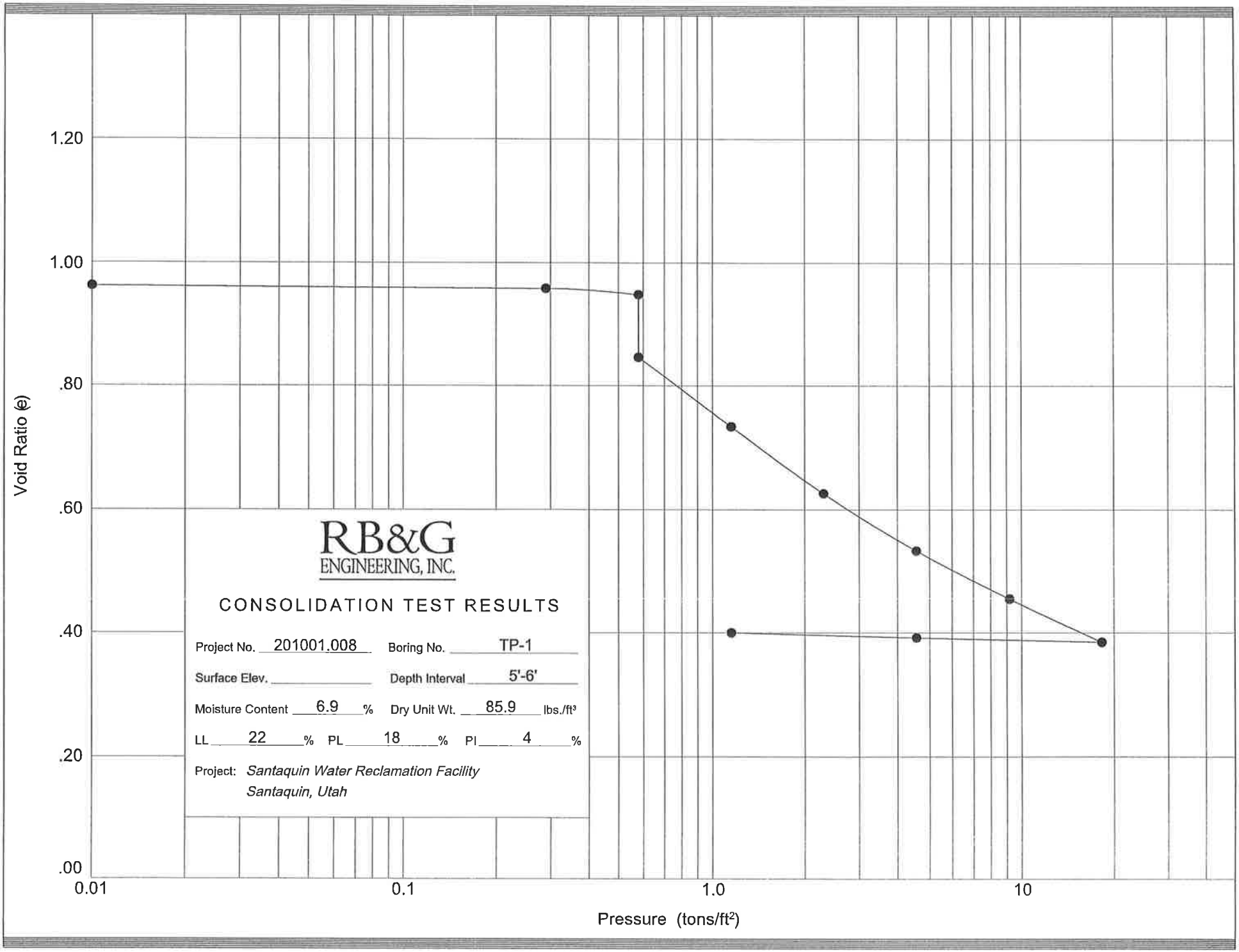
Project No. 201001.008 Boring No. TP-1

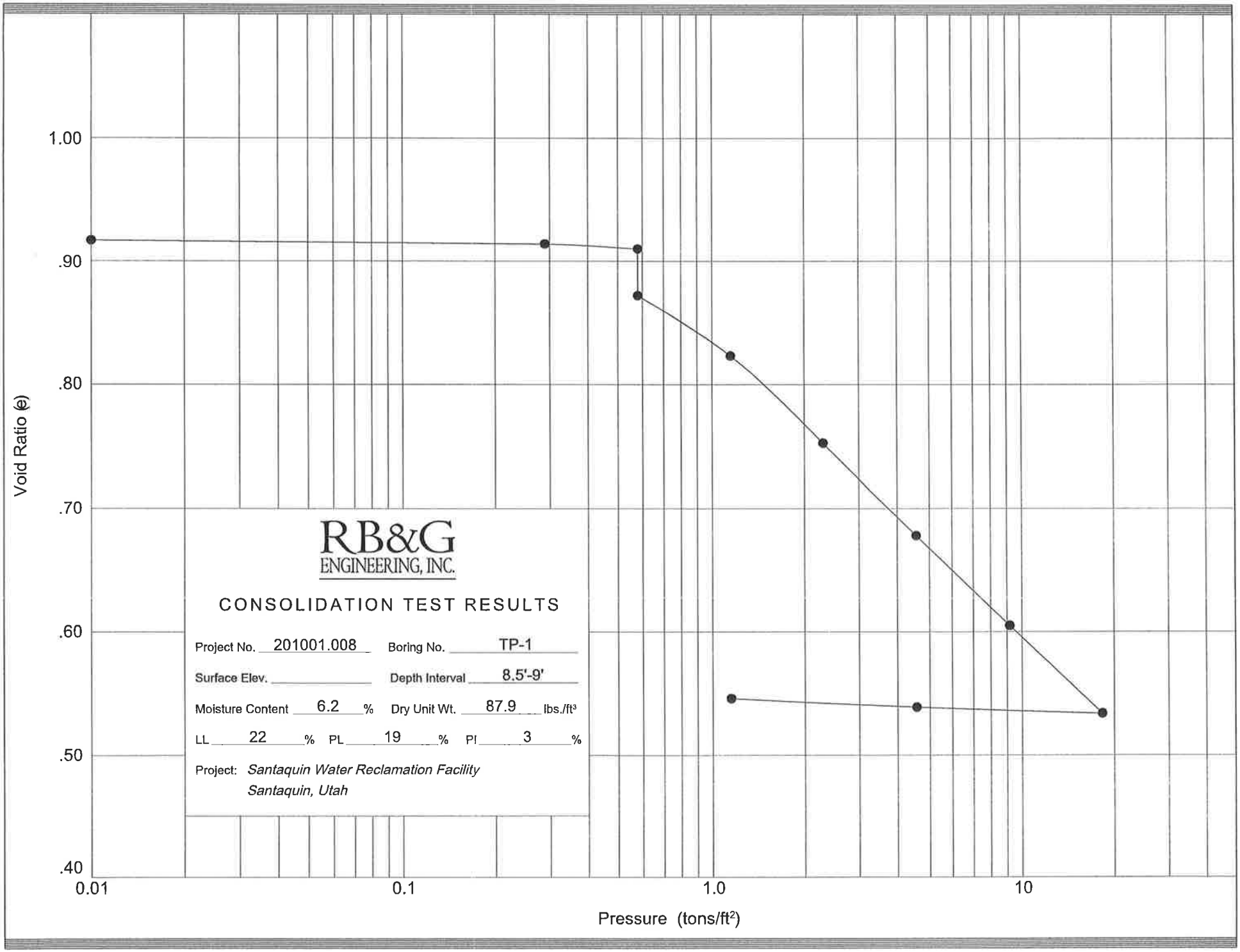
Surface Elev. _____ Depth Interval 2'-3'

Moisture Content 19.1 % Dry Unit Wt. 93.9 lbs./ft³

LL 29 % PL 17 % PI 12 %

Project: *Santaquin Water Reclamation Facility*
Santaquin, Utah


1.20
1.00
.80
.60
.40
.20
.00
Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G
ENGINEERING, INC.
CONSOLIDATION TEST RESULTS
Project No. 201001.008
Boring No. TP-1
Surface Elev.
Depth Interval 5'-6'
Moisture Content 6.9 %
Dry Unit Wt. 85.9 lbs./ft³
LL 22 % PL 18 % PI 4 %
Project: Santaquin Water Reclamation Facility
Santaquin, Utah



RB&G ENGINEERING, INC.

CONSOLIDATION TEST RESULTS

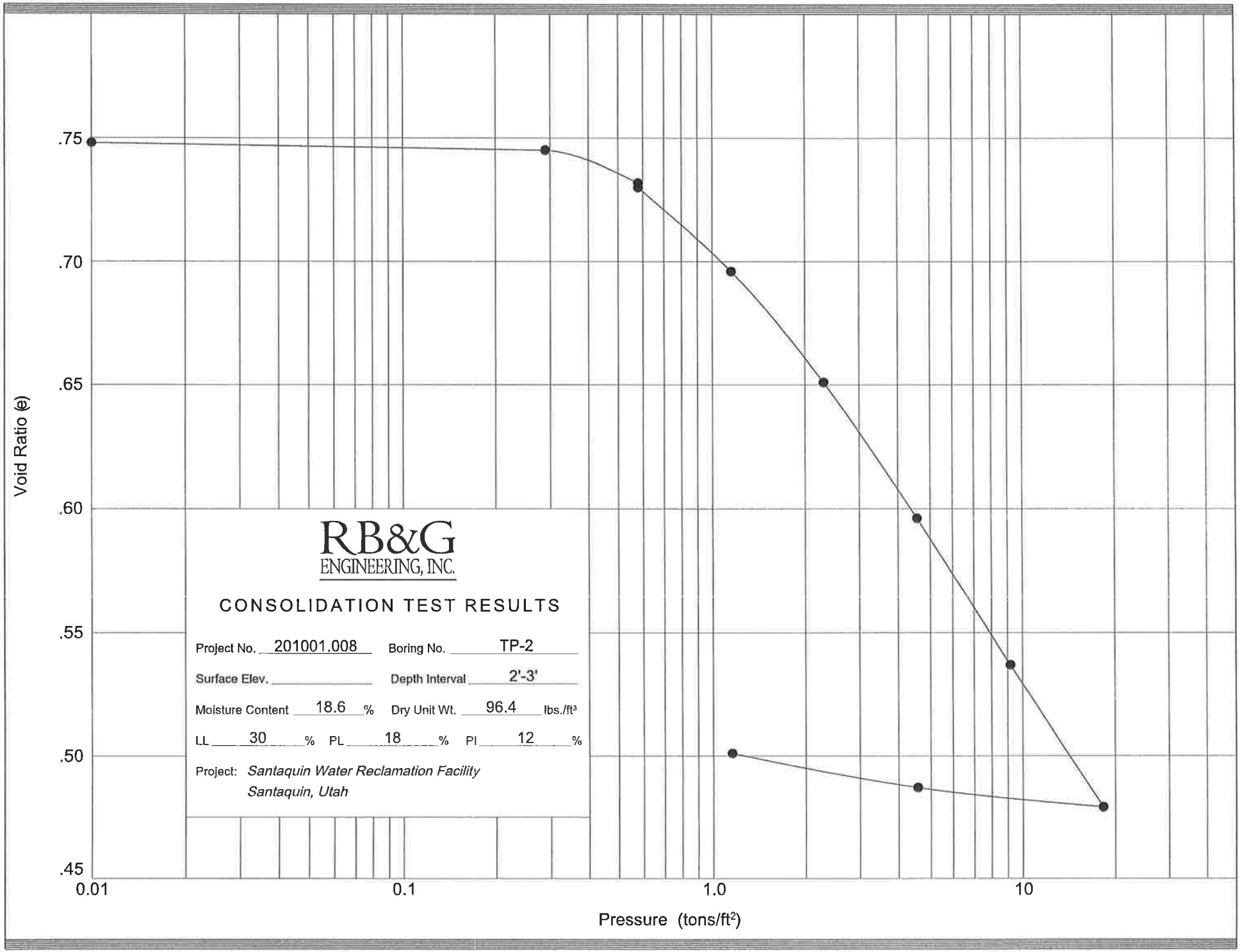
Project No. 201001.008 Boring No. TP-1

Surface Elev. _____ Depth Interval 8.5'-9'

Moisture Content 6.2 % Dry Unit Wt. 87.9 lbs./ft³

LL 22 % PL 19 % PI 3 %

Project: *Santaquin Water Reclamation Facility*
Santaquin, Utah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.65
.60
.55
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.45
Void Ratio (e)
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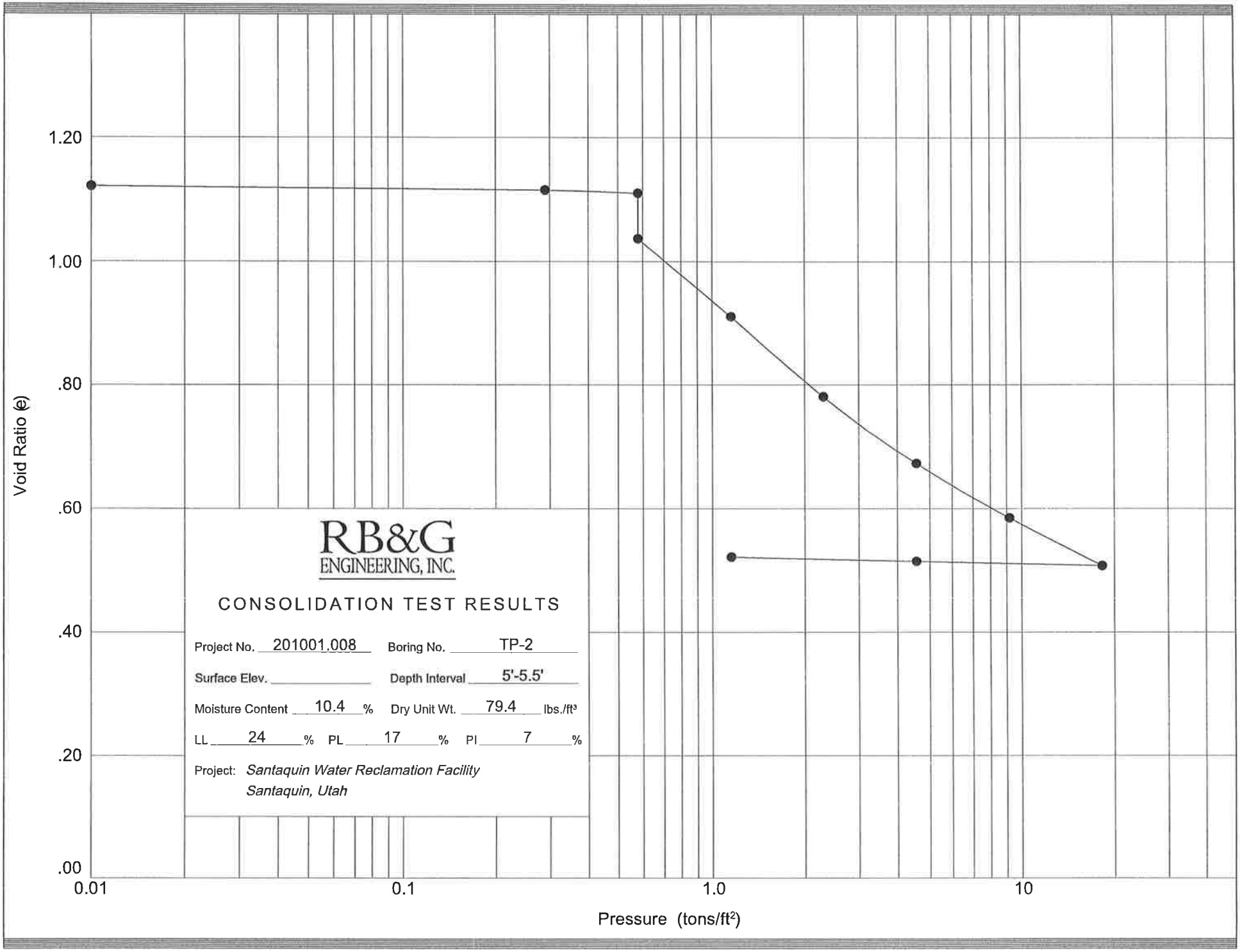
0.1
1.0
10
Pressure (tons/ft²)
RB&G
ENGINEERING, INC.
CONSOLIDATION TEST RESULTS
Project No. 201001.008
Boring No. TP-2
Surface Elev.
Depth Interval 2'-3'
Moisture Content 18.6 %
Dry Unit Wt. 96.4 lbs./ft³
LL 30 %
PL 18 %
PI 12 %
Project: Santaquin Water Reclamation Facility
Santaquin, Utah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Void Ratio (e)
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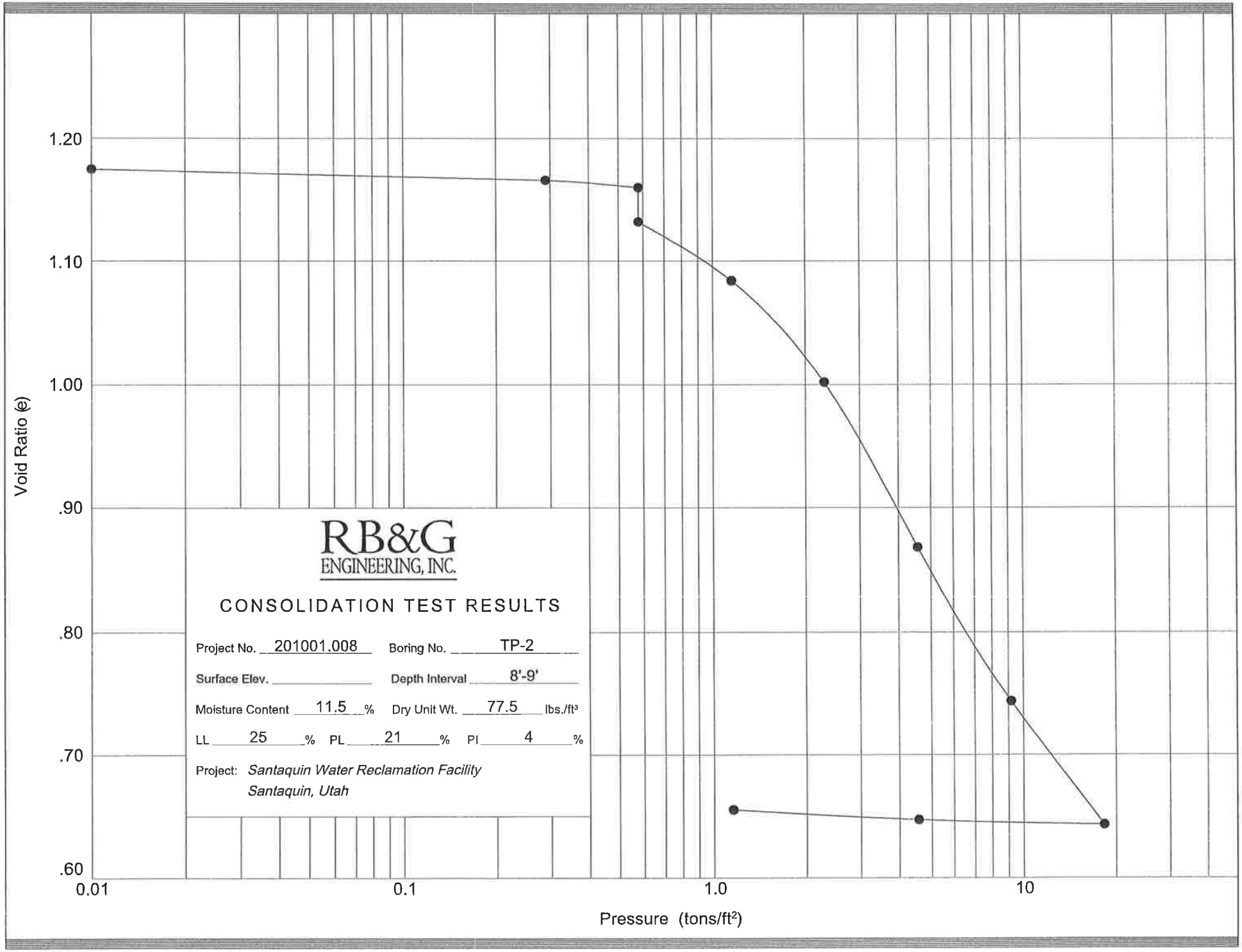
0.1
1.0
10
Pressure (tons/ft²)
RB&G
ENGINEERING, INC.
CONSOLIDATION TEST RESULTS
Project No. 201001.008
Boring No. TP-2
Surface Elev.
Depth Interval 5'-5.5'
Moisture Content 10.4 %
Dry Unit Wt. 79.4 lbs./ft³
LL 24 % PL 17 % PI 7 %
Project: Santaquin Water Reclamation Facility
Santaquin, Utah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Void Ratio (e)
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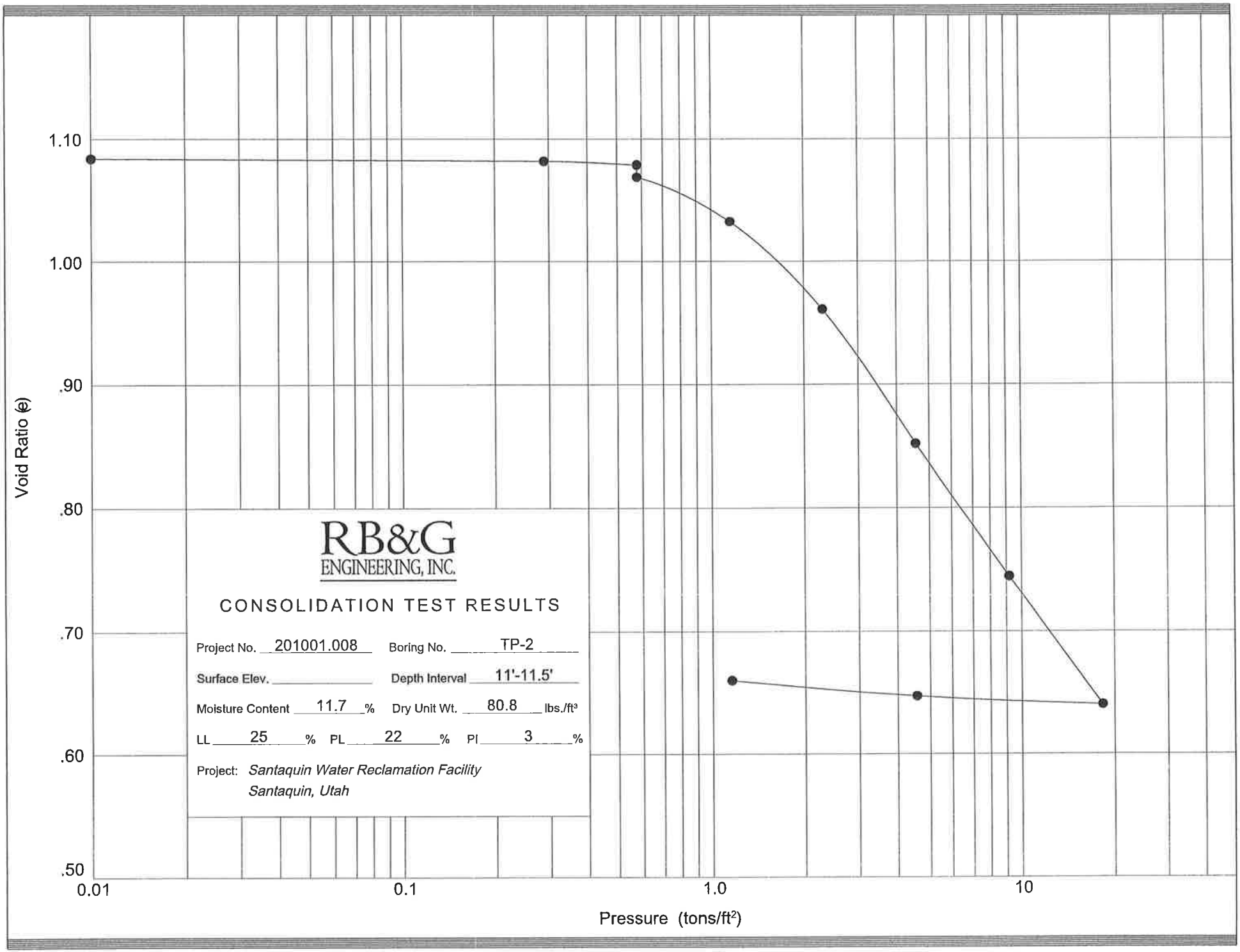
Pressure (tons/ft²)
RB&G
ENGINEERING, INC.
CONSOLIDATION TEST RESULTS
Project No. 201001.008
Boring No. TP-2
Surface Elev.
Depth Interval 8'-9'
Moisture Content 11.5 %
Dry Unit Wt. 77.5 lbs./ft³
LL 25 %
PL 21 %
PI 4 %
Project: Santaquin Water Reclamation Facility
Santaquin, Utah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Void Ratio (e)
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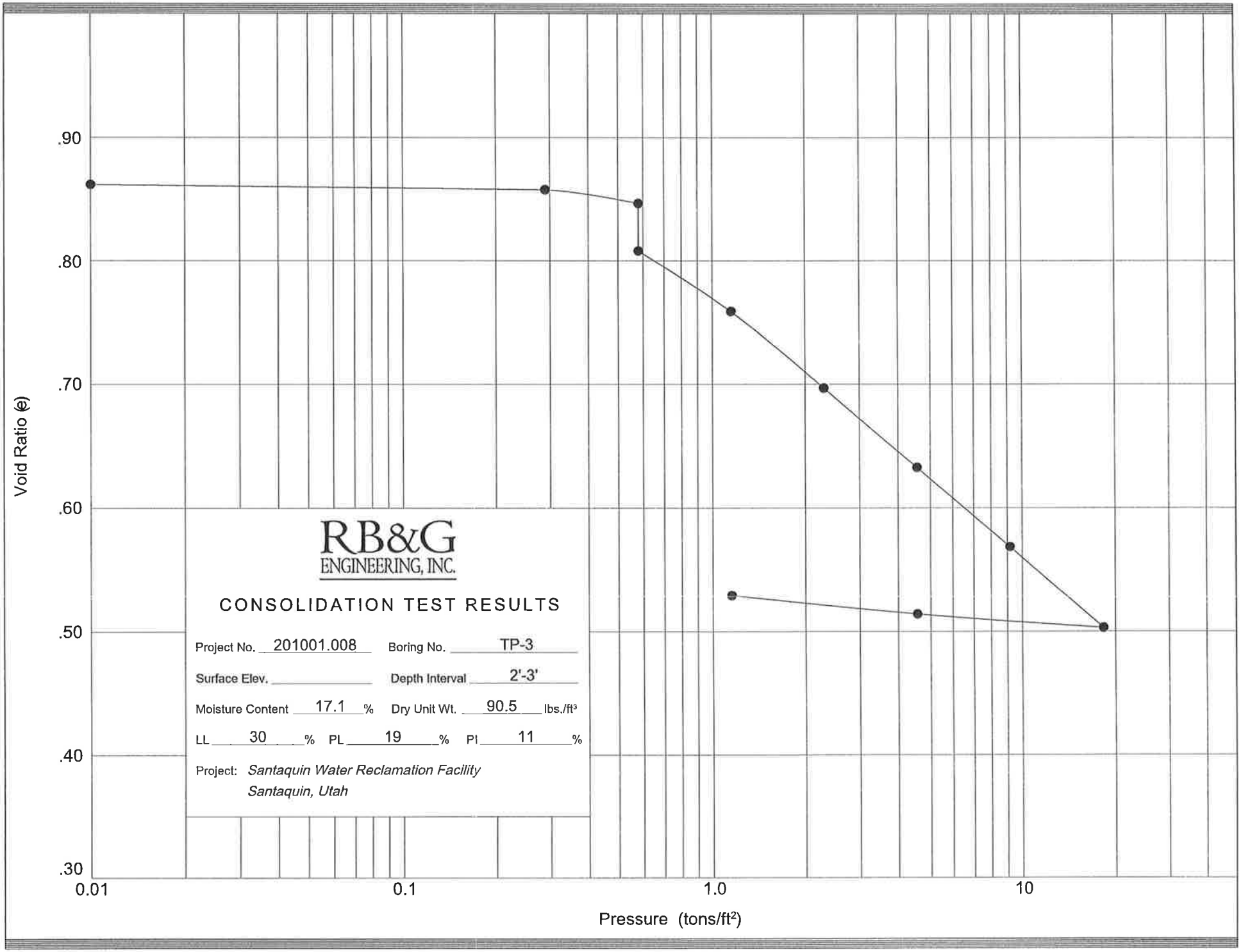
1.0
10
Pressure (tons/ft²)
RB&G
ENGINEERING, INC.
CONSOLIDATION TEST RESULTS
Project No. 201001.008
Boring No. TP-2
Surface Elev.
Depth Interval 11'-11.5'
Moisture Content 11.7 %
Dry Unit Wt. 80.8 lbs./ft³
LL 25 %
PL 22 %
PI 3 %
Project: Santaquin Water Reclamation Facility
Santaquin, Utah



RB&G ENGINEERING, INC.

CONSOLIDATION TEST RESULTS

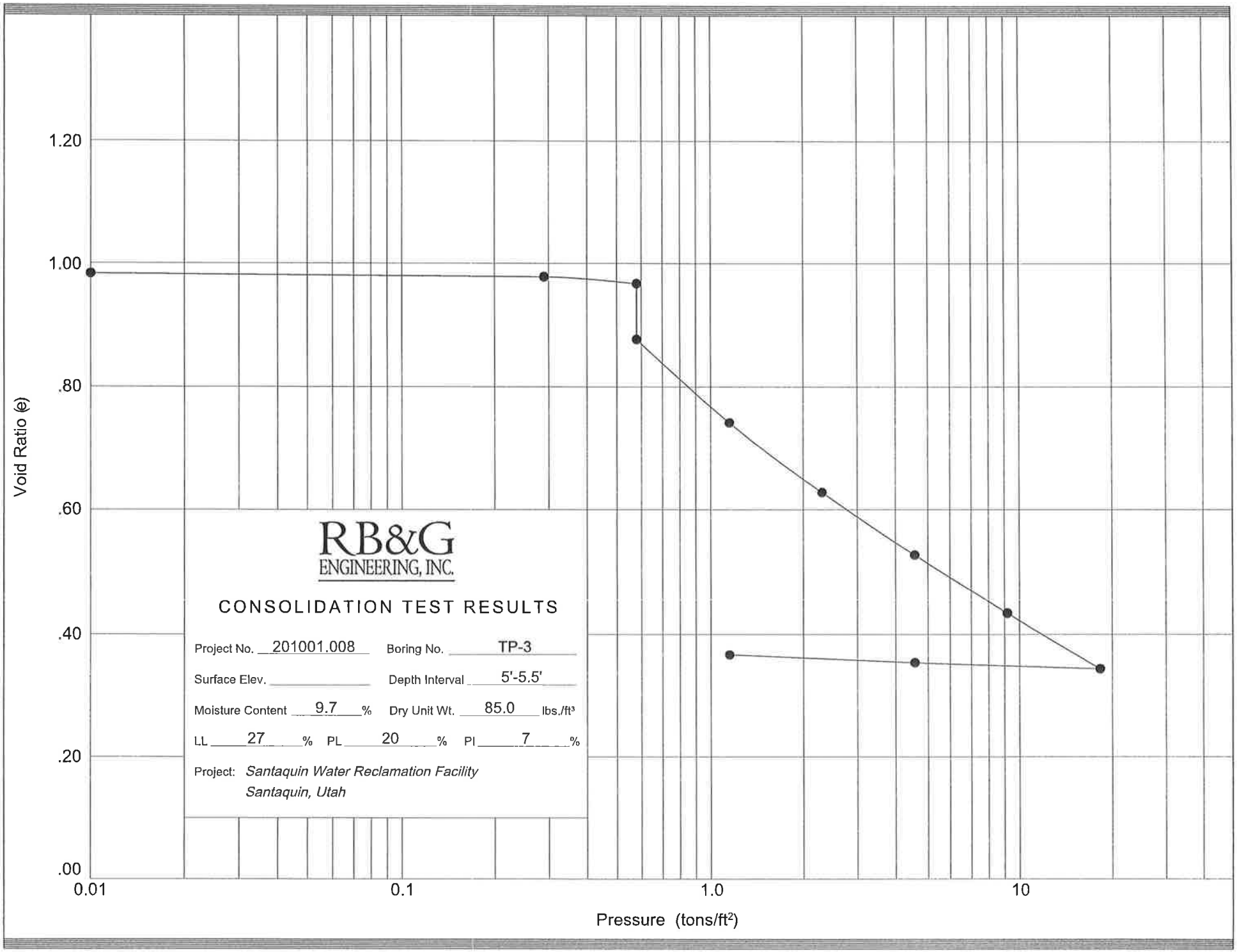
Project No. 201001.008 Boring No. TP-3

Surface Elev. _____ Depth Interval 2'-3'

Moisture Content 17.1 % Dry Unit Wt. 90.5 lbs./ft³

LL 30 % PL 19 % PI 11 %

Project: *Santaquin Water Reclamation Facility*
Santaquin, Utah



RB&G
ENGINEERING, INC.

CONSOLIDATION TEST RESULTS

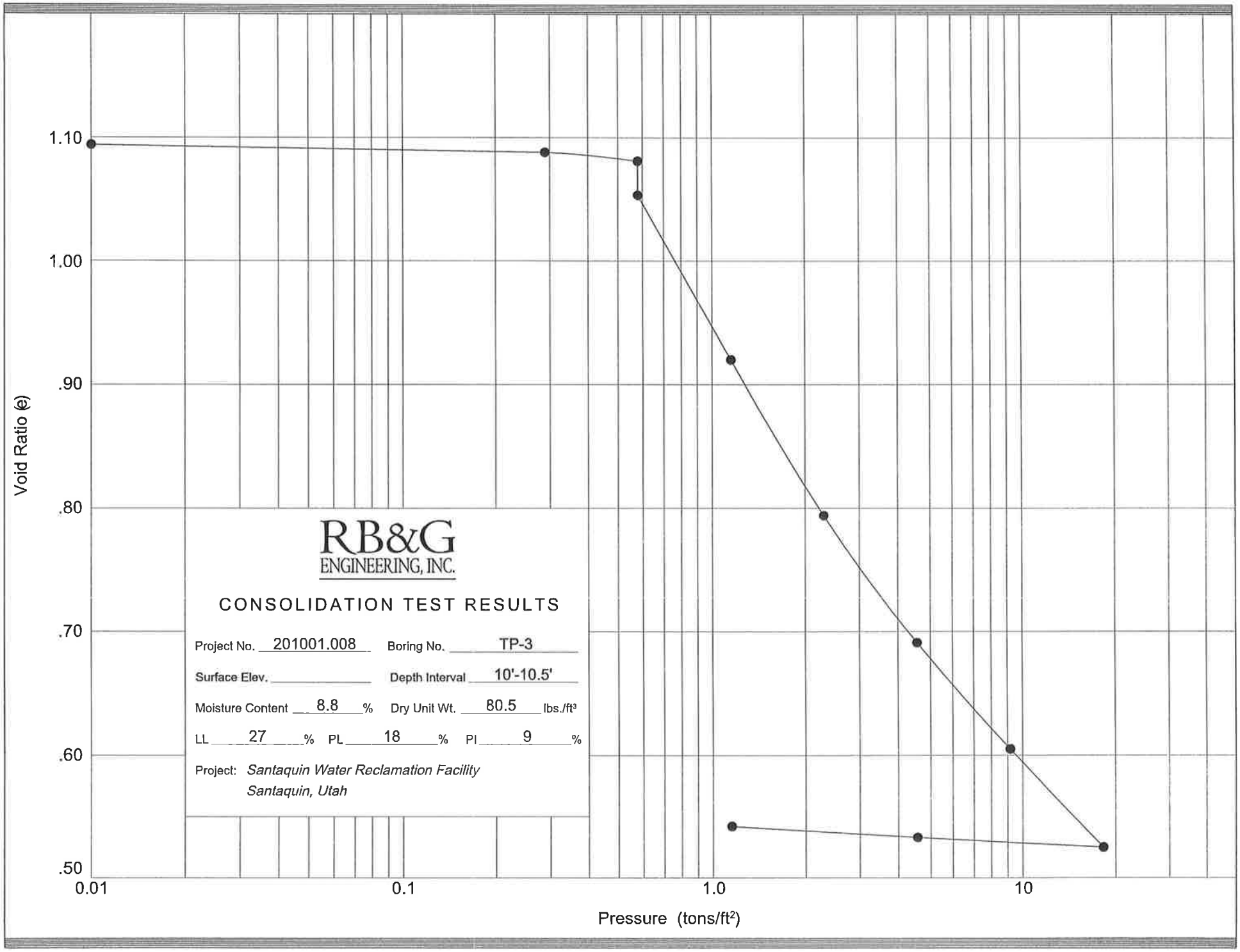
Project No. 201001.008 Boring No. TP-3

Surface Elev. _____ Depth Interval 5'-5.5'

Moisture Content 9.7 % Dry Unit Wt. 85.0 lbs./ft³

LL 27 % PL 20 % PI 7 %

Project: *Santaquin Water Reclamation Facility*
Santaquin, Utah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Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
RB&G
ENGINEERING, INC.
CONSOLIDATION TEST RESULTS
Project No. 201001.008
Boring No. TP-3
Surface Elev.
Depth Interval 10'-10.5'
Moisture Content 8.8 %
Dry Unit Wt. 80.5 lbs./ft³
LL 27 % PL 18 % PI 9 %
Project: Santaquin Water Reclamation Facility
Santaquin, Utah

SECTION 01 20 00
MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General Description of Measurement and Payment

B. Schedule of Values

C. Schedule of Estimated Progress Payments

D. Applications for Payment

E. Nonpayment for Rejected or Unused Goods

F. Partial Payment for Stored Materials and Equipment

G. Bid Schedule

1.2 GENERAL DESCRIPTION OF MEASUREMENT AND PAYMENT

A. Measurement and Payment for the bid items listed in the Bid Form shall be on the basis of the description in the Contract Documents. Unless the work to be done is specifically called out to be measured and paid for in the Bid Form, payment for such work shall be included in other applicable items, and there shall be no separate measurement and payment for the work.

B. Items listed in the Bid Form as lump sum (LS) shall include all work for the complete installation as generally described in the Contract Documents.

C. Payment shall be made at the contract unit bid price listed in the Bid Form. The price listed therein shall be payment in full for all labor, tools, equipment, materials, etc., which are required to construct the respective bid items according to the Contract Documents including all work and materials incidental thereto.

D. Partial payment for unit bid items and lump sum bid items only partially completed at the end of monthly pay periods shall be made based upon the percentage of work completed as recommended by the Engineer and approved by Owner.

1.3 SCHEDULE OF VALUES

A. Prepare a Schedule of Values for the Work. Schedule of Values shall list values for all Work for complete installation to serve as the basis for computing values for progress payments during construction.

B. Submit Schedule of Values in accordance with the General Conditions. Submit on Contractor's standard forms and provide a PDF copy and a spreadsheet copy (format compatible with latest version of Excel).

C. List bonds and insurance premiums, mobilization, demobilization, and contract closeout separately in the Schedule of Values.

D. An unbalanced or front-end loaded schedule, as determined by the Engineer, will not be acceptable.

E. Summation of the complete Schedule of Values representing all the work shall equal the Contract Price.

F. Unit Price Work:

1. Where the Contract Documents provide that portions of the Work are to be paid as Unit Price Work, include the unit price and the estimated quantity of each item as indicate in the Agreement in the Schedule of Values.

2. Final payment for Unit Price Work will be established per the General Conditions.

G. Lump Sum Work:

1. Where the Contract Documents provide that portions of the Work are to be paid as Lump Sum Work, the Schedule of Values shall include the corresponding equipment, additive alternates (as applicable), specified allowances (as applicable), labor, tools, materials, piping, fittings, temporary bypassing / components, environmental controls and permitting, appurtenances, and all other items of expense for a complete and properly functioning installation as shown and described in the Contract Documents.

2. Payment shall be made at the approved Schedule of Value prices. Provide a breakdown of costs by Process Area (below) with subsequent breakdown by corresponding Technical Division; i.e. Process Area X with Division 1 through Division 46 (as applicable). Include the Process Areas shown below as a minimum; additional areas may be used if appropriate.

Process Areas
00: General
01: Overall Headworks/Dewatering Building
02: Overall Process Building
03: Site Civil
05: Influent Pump Station
16: Biological Systems

20: Membrane Processes
23: Chemical Systems
70: UV Disinfection
75: Reclaimed Water Pump Station
80: Biosolids Handling / Dewatering
81: Solids Holding Tank
82: Solids Handling Building
88: Winter Storage Ponds

3. Within the Process Area and Technical Division Schedule of Values breakdown described above:

   a. Itemize each equipment item separately with separate amounts for

      i. Equipment Purchase and Delivery

      ii. Equipment Installation

      iii. Equipment Training & Commissioning.

   b. For Contractor provided equipment, the following payment schedule (**Table 1**) describes the maximum cumulative percentages that shall be paid in progress payments for the listed project milestones. Scheduled Values for individual process equipment items shall include the material and labor for all packaged components (instruments, control panels, etc.) supplied by a single vendor associated with that equipment item.

   c. For Pre-Procured Equipment (as applicable), payment terms shall be per the Assigned Procurement Agreement specific to that equipment package.

Table 1 – Equipment Payment Schedule

Scheduled Value	Submittal with "No Exceptions Taken"	Delivered and Stored On-Site [(c)]	Completed Initial Starting and Testing [(a)] [(b)]	Completed Owner Training	Completed Commissioning	Final O&M Manual with "No Exceptions Taken"
Equipment Purchase & Delivery	10%	85%	90%	95%	100%	---
Equipment Installation, Training, & Commissioning	0%	0%	85%	90%	95%	100%

(a) Reference Section 01 65 00. Corresponds to Notice of Completed Installation.

(b) Must include "no exceptions taken" Preliminary O&M Manual for equipment. Reference Section 01 73 00.

(c) *Must include "no exceptions taken" Installation manual for equipment. Reference Section 01 73 00.*

1.4 SCHEDULE OF ESTIMATED PROGRESS PAYMENTS

A. Show estimated payment requests throughout Contract Times aggregating initial Contract Price.

B. Base estimated progress payments on initially acceptable progress schedule.

C. Submit an updated Schedule of Estimated Progress Payments with each Application for Payment. Update accordingly to reflect subsequent modifications to the progress schedule, as well as modifications to the Contract Price.

1.5 APPLICATIONS FOR PAYMENT

A. Submit Applications for Payment in accordance with the General Conditions and per the approved Schedule of Values.

B. Submit Application for Payment, including a Transmittal Summary Form and detailed Application for Payment Form(s), a listing of materials on hand but not incorporated into the Work, and such supporting data as may be required by Funding Agency (or Agencies) and Engineer. Contractor shall include an update to the progress schedule with each application for payment. Project schedule updates shall document the work to-date and adherence to project times. Reference Section 01 32 16 Construction Progress Schedule.

C. Final Application for Payment:

1. Submit Final Application for Payment in accordance with the General Conditions.

2. Reference Section 01 70 00 Closeout Requirements.

D. Use detailed Application for Payment Form suitable to Engineer, Owner, and Funding Agencies (as applicable).

E. Preparation:

1. Round values to nearest dollar.

2. List each Change Order executed prior to date of submission as a separate line item.

3. Take all measurements and compute quantities to estimate percent complete of each item listed in the Schedule of Values. The Engineer will review measurements, quantities, and percent complete with Contractor's Application for Payment per the General Conditions.

4. Content and Format: Utilize Schedule of Values for listing items in Application for Payment. For each item, provide a column for listing: Item Number, Description of Work, Unit Price, Quantity, Amount, Previous Applications, Work in Place under this Application, Authorized Change Orders, Total Completed to Date of Application, Percentage of Completion, Balance to Finish, and Retainage.

5. Waiver of Liens: The Contractor shall provide a Waiver of Lien to the Owner as part of the Application for Payment.

6. Affidavits attesting to off-Site stored products shall be submitted, as applicable, with each Application for Payment.

7. When Owner, Engineer, or funding agency (as applicable) requires substantiating information for review, approval, or processing an Application for Payment, submit such information as requested.

8. The date of the month for Contractor's submission of monthly Application for Payment shall be per the Agreement.

9. Progress payments will be made monthly, provided Contractor's submissions are in accordance with the Contract Documents and acceptable to the funding agencies and Owner.

1.6 NONPAYMENT FOR REJECTED OR UNUSED PRODUCTS

A. Payment will not be made for the following:

1. Loading, hauling, and disposing of rejected or defective material.

2. Quantities of material wasted or disposed of in a manner not called for under the Contract Documents.

3. Rejected loads of material, including material rejected after it has been placed by reason of failure of Contractor to conform to provisions of Contract Documents.

4. Material not unloaded from transporting vehicle.

5. Defective work not accepted by the Owner.

6. Items purchased by Contractor and remaining on-hand after completion of Work.

7. Products placed beyond lines and levels of required Work.

1.7 PARTIAL PAYMENT FOR STORED MATERIALS AND EQUIPMENT

A. Partial Payment: No partial payments will be made for materials and equipment delivered and stored on site (but not incorporated into the Work) unless:

1. Submittals and Shop Drawings have been noted as “no exceptions taken”.

2. The items are properly stored and secured on site (per vendor or supplier requirements) and in a manner acceptable to the Owner and Funding Agencies (as applicable).

3. Payment shall not be made for materials or equipment which are never delivered to the site or for products which are delivered but improperly stored. Reference Section 01 60 00 Product Requirements.

4. Final Payment: Final payment will be made only for products incorporated in work; remaining products, for which partial payments have been made, shall revert to Contractor unless otherwise agreed, and partial payments made for those items will be deducted from final payment.

B. BID SCHEDULE

SCHEDULE A: WRF UPGRADES

ITEM A1: Mobilization, PM, OH&P (All Process Areas)

A. Basis of Measurement: Lump Sum

B. Basis of Payment: Unless otherwise itemized separately in the Unit Price Schedule, Payment will be made at the contract lump sum price based on agreed upon Schedule of Values submitted by the Contractor. Included in this item are all costs relating to mobilization, demobilization, permitting, project management, environmental compliance, quality control, inspections, testing, submittals, contractor overhead and profit, and other construction management related activities and shall include coordination with the Owner, vendors, and other Contractors noted in the Contract Documents; progress meetings, and project administration.

ITEM A2: Civil Site Work, Piping, and Utilities (Process Area 03)

A. Basis of Measurement: Lump Sum

B. Basis of Payment: Unless otherwise itemized separately in the Unit Price Schedule, Payment will be made at the contract lump sum price based on agreed upon Schedule of Values submitted by the Contractor. Included in this item are all costs relating to equipment, materials, and labor for site preparation, excavation, backfill, compaction,

watering/dewatering, erosion control, SWPPP compliance, magmeter vaults, finished grading, finished site surfaces including sidewalks, concrete approaches/aprons, asphalt, landscaping, fencing, and site restoration. Also included are site civil (onsite/offsite) lift stations, piping, utilities, pipe appurtenances, manholes, catch basins, vaults, tie-ins, other tie-ins to existing piping, pipe trench excavation, backfill, compaction, testing, commissioning, trench dewatering, bypass pumping and all other items relating to civil site work excluding electrical/controls.

ITEM A3: Center St. Lift Station Improvements (Process Area 05)

A. Basis of Measurement: Lump Sum

C. Basis of Payment: Unless otherwise itemized separately in the Unit Price Schedule, Payment will be made at the contract lump sum price based on agreed upon Schedule of Values submitted by the Contractor. Included in this item are all costs relating to equipment, materials, and labor for site preparation, excavation, backfill, compaction, watering/dewatering, erosion control, SWPPP compliance, meter vault, control valve vault, wet well rehabilitation, installation of new and existing pumps, finished grading, finished site surfaces including sidewalks, concrete approaches/aprons, asphalt, landscaping, fencing, and site restoration. It also includes a new CMU building and components including; building foundation, floors, walls, roof systems, metals, finishes, coatings, thermal and moisture protections, mechanical HVAC/plumbing, and all building related architectural and structural components. All other items not specifically mentioned within previous categories but required for a complete and fully functional lift station to be included in this item, including project startup, commissioning, compliance, training, and testing. Excluded in this item are pre-procured equipment, electrical, controls, and instrumentation.

ITEM A4: Process Building Improvements (Process Areas 02, 16, 20, 23, and 70)

B. Basis of Measurement: Lump Sum

C. Basis of Payment: Unless otherwise itemized separately in the Unit Price Schedule, Payment will be made at the contract lump sum price based on agreed upon Schedule of Values submitted by the Contractor. Included in this item are all costs to manufacture, construct, deliver, install, etc. all components of the process building improvements and shall include demolition of existing equipment, metals, finishes, coatings, piping, valves, fittings, mechanical equipment, and process components including coordination with the Owner, vendors, and other Contractors noted in the Contract Documents; and all other items of expense for a complete and functional process building per the Contract Documents. All other items not specifically mentioned within previous categories but required for a complete and fully functional process facility to be included in this item, including project startup, commissioning, compliance, training, and testing. Excluded in this item are pre-procured equipment, electrical, controls, and instrumentation.

ITEM A5: Reclaimed Water Pump Station Improvements (Process Area 75)

A. Basis of Measurement: Lump Sum

B. Basis of Payment: Unless otherwise itemized separately in the Unit Price Schedule, Payment will be made at the contract lump sum price based on agreed upon Schedule of Values submitted by the Contractor. Included in this item are all costs to manufacture, construct, deliver, install, etc. all components of the reclaimed water pump station improvements and shall include metals, finishes, coatings, piping, valves, fittings, mechanical equipment, and process components including coordination with the Owner, vendors, and other Contractors noted in the Contract Documents; and all other items of expense for a complete and functional headworks building per the Contract Documents. All other items not specifically mentioned within previous categories but required for a complete and fully functional reclaimed water pump station to be included in this item, including project startup, commissioning, compliance, training, and testing. Excluded in this item are electrical, controls, and instrumentation.

ITEM A6: Dewatering Building Improvements / Solids Loadout Facilities (Process Area 80)

A. Basis of Measurement: Lump Sum

B. Basis of Payment: Unless otherwise itemized separately in the Unit Price Schedule, Payment will be made at the contract lump sum price based on agreed upon Schedule of Values submitted by the Contractor. Included in this item are all costs to manufacture, construct, deliver, install, etc. all components of the dewatering building expansion and shall include building excavation, subgrade preparation, compliance with geotechnical engineering report, building foundation, floors, walls, roof systems, metals, finishes, coatings, thermal and moisture protections, piping, valves, fittings, fixtures, mechanical HVAC/plumbing/piping, mechanical equipment, furnishings, and all building related architectural, structural, mechanical equipment, and process components including coordination with the Owner, vendors, and other Contractors noted in the Contract Documents; and all other items of expense for a complete and functional process controls building per the Contract Documents. All other items not specifically mentioned within previous categories but required for a complete and fully functional process controls facility to be included in this item, including project startup, commissioning, compliance, training, and testing. Excluded in this item are electrical, controls, and instrumentation.

ITEM A7: Solids Holding Tank and Solids Handling Building (Process Area 81 and 82)

A. Basis of Measurement: Lump Sum

C. Basis of Payment: Unless otherwise itemized separately in the Unit Price Schedule, Payment will be made at the contract lump sum price based on agreed upon Schedule

of Values submitted by the Contractor. Included in this item are all costs to manufacture, construct, deliver, install, etc. all components of the new solids holding tank and solids handling building and shall include building excavation, subgrade preparation, compliance with geotechnical engineering report, building foundation, floors, walls, roof / cover systems, metals, finishes, coatings, thermal and moisture protections, piping, valves, fittings, fixtures, mechanical HVAC/plumbing/piping, mechanical equipment, furnishings, and all building related architectural, structural, mechanical equipment, and process components including coordination with the Owner, vendors, and other Contractors noted in the Contract Documents; and all other items of expense for a complete and functional process controls building per the Contract Documents. All other items not specifically mentioned within previous categories but required for a complete and fully functional process controls facility to be included in this item, including project startup, commissioning, compliance, training, and testing. Excluded in this item are electrical, controls, and instrumentation.

ITEM A8: Electrical, Controls, and Instrumentation (all Process Areas)

A. Basis of Measurement: Lump Sum

B. Basis of Payment: Unless otherwise itemized separately in the Unit Price Schedule, Payment will be made at the contract lump sum price based on agreed upon Schedule of Values submitted by the Contractor. Included in this item are all costs to manufacture, construct, deliver, install, etc. all electrical, controls, and instrumentation components of the project and shall include power/signal/communications cables/wires, duct banks, raceways, conduits, panels, electrical equipment, site/building electrical, power, lighting, all building related electrical and process-electrical control components, instruments, transmitters, actuators, solenoids, factory acceptance testing, terminations, loop testing, commissioning, training, including coordination with the Owner, vendors, and other Contractors noted in the Contract Documents; and all other items of expense for a complete and functional electrical and controls system per the Contract Documents.

SCHEDULE B: PRE-PROCURED EQUIPMENT

ITEM B1: MBR Equipment

A. Basis of Measurement: Lump Sum

B. Basis of Payment: See the Executed Contract Documents in Volume IV.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 30 00
COORDINATION AND MEETINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Coordination

B. Operational coordination

C. Surveying by Engineer

D. Preconstruction Conference

E. Progress Meetings

1.2 COORDINATION

A. Contractor shall coordinate the Work schedule, including submittals, for all sections of the Contract Documents to ensure the efficient and orderly sequence of installation of interdependent construction elements. Reference Section 01 32 16 Construction Progress Schedule.

B. Contractor shall coordinate space requirements and installation of all components of the Work, including process mechanical, mechanical, and electrical work (including locations of outlets and fixtures), which are indicated diagrammatically or schematically on the Drawings to prevent conflicts. Contractor shall follow routing shown for pipes, ducts, and conduit, as closely as practicable and denote any deviations from the Contract documents within submittals – references Section 01 33 00 Submittal Procedures. Contractor shall utilize space efficiently to maximum accessibility for other installations, for maintenance, and for repairs.

C. Contractor shall coordinate completion and clean-up of the Work of separate Sections in the Contract Documents in preparation for Substantial Completion.

D. Contractor shall coordinate startup with the Owner, Engineer, state agencies, and funding agencies. Reference Section 01 65 00 Commissioning of Systems.

E. Contractor shall verify that utility requirements (including, but not limited to power, process water, etc.) of operating equipment are compatible with building utilities.

F. Coordinate Work of various portions / disciplines of the Contract Documents having independent responsibilities for installing, connecting to, and placing in service, such equipment.

G. Contractor shall coordinate the Work with additional work being performed by others on-site. Reference Section 01 10 00 Summary of Work.

1.3 OPERATIONAL COORDINATION

1. Owner will be responsible for operating the existing treatment plant throughout the execution of this Contract. Refer to Section 01 32 17 Work Sequence for operational coordination.

2. Contractor shall maintain road access for plant operations vehicles to all treatment process units, from at least one direction, or provide alternate temporary road access at no additional cost to the Owner, always.

1.4 SURVEYING BY ENGINEER

A. Engineer will provide survey control and reference points during construction as follows. Each mobilization consists of one 8-hour workday on-site.

1. Number of mobilizations: 1

2. Survey control and reference points provided:

a. Control and temporary benchmarks

b. Building/structure corner offsets at grid lines established on the structural plans.

c. Elbows, tees, and valve points for yard piping ≥ 6-inch diameter, unless plans provide sufficient dimensioning to allow establishment of the utilities in the field.

d. Manhole locations and inverts

e. Rough site grading

B. Request for Owner-provided survey control and reference points shall be scheduled by the Contractor. Contractor shall submit a written survey mobilization request to Engineer a minimum of 10 working days in advance of requested date of survey.

C. The Contractor will locate and protect survey control and reference points and generate other points as necessary for completing the work. Contractor shall verify control provided and notify Engineer if Contractor discovers a discrepancy or error. Contractor shall maintain and protect all survey control provided by Owner. Replacement of survey control and reference points will be at the Contractor's expense.

D. Control datum for survey is that established by Owner-provided survey.

1.5 PRECONSTRUCTION CONFERENCE

A. Engineer will schedule and conduct a conference after Notice of Award.

B. Attendance is required by at least one person from each of the entities listed below:

1. Owner or their representative

2. Engineer

3. Engineer's Resident Project Representative(s) (as applicable)

4. Contractor including Project Manager, Site Superintendent, and Project Safety Officer. Contractor should consider including key subconsultants.

5. Funding agencies, as applicable.

1.6 AGENDA:

A. Statues of the Agreement and required supplemental documents, e.g. bonds, insurance certificates, etc.

B. Distribution of Contract Documents

C. List of Subcontractors

D. Schedule of Values

E. Contractor's Schedule

F. Designation of personnel representing the parties in Contract, and the Engineer, including communication procedures.

G. Procedures and processing of field decisions, submittals, substitutions, applications for payment, change proposal requests, Change Orders and Contract closeout.

H. Surveying, including number of mobilizations, layout/reference points and scheduling requirements.

I. Specific funding agency requirements.

J. Owner-furnished equipment/materials (as applicable)

K. Pre-procured Equipment (as applicable)

L. Utility Company Coordination

M. Quality Control Testing Responsibilities

N. Other items as deemed necessary by the Owner, Engineer, and Contractor

1.7 PROGRESS MEETINGS

A. The Engineer will schedule and administer progress meetings. Additional meetings as needed by Owner, Contractor, vendor(s), and/or agencies throughout progress of the Work shall also be scheduled and administered by the Engineer.

B. Attendance Required: Contractor's project manager, Contractor's site superintendent, Contractor's major subcontractors and suppliers, Owner, Engineer, funding agencies (as applicable), and others as considered necessary by Owner or Engineer during the work and as appropriate to agenda topics for each meeting.

C. Agenda:

1. Review minutes of previous meetings.
2. Review of Work progress and changes made or proposed to the Contract Documents.
3. Field observations, problems, and decisions.
4. Identification of problems which impede planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
7. Contractor's maintenance of progress schedule.
8. Contractor's proposed corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress, including scheduling of special inspections, planned shutdowns/outages, and major work items.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Funding agency, local, state, and federal requirements affecting the Work.
14. Applications for payment.
15. Other business relating to the Work.

D. Meetings are anticipated to occur weekly but may be delayed depending on progress of the Work.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

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SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.1 SCOPE

A. The Contractor is responsible for scheduling and coordinating all elements of the Work in compliance with the Contract Documents.

B. Contractor's schedule shall include critical construction items generally noted in Section 01 10 00 Summary of Work and 01 32 17 Work Sequence to:

1. Minimize disruption to existing processes and facility operations.

2. Comply with effluent quality limitations and maintain compliance with the discharge permit limits.

3. Maintain the highest possible level of treatment during construction.

4. Maintain the necessary minimum number of liquid and solid stream units in effective operation. Minimum number to be determined by the Owner.

5. Continuously maintain facility monitoring and control functions.

6. Ensure the availability of adequate electrical power (including standby power) and controls, as determined by the Owner.

7. Ensure the availability of support systems (or provide temporary/alternate sources as approved by the Engineer) at all times during the completion of this contract.

8. Existing electrical systems (or alternate feed sources as approved by the Engineer) to the existing facility shall be maintained throughout construction.

C. Work shall be so scheduled and conducted by Contractor such that it shall not impede any treatment process, create potential hazards to operating equipment and/or facility personnel, or reduce the quality of the effluent from the facility. In performing the Work shown and specified, Contractor shall plan and schedule the work to meet both the constraints outlined in Section 01 32 17 Work Sequence and the facility operating requirements as determined by the Owner.

D. Contractor is responsible for updating and maintaining the schedule in accordance with the Contract Documents.

E. The project management tool critical path method, commonly called CPM, shall be employed by the Contractor for planning and scheduling of all work required under the Contract Documents.

1.2 SUBMITTAL PROCEDURES FOR SCHEDULES

A. With each schedule submittal, Contractor shall provide a summary of major changes including, but not limited to:

1. Adjusted or modified sequences of work

2. Revised projections of progress completion

3. Changes in Work that have been formally incorporated into the Contract Documents via Change Order

4. Summary of work completed since previous submittal

5. Delays, including their overall impact to the project and Contractor's proposed methods of mitigation

B. With each schedule submittal, Contractor shall submit a single PDF of the arrow-type network diagram and the tabulated schedule. Contractor shall also submit a digital copy of the schedule file including the network diagram and tabulated schedule that is compatible with Microsoft Excel or other software program as agreed to by the Engineer.

C. Reference the General Conditions for submission timing regarding the preliminary schedule and initial acceptance of schedules. The preliminary schedule shall include all the components as required by this Section. When accepted by the Engineer, the network arrow diagram and tabulated schedule shall constitute the project work schedule until a revised schedule is submitted. The project work schedule shall be followed unless there are delays beyond the control and without the fault or negligence of the Contractor.

D. Additional Work Schedules.

1. With each application for payment or change to the Contract Days, the Contractor shall submit to the Engineer a revised schedule for those activities that remain to be completed. The revised schedule shall be submitted in the form, sequence, and in the number of copies required for the initial schedule.

2. If requested by the Engineer, the Contractor shall provide an additional work schedule if, at any time, the Engineer considers the completion date to be in jeopardy because of "activities behind schedule." The additional work schedule shall include a new arrow diagram and tabulated schedule conforming to the requirements of this Section designed to show how the Contractor intends to

accomplish the work to meet the completion date. The form and method employed by the Contractor shall be the same as for the original work schedule.

3. The Contractor shall submit weekly schedule updates by noon each Friday during the course of the Work to the Engineer. These schedules shall reflect the planned work for the upcoming week and clearly identify days requiring testing, inspection, and/or observation services for either Quality Control or Quality Assurance purposes.

E. Schedule Revisions. The Engineer may require the Contractor to modify any portions of the work schedule that become infeasible because of "activities behind schedule" or for any other valid reason. An activity that cannot be completed by its original latest completion date shall be deemed to be behind schedule.

1.3 INCORPORATING CHANGE ORDERS

A. Upon approval of a change order, the approved change order shall be reflected in the next schedule submittal by the Contractor.

1.4 CPM STANDARDS

A. Definition: CPM, as required by this section, shall be interpreted to be generally as outlined in the Associated General Contractors of America publication, The Use of CPM in Construction. Such other terms used in this Section are as defined in this Section, and if not stated therein, as generally utilized in the industry.

B. Work Schedules. Work schedules shall include a graphic network and tabulated schedules, as described below.

C. All schedules shall be completed using calendar days only. Schedules created using a mix of working days and calendar days are unacceptable.

D. Networks

1. The CPM network, or arrow diagram, shall be in the form of a time-scaled arrow diagram, shall be of the customary activity-on-arrow type, and may be divided into a number of separate pages with suitable notation relating the interface points among the pages. Individual pages shall not exceed 11-inch x 17-inch. Notation on each activity arrow shall include a brief work description and a duration estimate.

2. All construction activities and procurement shall be indicated in a time-scaled format, and a calendar shall be shown on all sheets along the entire sheet length. Each activity arrow shall be plotted so that the beginning and completion dates of said activity can be determined graphically by comparison with the calendar scale. All activities shall be shown using the symbols that clearly distinguish between critical path activities, non-critical activities, and free

float for each non-critical activity. All non-critical path activities shall show estimated performances time and free float time in scaled form.

3. The arrow-type network diagram shall describe the activities to be accomplished in the project, as well as their dependency relationships, and include a tabulated schedule (as defined following). The schedule produced and submitted shall indicate a project completion date on or before the contract completion date.

E. Tabulated Schedules. The schedule shall include the following minimum data for each activity:

1. Activity beginning and ending event numbers.

2. Predecessors.

3. Estimated duration.

4. Activity description.

5. Early start date (calendar dated).

6. Early finish date (calendar dated).

7. Latest allowable start date (calendar dated).

8. Latest allowable finish date (calendar dated).

9. Status (whether critical).

10. Estimated percentage of completion.

11. Total float.

12. Free float for each activity.

F. Project Information. Each tabulation shall be prefaced with the following summary data:

1. Project name.

2. Contractor.

3. Type of tabulation (initial or updated).

4. Project duration.

5. Project scheduled completion date.

6. The effective or starting date of the schedule.

7. If an updated (revised) schedule, the new project completion date and project status.

G. The CPM schedule shall include submittal dates required for shop drawings, product data, samples, and product delivery dates.

H. The CPM schedule shall include all shutdowns and outages – Reference Section 01 32 17 Work Sequence.

1.5 TRADES AND SUBCONTRACTS

A. For each general category, the construction schedule shall identify the following trades or subcontracts whose work is represented:

1. Structural work (to include structural excavation, backfill, concrete and steel erection work, etc.).

2. Pre-cast concrete and masonry (to include both architectural and structural).

3. Architectural work (all except painting).

4. Mechanical work (to include piping, pumps, process equipment, support equipment, etc.).

5. Undelivered material (when eligible for off-site progress payments).

6. Plumbing work.

7. Heating, ventilation, and air conditioning work.

8. Electrical work.

9. Instrumentation and controls.

10. Painting, coating, and waterproof system work.

1.6 ACTIVITIES AND EVENTS

A. General Categories. The construction schedule shall, as a minimum, be divided into the following general categories:

1. Mobilization

2. Site Work

3. Site Yard Piping

4. Major processes as defined in Section 01 20 00 Measurement and Payment

B. The construction schedule shall indicate the following procurement, construction, and testing activities and events in their logical sequence for materials and equipment for each of the trades and subcontracts identified above:

1. Preparation and transmittal of submittals.

2. Submittal review periods.

3. Shop fabrication periods.

4. Erection or installation.

5. Installed starting and testing of systems.

6. Plant operator instruction/training.

7. Owner's programming period.

8. Acceptance testing (initial and final, as applicable).

9. Commissioning.

10. Final inspection.

C. Contractor's schedule shall include the following activities, which must be scheduled prior to the date of Substantial Completion:

1. Initial starting and testing of systems

2. Owner Training

3. Owner Programming Period

4. Acceptance Testing (isolated unit process, with recirculated flows)

5. Acceptance Testing (full facility) /Follow Up Owner Training

6. Commissioning of Systems

D. Contractor shall schedule and achieve Substantial Completion for established Milestones (as applicable) as noted in the Agreement.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

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SECTION 01 32 17
WORK SEQUENCE

PART 1 GENERAL

1.1 EXISTING FACILITY

A. The existing facility is currently and continuously receiving wastewater from the collection system and treating the wastewater prior to discharge. Those functions necessary for treatment in the existing facility prior to discharge are not to be interrupted except as specified herein.

B. The existing facility generally consists of the following:

1. Center St. Lift Station (CSLS)

    a. Raw wastewater from Santaquin City's interceptor enters the facility at the Headworks. The facility includes a wet well, 2 submersible pumps, concrete vault with valves, meter manhole, bypass connection manhole, electrical equipment/controls and a standby generator.

2. Headworks

    a. Flow from the CSLS enters the headworks and undergoes primary treatment with two 2.0 mm rotary drum fine screens and screening washer/compactors.

3. Biological Process Basins

    a. The biological process is configured to provide denitrification using the Modified Ludzack-Ettinger (MLE) process. The MLE process employs a series configuration of an anoxic zone followed by an aerobic zone and relies on a nitrate recycle to achieve nitrogen removal. The MLE process at Santaquin consists of three parallel process trains. Two process trains are fully outfitted and are currently used as process basins. The third basin currently serves as a solids holding tank.

4. Membrane Basins

    a. The MBR process consists of six membrane tanks, four of which are currently outfitted with membrane cassettes, and two of which are empty and available for future use. One of the future tanks is temporarily serving as a backpulse tank.

5. UV Disinfection

a. The UV lamps are arranged in an open channel configuration located inside the MBR building. The UV system utilizes low pressure-high output lamps that are encased with quartz sleeves and arranged horizontally.

6. Reclaimed Water Pump Station

a. The reclaimed water pump station consists of three 40 hp vertical turbine pumps. Two of the pumps are duty and one is standby. A spare slot was included in the original design for the future installation of pump 2. The vertical turbines pump treated effluent (reclaimed water) to the existing winter storage lagoons.

7. Biosolids Holding Tank

a. The biosolids are wasted by diverting MLSS from the deoxygenation tank to the existing biosolids holding tank in the process building. The holding tank is aerated to provide mixing and oxygen for additional biological degradation of volatile solids and organic material. Periodically, biosolids from the holding tank are pumped the screw presses for dewatering.

8. Dewatering

a. The dewatering process consists of two dewatering feed pumps in the MBR building. The two pumps send WAS to the two screw presses located in the dewatering building. The City currently hauls biosolids to the landfill approximately 5 days/week.

9. Plant Drain Lift Station

a. The plant drain lift station consists of duty/standby submersible pumps, which pump plant drains to the force main tie-in located upstream of the headworks.

10. Winter Storage Ponds

a. There are two winter storage ponds located offsite with a total storage capacity of 178 million gallons. The ponds store water generated by the WRF during the winter months for use as irrigation during the summer months.

C. The new upgrades to the existing WRF will be constructed at the existing WRF site, lift station site, and lagoon/winter storage site.

D. Contractor shall reuse, dispose, or salvage to the city any existing equipment that is removed as part of this project as specified in the plans. If the Contractor damages any item noted to be reused or turned over to the Owner, Contractor shall replace the item,

at no additional cost the Owner, with a new component of the same make, model, and material, or an equivalent item that is acceptable to the Owner.

E. Retain and protect existing facilities not designated for Work in this project. Reference Section 01 50 00 Temporary Facilities and Controls.

1.2 DISCHARGE PERMIT CONDITIONS

A. Discharge from the facility must satisfy the following conditions:

1. The Owner's UPDES Discharge Permit is #UT0026000. Compliance with the UPDES Permit shall be maintained at all times during construction. A copy of the permit may be obtained at: https://deq.utah.gov/water-quality/updes-permitting-program#individual

B. Bypassing of untreated or partially treated wastewater to surface waters is prohibited.

C. Owner will notify Contractor immediately if Permit limits are violated, or if an imminent violation is anticipated. The Owner and/or Engineer shall determine if the violation or imminent violation is caused by the actions or inactions of the Contractor, its employees, subcontractors, and/or agents.

D. If the actions or inactions of the Contractor, its employees, subcontractors, and/or agents, result in a violation of the Permit or an imminent violation, the Contractor shall, at no cost to Owner, mitigate any damages, suspend or modify certain aspects of work (if deemed necessary by Owner and/or Engineer), and fully cooperate with Owner and Engineer to bring the facility into compliance with the Permit.

E. Penalties and all related costs, including but not limited to legal and engineering expenses, imposed on or incurred by the Owner as a result of any bypass or Permit violation caused by the actions or inactions of the Contractor, its employees, subcontractors or agents, are to be borne in full by the Contractor.

1.3 MAJOR WORK ELEMENTS

A. The project generally consists of the following upgrades to the facility:

1. Center St. Lift Station

a. Upsize the force main from the lift station to the railroad crossing

b. Convert wet well from duplex to triplex pumping system

c. Install new valve vault and flow metering system

d. New electrical and controls building

2. Biological Process Train #3

a. Convert existing solids holding tank to biological train no. 3 for activated sludge process

b. New mixed liquor recycle pumping system to serve the third train

c. New process blower no. 4

3. Membrane Process Train #5

a. Outfit the fifth membrane train with membrane cassettes and ancillary equipment

b. Repurpose the existing two solids handling blowers to membrane scour air blowers

c. New air compressor system

4. UV Disinfection

a. Relocate existing UV modules and electrical components from channel 1 to channel 2

b. Add additional UV modules to channel 2

5. Reclaimed Water Pump Station

a. Install one new vertical turbine pump

b. Upsize one existing vertical turbine pump

6. New Solids Handling Facilities

a. New solids holding tank with coarse bubble diffusers

b. New solids handling building to house blowers and dewatering feed pumps

7. New Solids Loadout Facilities

a. New solids loadout bay

b. New shaftless screw conveyors

8. Winter Storage Ponds

a. Retrofit former treatment lagoons to winter storage ponds

b. New piping, clay liner, and site improvements

9. Associated site civil, yard piping, electrical and instrumentation, and ancillary improvements.

B. No upgrades to the following processes are anticipated as part of Phase 3:

1. Headworks

2. Chemical systems

3. Non-potable water system

4. Plant drain lift station

1.4 SUBMITTALS

A. Incorporate provisions of this specification in Section 01 32 16 Construction Progress Schedule.

B. Provide work plan and sequence for coating of the fifth membrane tank.

C. Provide a detailed outage and time schedule plan for each work item that may impact plant operation. Provide long-range and short-range plans, as appropriate for coordinating work with the Owner.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. Owner will occupy the premises during the entire construction period and continue operations of the existing facility until the new facility is complete. Contractor shall cooperate, schedule, and coordinate all activities with Owner to avoid conflicts in the normal operation of the facility.

3.2 SHUTDOWNS/OUTAGES

A. Provide a detailed outage plan for each work item that may impact facility operation, including utility outages required for construction purposes. Each outage plan shall be submitted to the Engineer and Owner for review fifteen working days prior to the start of the outage, and shall include the following, at a minimum:

1. Schedule, including start/stop dates and overall duration.

2. Location of the outage, including any processes, structures, electrical service, and/or equipment that will or may be affected by the outage.

3. General description of the work to occur, and who will be performing the work, including subcontractors.

4. Special tools or equipment required to complete the Work. Delineate Contractor's provisions for bypass pumping, as applicable. Contractor shall coordinate discharge locations with the Owner prior to submitting the plan to the Engineer for review.

5. Safety precautions.

6. Preparatory work to occur prior to the shutdown. Contractor shall specifically delineate any Owner coordination items including, but not limited to:

    a. Transferring of tank contents, including final discharge location

    b. Maximizing storage volumes available

    c. Altering which equipment is in operation

7. Operational modifications required to accommodate the shutdown while still maintaining facility operations and Permit requirements.

8. Simultaneous or overlapping outages.

B. Unless otherwise specified, Contractor shall dewater process tanks and pipelines at the beginning of each shutdown. Contractor shall be responsible for washing down and cleaning all tanks, basins, pipelines, and other work areas. Approximate depth of debris that can be expected to have accumulated in the bottom of basins is 12 to 18 inches. It is the responsibility of the Contractor to remove all debris, washdown, cleaning, and stormwater that accumulates in the work areas in accordance with all local and federal laws and regulations.

C. Contractor shall not shut off or disconnect any operating system of the facility unless approved by the Owner, in writing. All facility equipment operations and shutdowns shall be executed by the Owner unless otherwise noted. Contractor shall seal Owner-operated gates and valves upon approval by the Owner to prevent unnecessary leakage. After Contractor's work has been completed, Contractor shall remove the seal(s) to the satisfaction of the Engineer.

D. Operating processes, systems, individual equipment items, piping, or controls shall be isolated, dewatered, decommissioned, de-energized, or depressurized only during scheduled, planned outages.

E. The Owner, or designated representative, shall have the right to cancel or terminate an outage at no cost to the Owner when in their opinion the potential for a safety hazard or violation of the discharge permit exists. However, this does not relieve the Contractor of the responsibility to maintain a safe working environment and to maintain facility operations.

F. If requested by the Owner or Engineer, the Contractor shall send a representative to meet with facility and Engineer's staff to plan activities prior to the requested outage.

G. Outages shall not be permitted on Fridays, weekends, or Holidays. Shutdowns shall not occur on consecutive days unless previously approved by the Engineer and accepted by the Owner.

H. Contractor shall be responsible for coordinating all shutdowns with the Owner and Engineer. Contractor shall, whenever possible, combine discrete shutdown procedures identified in this section or by Contractor into a single shutdown when the duration of the shutdowns or the work requirements allow such combining to occur on a unit process or work area. The intent of combining procedures is to minimize the impacts upon facility operations and processes by limiting the number of shutdowns required.

I. Except for the shutdown durations specified in this section, Contractor's means and methods shall be implemented such that the existing facility, in its entirety, shall remain in continuous satisfactory operation, as determined by the Owner, during the entire duration of the Contract.

J. Coordinate with the Engineer, Owner, and Utility Provider to obtain approval to disconnect or reconnect utilities.

K. Coordinate with the Engineer and Owner regarding the shutdown and safety tagout/lockout of pressurized systems, electrical, mechanical, pneumatic, hydraulic, etc. systems, and other equipment and utilities.

L. Contractor is responsible for ensuring that all of the Work is completed in accordance with the Contract Documents.

3.3 TEMPORARY FACILITIES

A. Contractor has the option of providing additional temporary facilities that can eliminate a constraint, provided the temporary facilities are implemented without additional cost to the Owner and all requirements of the Contract Documents are fulfilled.

B. If the Contractor elects to provide additional temporary facilities in accordance with the above requirements, the Contractor shall provide a temporary facility plan to the Engineer and Owner for review a minimum of fifteen working days prior to implementation. The plan shall include the following, at a minimum:

1. Schedule, including start/stop dates for use of temporary facilities and overall duration.

2. Location of the temporary facilities.

3. General description of the temporary facilities to be implemented.

4. Design calculations, plans, vendor cut sheets, etc. illustrating the temporary system.

5. Safety precautions.

6. Preparatory work to occur prior to the implementation of the temporary facilities. Contractor shall specifically delineate any Owner-required coordination items (e.g., maximizing storage volumes available, altering which equipment is in operation…etc.).

7. Operational modifications required to accommodate the temporary facilities while still maintaining facility operations and Permit requirements. Delineate any processes, structures, electrical service, and/or equipment that will or may be affected by the facilities.

C. Contractor shall be responsible for providing all temporary pipelines, fittings, valves, pumps, meters, backflow preventers, spare parts, supports, electrical, power, controls, any other appurtenances, and labor required for the installation and operation of temporary bypass lines, pumping systems, processes, or conveyance systems required to maintain operations of the facility during construction activities, including those items deemed appropriate and/or necessary by the Owner and Engineer for satisfactory operation of the facility.

3.4 WORK SEQUENCE

A. The Contractor shall submit a detailed schedule (reference Section 01 32 16 Construction Progress Schedule) for the Work for general review and consideration by the Owner and Engineer. In all cases, operation of existing equipment and processes must be maintained to maintain compliance with the Owner's Permit.

B. Monitoring for Permit compliance when unit processes are out of service, being temporarily modified, or otherwise impacted during construction shall be the responsibility of the Owner. If Contractor's construction activities impact Owner's ability to sample for compliance, Contactor shall provide assistance as deemed necessary by the Owner, including but not limited to, labor, tools, equipment, and temporary structures, at no additional cost.

C. Some work elements may be done simultaneously. Not all construction activities are noted herein.

D. Demolition shall be coordinated to prevent damage to existing components as well as the new Work described in the Contract Documents. Demolition may need to proceed portions of the Work or be completed after the Work is operational.

E. A summary of critical coordination items is included in **Table A**.

1. The table includes a discussion of major construction elements by process area, including envisioned coordination with other work activities, potential

temporary systems, and process constraints for continued operation of the facility. The summary provided in **Table A** shall not be construed as stipulating the means and methods for completion of the Work. It is presented to highlight sequencing needs in general and to aid Contractor in preparation of Contractor's detailed work schedule.

2. Some outages (includes both short- and long-term outages) cannot be combined while maintaining satisfactory operation of the facility. Potential combinations that would likely compromise the facility operation and potentially result in Permit violations are identified in **Table A**. However, it is not possible to identify all possible combinations that Contractor may wish to use in sequencing the work. In preparing an individual outage plan, Contractor shall identify all other simultaneous or overlapping outages (short- and long-term) that would be in effect for that process and other processes. Owner reserves the right to prohibit outage combinations if, in the sole opinion of the Owner, such outages could result in Permit violations or negative impacts to the plant operations.

Table A – Summary of Critical Construction Items

Item	Description
Site Access	
General	Site access to the WRF is from the north end of Center St. The main WRF site includes a single lane entrance from the main access gate to the MBR Process Building. A second road from the main access gate provides access to the Public Works Building, which is south of the WRF process buildings. The new facilities will be constructed where the Public Works access road is currently, and a new replacement road will be constructed further to the east. A temporary road will need to be constructed during construction to allow for access to the Public Works Building.
Short-Term Outages	Short-term outages of the main access gate and single lane entrance to the Process Building of up to 1 hour in a single day are permitted with 2 days advanced notice and approval by Owner. Short-term outages of the single lane entrance to the Public Works Building are not allowed. A temporary road will need to be constructed during construction to allow full time access to the Public Works Building.
Long-Term Outages	A long-term outage of the main access gate and single entrance lane to either the WRF or Public Works Building is not permitted.
Center St. Lift Station	
General	Influent wastewater from an 18" gravity sewer main enters the Center St. Lift Station and is pumped to the Santaquin WRF for treatment. Peak flows occur during the late morning hours. Construction of the new force main can occur without removing the existing force main and pumps from service, until connection occurs. An outage is required for the final connection, where the existing main will be cut and taken offline, and the new main will be put online. Removal of the existing pumps, rehabilitation of the existing wet well, and installation of the new pumps will require an outage since the existing wet well is not partitioned. Bypass pumping will be required during construction of the new facilities. Failure of bypass pumping can result in flooding of residential homes immediately upstream of the CSLS. Contractor shall be responsible for all damages if this outage results in flooding and damage to residential homes, at no cost to the Owner. During construction, all wastewater flow sent to the Santaquin WRF must be metered with a 4-20mA signal relayed to the plant PLC/SCADA. It is expected that a mag meter,

Item	Description
	doppler meter, or approved equivalent will be used. Meter data must be configured so that the existing Santaquin WRF controls and system can use flow data for ongoing treatment processes within the plant.
Short-Term Outages	Short-term outages of 2 hour may be permitted (one per day maximum), provided the outage occurs during low-flow conditions and meets Specification 33 30 00. Contractor shall provide personnel to continually monitor the wet well level in the Center St. Lift Station.
Long-Term Outages	A long-term outage will be required to install the new pumps. The outage shall be as short as possible and will be limited to 30 calendar days. During the outage, full-time bypass pumping will be required with personnel stationed 24/7 on-site. Evening and weekend work is permitted to minimize the outage duration. During a long-term outage, meter data must accurately send bypass flow data to the Santaquin WRF controls system. Additional outages may be required during construction and installation of the valve vault and metering vault, but these may be able to be sequenced by the contractor to eliminate or minimize bypass pumping.
Headworks	
General	Influent wastewater enters the Headworks after being pumped from the Center St. Lift Station. Raw wastewater is screened by 2-mm fine screens before being pumped to Biological Treatment. The Headworks also contains two screenings washer/compactors to accompany the fine screens. No work is scheduled in the Headworks.
Biological Treatment Basins	
General	Screened influent from the Headworks is continually discharged to the RAS Splitter Box south of the Biological Treatment basins. The facility does not include any upstream storage or equalization. A Treatment Train is defined as an anoxic (AX) zone and both aerated (AE) zones. Two Treatment Trains must be in service at all times. The project will require the conversion of the existing solids holding tank into biological basin no. 3. The conversion process includes the installation of two new mixed liquor recycle pumps in Kiva 2, fine bubble diffusers/mixers in the basin, and a new process blower no. 4 in the blower room. Work on the biological treatment basins and any equipment demolition in the process building cannot begin until the new solids holding tank and solids handling

Item	Description
	building have been constructed, commissioned, and in operation. Specifically, the existing dewatering feed pumps located in Kiva 2 must be demoed prior to installation of the new mixed liquor recycle pumps. The new recycle pumps will be dedicated units for biological train no. 3. Once the new solids holding tank is online, the existing solids holding tank (basin no. 3) can be drained, existing equipment can be demoed, and new equipment/piping can be installed. The new mixed liquor recycle pumps should be commissioned and tested prior to commissioning the new membranes. Use of MLSS is permitted during initial testing and commissioning of the new recycle pumps.
Short-Term Outages	No short-term outages of the biological treatment trains are permitted with the exception of train no. 3, which can be removed from service after the new biosolids holding tank, dewatering feed pumps, and aeration system is operational. A short-term outage of the existing solids holding tank (train no. 3) is permitted for a maximum of 3 days for installation of the new 6" WAS pipe in biological train no. 3.
Long-Term Outages	No long-term outages of the biological treatment trains are permitted with the exception of train no. 3, which can be removed from service after the new biosolids holding tank, dewatering feed pumps, and aeration system is operational.
Membrane Biological Reactors (MBR)	
General	Biologically treated effluent from Treatment Train 1 and 2 flows into the MBR influent channel and then splits to MBR Basins 1, 2, 3, and 4 in the existing process building. Return activated sludge (RAS) gravity flows back to the de-ox basin, AX-1, and AX-2 as RAS. Effluent from MBR Basins 1, 2, 3, and 4 is pumped via the permeate pumps to the UV system. UV treated final effluent then flows to the Reclaimed Water Pump Station and is pumped to the winter storage ponds for irrigation. This project includes expansion of the membrane process by outfitting membrane basin no. 5, new permeate pump no. 5, installing a new air compressor, and repurposing the existing solids handling blowers for membrane scour air. A minimum of three membrane basins (consisting of 96 modules) must be in service at all times. The existing membrane cleaning chemical system will be retained. The Work includes connecting to existing chemical lines to route citric acid and sodium hypochlorite to membrane train no. 5. The two existing solids handling blowers will be repurposed and reprogrammed with new instrumentation for use as membrane air scour blowers. An outage of the Air

Item	Description
	Scour system is not permitted at any time. Contractor must schedule the work such that the new membrane basins are commissioned and served by the new air scour blowers. The WRF currently has four MBR trains installed in parallel and this project will add a fifth parallel train. The facility has tanks in place for up to six MBR trains in parallel. The work associated with this phase primarily involves the installation of membrane equipment and ancillary facilities and integration of these facilities with those existing. Work to be done to integrate the existing membrane equipment with the new membrane equipment may require short term outages of the existing equipment. The existing concrete tank for the fifth MBR train is required to be coated prior to the installation of the membrane systems. The tank coating and prep work represents a considerable risk to the operation of the existing MBR trains and precautions must be taken to prevent damage to the existing units. The conversion of the existing solids handling blowers to membrane scour air blowers may not commence until the new solids holding tank and solids handling facility is online.
Short-Term Outages	A short-term outage of the chemical system is permissible for up to 3 days for piping connections. Contractor shall coordinate with Owner about cleaning schedules (weekly hypochlorite cleans and semi-annual hypochlorite/citric cleans are required for the membranes) and modify the construction schedule as needed. A short-term outage of membrane basin no. 4 is permitted to accomplish the permeate line and air line connections (less than two hours). Outages are limited to when the water temperature is greater than 15 deg C. The scour air system must remain operational throughout construction except for short durations during equipment tie-ins (less than one hour).
Long-Term Outages	None permitted.
UV Disinfection	
General	The UV system will be upgraded by relocating the existing power distribution centers (PDCs), modules, and lamps from the existing channel (Channel No. 2) to the adjacent parallel channel (Channel No. 1). The channel reduction baffle will be removed and each PDC will be outfitted with an additional 4 new modules with 8 new lamps per module. A new low-level sensor and module supporting racks will also be installed. The UV system will operate in two duty banks and one standby bank configuration, similar to Phase 1. Alternate disinfection is not possible; therefore, the UV system must remain fully functional throughout construction. As a minimum, two UV banks in each channel shall

Item	Description
	be available at all times. The system has isolation gates that should permit uninterrupted operation and not necessitate an outage. The PDC in Bank 3 should be relocated first to Channel no. 1 with new modules and lamps. After that, PDCs modules, and lamps from Bank 1 and 2 can be relocated to Channel no.1.
Short-Term Outages	None permitted
Long-Term Outages	None permitted
Reclaimed Water Pump Station	
General	One new reuse pump will be installed in the reclaimed water pump station as part of this project. A spare slot was included in the original design for the future installation of pump 2. Pump no. 1 will also be upsized with a larger impeller to increase the pump's flow capacity and pump at a higher head in this project. Pump no. 2 shall be installed and commissioned first, followed by the upgrade to pump no. 1.
Short-Term Outages	The reclaimed water pump station must remain operational throughout construction except for short durations during equipment tie-ins (less than one hour).
Long-Term Outages	None permitted.
Solids Handling Facilities	
General	Since the existing biosolids holding tank will be reconfigured as the Train 3 biological process basin, a new biosolids holding tank will be constructed outside of the current process building in this project. Also, the existing dewatering feed pumps in Kiva 2 will be demoed to make room for the new mixed liquor recycle pumps, so a new solids handling building will be constructed to house the new dewatering feed pumps and blowers. The Contractor must provide alternate feed pumping to the existing dewatering equipment OR the new solids holding tank and solids handling building must be constructed prior to any work on the biological train 3 (existing solids holding tank) conversion process. The new WAS pipe from the biological trains to the new holding tank must also be constructed and brought online as part of the solids upgrades work. After the new solids holding tank and solids handling building / equipment are brought online, the existing solids handling blowers can be reconfigured for membrane scour air and work on biological train 3 can begin.
Short-Term Outages	None permitted.
Long-Term Outages	None permitted.
Dewatering / Solids Loadout Facilities	

Item	Description
General	WAS is dewatered via two screw presses and collected in a trailer located inside the existing dewatering building for landfill disposal. As part of this project, two new screw conveyors will collect dewatered sludge from the existing screw presses and convey the dewatered sludge to the new solids loadout building to be collected in a dump truck or roll off container. Installing the southern conveyor first will allow the northern (FKC) dewatering press to remain viable to dewater solids during non-construction hours, if required. The southern (Huber) dewatering press and new conveyor can be utilized for dewatering during non-construction hours during installation of the northern conveyor.
Short-Term Outages	Screw conveyor installation will directly impact dewatering activities. For short term outages, WAS can be temporarily stored in the new solids holding tank during conveyor installation (<7-days). If screw conveyor installation requires more than 1-week, coordinate with the Engineer and Owner to develop a long-term dewatering outage schedule.
Long-Term Outages	None permitted.
Plant Drain Lift Station	
General	The plant drain lift station consists of duty/standby submersible pumps, which pump plant drains to the force main tie-in located upstream of the headworks. No work is scheduled at the Plant Drain Lift Station.
Electrical, Controls and SCADA	
General	Alterations are to be made regarding the control narratives and systems for process areas interconnected as part of the Water Reclamation Facility. In addition, a new electrical building is being constructed and commissioned for the Center St. Lift Station. Reference the Electrical Plans and Division 26 specifications.
Short-Term Outages	Division 26 Specifications
Long-Term Outages	Division 26 Specifications
Winter Storage Ponds	
General	The Winter Storage Ponds store reclaimed water during the winter months for use as irrigation water during the summer months. The ponds have a total storage capacity of 178 million gallons. The irrigation season is from April 15 – October 15 (6 months) and the remainder of the year the treated effluent needs to be stored. To increase the storage capacity of irrigation water, the abandoned treatment lagoons will be rehabilitated to receive water from the Reclaimed Water Pump Station.

Item	Description
	Construction of the transfer structure between Winter Storage Pond 2 and existing Lagoon 3 must be completed when Winter Storage Pond 2 is empty and before Winter Storage pond 1 is full. Winter Storage Pond 2 is typically empty from the month of August to November, but may fluctuate due to varying flows from the WRF and irrigation system. Contractor must verify with Owner on the exact dates that the winter storage ponds are empty. An outage is required for the final connection, where the existing reclaimed water pipe will be cut and connected to the new transfer structure.
Short-Term Outages	A short-term outage of the Winter Storage Ponds can be accomplished with a short-term outage of the Reclaimed Water Pump Station. The outage shall not exceed 8 hours.
Long-Term Outages	A long term outage of approximately 3 months of the winter storage ponds is permissible, but exact outage period must be verified with Owner.

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Web-based Administration of Submittals

B. Construction Progress Schedules

C. Shop and Fabrication Drawings

D. Product Data

E. Samples

F. Deferred Submittals

G. Material Safety Data Sheets

H. Installation, Operation, and Maintenance Manuals with Product Submittals

I. Manufacturers' Instructions

J. American Iron and Steel (AIS) Certification

K. Spare Parts and Maintenance Materials

L. Submittal Preparation

M. Submittal Review

N. Submittal Limits

O. Spare Parts and Maintenance Materials

P. Electronic Web-Based Cloud Construction Administration Software

1.2 RELATED SECTIONS

A. Section 01 40 00 – Quality Assurance and Quality Control

B. Section 01 65 00 – Commissioning of Systems

C. Section 01 70 00 – Closeout Requirements

D. Section 01 73 00 – Installation, Operation and Maintenance Manuals

1.3 WEB-BASED CONSTRUCTION ADMINISTRATION SOFTWARE

A. Contractor shall pay for and utilize a web-based cloud construction administration software (Software) throughout the construction process to aid the project communication and submittal review process.

B. Contractor shall be responsible for all costs and fees associated with the Software through the duration of the Contract.

C. Contractor shall be responsible for all startup and setup required for the successful operation of the Software. The Contractor shall coordinate and provide assistance as required throughout the project to the Engineer and their subconsultants, the Owner, and their designated representatives to successfully apply the Software and its application to the Project. The Contractor shall provide training on how to utilize the Software to all project team members by a method acceptable to the Owner and the Engineer. The Engineer, Owner and their representatives are responsible for their own hardware, web access, and internal operating systems necessary to access the Software website.

D. Contractor shall provide Engineer with administrative rights to the Software for the project. Engineer shall have the same capabilities within the Software package as the Contractor.

E. Contractor shall make all items stored and/or transmitted within the Software available to all project team members, as determined by the Engineer, always.

F. The use of construction administration Software does not eliminate the Contractors' responsibilities for maintaining one hard copy of all record documents in accordance with the General Conditions.

G. The items below provide a general list of documents intended to be stored, transmitted, and accessed with the Software:

1. Bid Set Electronic Copy of Project Plans, Specifications, and Addenda

2. Submittals including Shop Drawings and a copy of transmittal letters for hard copy submittals

3. Requests for Information, i.e., a written request for information, requiring a written response, to Owner, Engineer, or Contractor, initiated by Owner, Engineer, or Contractor

4. Executed Field Orders

5. Executed Work Change Directives

6. Executed Change Orders

7. Contractor's Applications for Payment

8. Executed Applications for Payment

H. Prior to Final Completion of the project, the Contractor shall deliver to the Engineer as a required submittal, a complete electronic copy of all information exchanged through the Software by all parties using the system for the project. The information shall be on suitable electronic storage media agreeable to the Engineer and the Owner. The information must be readily reviewable in standard operating system software generally and publicly available to the Owner and Engineer. The Engineer shall review the submitted electronic information for completeness and format and respond to the Contractor as to the acceptability of the submittal and/or any modifications or resubmittal that is required to be made and resubmitted by the Contractor.

I. If the web-based Software becomes unavailable, unusable, or otherwise unsuitable for continued use for this project at the sole discretion of the Engineer, the Contractor is responsible for delivering all electronic information previously transmitted for the project through the construction administration Software in an acceptable format (i.e., either electronic or hard/paper copies, at Engineer's discretion) to the Engineer, and Owner at no additional cost.

J. The Owner and Engineer reserve the right to require paper copies and transmittal procedures of any documents they deem necessary. Examples of such paper copies that are currently intended to be transmitted in hard copy are as follows:

1. Fully executed contracts, pay requests, change orders, and other contractual documents

2. Final Operations and Maintenance submittals

3. Contractor's final record drawing information

K. For Hard (Paper Copy) Submittals and Samples:

1. Contractor shall utilize the construction administration Software to assist tracking, posting, review, and return of review comments for all hard (paper copy) submittals and samples.

    a. For samples, Contractor shall submit samples to Engineer (and Engineer's subconsultants as required). Samples will be retained by the Engineer and/or subconsultants.

        i. Contractor shall submit color samples for all product submittals which require a color selection by the Owner. Contractor shall

mail one sample directly to the Engineer and one sample directly to the Architect.

ii. Contractor shall be responsible for all fees associated with procurement and shipment. If in the Architect's or Engineer's opinion the sample arrives in a state that renders it unusable for the purposes of review, Contractor shall provide another sample at no additional cost to the Owner.

b. For paper copies of submittals (where deemed necessary by Engineer), submit four (4) copies to be retained by Engineer, unless specifically noted otherwise.

c. Submittals which require a hard (paper copy) submittal include the following:

i. Fully executed contracts

ii. All over-sized submittals (larger than 8-1/2" x 11" sheets)

iii. Final Operations and Maintenance information.

1.4 SHOP AND FABRICATION DRAWINGS

A. Shop drawings are required for all process mechanical installations, piping connections to existing piping, fabrications, etc.

B. Fabrication drawings are required for all metal fabrications.

C. Drawings shall include dimensions, fit, and installation, and shall be coordinated with all adjacent Work elements.

D. Shop drawings are not required for yard piping beyond 20 feet from any structure, unless specifically requested by Engineer.

1.5 PRODUCT DATA

A. Contractor shall submit product data, supporting documentation, and certifications as required to show compliance with the Contract Documents for every product provided as part of the Work.

B. Contractor shall mark each copy to identify applicable products, models, options, and other data. Contractor shall supplement manufacturers' standard data to provide information unique to this Project. Non-project related information on manufacturer's standard data shall be stricken or otherwise deleted.

1.6 SAMPLES

A. Contractor shall submit samples when requested in individual sections or as requested by the Engineer.

B. Contractor shall submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

C. Contractor shall submit samples of finishes from the full range of manufacturers' standard colors, textures, and patterns for Owner's selection. Provide custom color samples where custom colors are required by the Contract Documents.

D. Contractor shall include identification on each sample, with full Project information.

1.7 DEFERRED SUBMITTALS

A. Where indicated in the Contract Documents, Contractor shall provide calculations and drawings signed and sealed by a Registered Professional Engineer licensed in the State where the project is to be constructed. Professional Engineer shall be responsible for designing the components as shown on the Shop Drawings.

1.8 MATERIAL SAFETY DATA SHEETS

A. Contractor shall provide OSHA information and material safety data sheets (SDS) as applicable for all chemicals, as requested by the Engineer or noted in the Contract Documents.

1.9 INSTALLATION, OPERATION, AND MAINTENANCE MANUALS WITH PRODUCT SUBMITTALS

A. Installation, operation, and maintenance information included with product submittals shall be considered information only. Draft and Final Installation, Operation, and Maintenance information shall be submitted separately from the product data per Section 01 73 00.

1.10 MANUFACTURERS' INSTRUCTIONS

A. Contractor shall submit manufacturers' printed instructions for delivery, storage, assembly, and installation for all products, except equipment, to be provided as part of the Work. This includes, but is not limited to, coatings, concrete repair products, etc.

B. Contractor shall identify conflicts between manufacturers' instructions and Contract Documents as part of the submittal.

1.11 SUBMITTAL PREPARATION

A. Contractor shall develop submittals as necessary to document proposed goods, materials, systems, plans, etc. for completion of the Work.

B. Contractor shall submit a “Schedule of Submittals” per the General Conditions.

C. Owner and Engineer reserve the right to request such additional submittal items as deemed necessary throughout the course of the Work, at no additional cost to the Owner.

D. Coordinate and group submission of related items. Provide a complete table of contents for each submittal. For PDF submittals, provide bookmarks for each section and subsection listed in the table of contents.

E. Before submitting a Shop Drawing or Sample, Contractor shall:

1. Review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

2. Determine and verify:

a. All field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;

b. The suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

c. All information relative to Contractor’s responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;

d. Confirm that the Submittal is complete with respect to all related data included in the Submittal.

3. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor’s obligations under the Contract Documents with respect to Contractor’s review of that Submittal, and that Contractor approves the Submittal.

4. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

5. Ensure that quantities are stated and project identification (i.e., tag numbers, process area codes, etc.) are provided and utilized appropriately.

F. Sequentially number the submittals with XX XX XX-YY-ZZ where:

1. XX XX XX is the 6-digit specification number.

2. YY is the number which reflects a different submittal for a given specification number

3. ZZ is the number of times that the submittal has been made (i.e., the revision number). The initial submittal shall be “01”.

G. Identify Project, Contractor, subcontractor or supplier, pertinent Drawing sheet and detail number(s), and Specification Section number, as appropriate.

H. Transmit each submittal with a letter of transmittal containing all pertinent information required for identification and checking of submittals. By submitting to Engineer, Contractor certifies that:

1. Contractor has complied with the requirements of Contract Documents in preparation, review, and submission of designated Submittal

2. The submittal is complete and in accordance with the Contract Documents and all requirements of applicable laws, regulations, and governing agencies

I. Contractor's designated representative shall apply their signature certifying that the submittal is in accordance with the requirements of the Contract Documents.

J. The Contractor shall submit a copy of the applicable specification(s) with each paragraph clearly marked with a check mark (✓) for conformance to the subsection. Alternately, if Contractor takes exception to the specification requirement, Contractor shall indicate such with an “x”. For each deviation, provide an explanation and include supporting documentation to defend the position that the proposed change meets or exceeds the specified requirements. The submittal will not be reviewed without this specification markup. Engineer shall review the deviations as an “or-equal” or “substitution” request (as appropriate and as determined solely by Engineer), in accordance with the General Conditions. The Engineer retains the right to reject the proposed deviation in favor of the specification as written.

K. The Contractor shall be responsible for submitting complete and accurate information in accordance with the Contract Documents.

L. Revise and resubmit submittals as required. With each resubmittal, the Contractor shall identify all changes made since the previous submittal in a cover letter. For each change, Contractor shall explicitly state what modifications were made, and on which page of the current submittal the modifications can be found. Any resubmittal not accompanied by such a summary will be returned for resubmittal without any further review.

M. All Contractor submittal information shall be supplied to the Owner in the electronic file format that it was originally developed and in condensed portable document format (PDF). The specifications for PDF generation are as follows:

1. The acceptable format is portable document format (PDF): Adobe Acrobat, Adobe Acrobat Exchange, or Revu Bluebeam.

2. Scan images at a resolution of 400 dpi or greater. Perform Optical Character Recognition (OCR) capture on all images. Achieve OCR with the "original image with hidden text" option (as seen in Adobe Acrobat Exchange 4.05).

3. Create one PDF document (PDF file) for each submittal. The entire file is converted to a single PDF file via scanning or other method of conversion. Drawings or other graphics must be converted to PDF format and made part of one combined PDF document. Rotate pages to the appropriate position for easy reading. Word searches of the PDF document must operate successfully (proof of OCR).

4. Create a bookmark in the navigation frame for each entry in the table of contents. The bookmark shall be three levels deep (i.e., "chapter", "section", and "subsection") unless otherwise approved by the Owner.

5. Generate thumbnails for reach completed PDF file.

6. Set the opening view for PDF files as follows:

   a. Initial view: bookmarks and page

   b. Magnification: fit in window

   c. Open to the cover page of the document, with bookmarks to the left, and the first bookmark linked to the table of contents.

1.12 SUBMITTAL REVIEW

A. The Engineer's review is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Corrections or comments made on the shop drawings during this review do not relieve Contractor from compliance with the requirements of the Contract Documents.

B. Engineer's review will result in the following submittal review designations:

1. No Exceptions Taken: This response indicates that the submittal generally appears to meet the requirements of the Contract Documents. A resubmittal is not required.

2. Revise and Re-Submit: Contractor shall address Engineer's comments and resubmit.

3. Submit Specific Item: This response indicates that additional information is required for Engineer's review of the submittal. Contractor shall provide requested information resubmit.

4. Rejected: If during Engineer's review, the submittal is found to be grossly inadequate, incomplete, and/or include substantial deviations from the Contract Documents, Engineer will cease review and deem the submittal rejected. Contractor shall prepare a suitable submittal for review and resubmit.

C. Contractor shall distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with the Contract Documents and Engineer's review comments.

D. Engineer reserves the right to request additional submittal items related to the project, at no additional cost to the Owner.

E. Engineer's review time: Engineer will endeavor to review each submittal within 15 working days (20 days for O&M submittals). However, the review time may be longer depending on the timing and number of submittals issued by Contractor, the quality of Contractor's submittal, the nature and complexity of the submittal including necessary coordination with other subconsultants, evaluation of or-equal or substitution requests contained within the submittal, and other factors. Contractor will not be granted additional Contract Days arising from Engineer's review. Contractor is encouraged to identify critical submittals for prioritization during Engineer's review.

F. Contractor shall include submittal periods for major equipment and critical components in the Project Schedule (reference Section 01 32 16 Construction Progress Schedule) and factor in the review time and resubmittals.

G. Submittals shall be noted as "No Exceptions Taken" prior to delivery and incorporation in the Work.

1.13 SUBMITTAL LIMITS

A. Three submittals will be permitted for each specified item/product at no cost to the Contractor.

B. For each item specified in the Contract Documents, Contractor shall submit a single product from a single manufacturer for Engineer's review. Engineer will not review multiple products that are intended for the same use unless, during construction, the product which was originally submitted becomes unavailable.

C. If Contractor fails to address Engineer's comments with the first three submittals and additional reviews are required, the Owner may charge the Contractor on a Time and Materials Basis (estimated at $2,000.00 for each resubmittal review) that is required.

D. Items requiring resubmittal shall be submitted to the Engineer within thirty (30) calendar days from the date of return to Contractor.

1.14 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections.

B. Deliver to project site prior to Operator/Owner Training – reference Section 01 65 00 Commissioning of Systems.

PART 2 PRODUCTS

2.1 WEB-BASED CLOUD CONSTRUCTION ADMINISTRATION SOFTWARE

A. Software Packages:

1. AEC-Sync/Newforma Project Cloud
2. Procore Cloud-Based Construction Software
3. Submittal Exchange/Oracle
4. VPO Construction Management Software
5. Approved Equivalent

B. The items below provide a general list of features required of the Web-based Cloud Construction Administration Software:

1. 100% web-based cloud with unlimited users' interface – no client software required, accessible from any internet connected device
2. Auditing – records for all actions performed on each document with a time stamp and user details
3. Process Flow and Project Team Setup – defined organizational structure
4. Customizable – add fields or completely new documents (submittal transmittals)
5. Central Repository for photos, drawings, specification, schedules, submittals, RFIs, and Change Orders, or any other custom document category

6. Print or exportable to PDF or similar file

7. Attach or upload any file type (e.g., PDF, JPEG, CAD, DWG, DWFX)

8. Collaborative Review of submittals – comments from several users incorporated on one electronic file; Software shall provide ability for simultaneous review by multiple reviewers.

9. Email Notifications and alerts for outstanding documents

10. Document Reporting and History

11. Automatic Workflow Process

12. Complete hosted solution with 24 hours, 7 days a week access, redundant servers, daily backup.

PART 3 EXECUTION – NOT USED

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SECTION 01 35 60
HEALTH AND SAFETY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Contractor shall develop, administer, and monitor a Safety Program for the project. Contractor shall include an Accident Prevention Program, Confined Space Entry Safety Plan, and Safety Plan as part of their overall Safety Program.

B. It is not the intent of the Owner or the Engineer to develop and/or manage the safety and health programs of Contractors or in any way assume the responsibility for the safety and health of Contractor's employee, including subcontractors, suppliers, manufacturers, or any other personnel employed either directly or indirectly by the Contractor. It is required that the Contractor adheres to applicable Federal, State, and local safety and health regulations.

1.2 REFERENCES

A. Comply with and enforce on-the-job site current applicable local, State, and Federal Health and Safety Standards, including, but not limited to, the following:

Reference	Title
29 USC *651* et seq.	Federal Occupational Safety and Health Act
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction
SARA Title III	Emergency Planning and Community Right-to-Know

1.3 SUBMITTALS

A. All submittals in this section are considered informational and shall be submitted to the Engineer for informational purposes only. Contractor is responsible for obtaining review and approval from federal, state, and/or local entities as required prior to submission of each plan to the Engineer.

1. Revise each plan prior to the start of work to accommodate changes requested by the Owner and/or regulatory agencies or jurisdiction(s). In the event that involved regulatory agencies or jurisdictions determine the aforementioned plans or associated documents, organizational structure, or work plan to be inadequate to protect employees and the public, Contractor shall:

a. Modify the plan(s) to meet the requirements of said regulatory agencies or jurisdictions.

b. Provide the Engineer and the Owner with the revisions to the plan(s) within seven days of the notice of deficiency.

i. Each plan shall be submitted to the Engineer prior to the start of work onsite, unless specifically noted otherwise.

ii. Contractor shall post a copy of each plan at the Contractor's job site office and each of the subcontractor's offices.

B. The following submittals shall be provided in accordance with Section 01 33 00, Submittal Procedures:

1. Accident Prevention Plan. This plan shall outline the anticipated hazards and safety controls necessary to safeguard Contractor's employees, the public, and other personnel. The plan shall be specific to the job and site and meet federal, state, and local jurisdictional requirements. In addition to any regulatory requirements, the Accident Prevention Plan shall include the following, at minimum:

a. Respiratory Protection

b. Accident/Injury Reporting

c. Emergency Plan (SARA Title-ifi—Community Right-to-Know)

d. Personal Protective Equipment

e. Fall Restraint and Fall Arrest: Work activities on this project may expose employees to fall hazards. Contractor must provide a written Fall Protection Plan for each fall hazard encountered throughout the project.

f. Fire Safety and Prevention

g. Hand and Power Tools

h. Welding and Cutting

i. Electrical

j. Vehicles and Other Motorized Equipment

k. Tagout/Lockout Procedures

l. Hearing Conservation and Protection

m. Material Safety Data Sheets: The plan shall include a list and corresponding Material Safety Data Sheets (MSDS) for hazardous chemicals to be used on site. If no hazardous chemicals are to be used, provide statement to that effect.

n. Emergency Management Plan for Gases: Contaminant gases that may be encountered include but are not limited to hydrogen sulfide, methane, carbon monoxide, carbon dioxide and sulfur dioxide. Provide a written Emergency Management Plan to address these and other potential hazardous substances on site.

i. Confined Space Entry Plan. The nature of work under this Contract may expose workers to permit-required confined spaces having possible toxic and oxygen fluctuation conditions. This plan shall classify hazardous confined spaces and describe specific procedures to ensure the safety of employees who enter them in accordance with applicable federal, state, and local regulations.

ii. Pathogen Program. Wastewater carries a wide spectrum of disease-producing organisms. Submit a written hazard communication and biological blood borne pathogen program detailing the preventive measures to be taken by the Contractor to provide an appropriate work environment for its employees as well as other employees on site. These may include, but are not limited to the following:

o. Instruction in appropriate measures to avoid contamination.

p. A preventative inoculation program (tetanus/diphtheria, etc.) available to all personnel.

q. Clothing and personal protective gear to protect against exposure and infection.

r. Facilities for workers to clean up and wash.

1.4 QUALITY ASSURANCE

A. Ensure that subcontractors receive a copy of this Specification section. The Contractor is responsible for ensuring compliance at the project site with the Accident Prevention Plan, Confined Space Entry Plan, and the Safety Plan.

B. Maintain good housekeeping in work areas. Entrances and egresses shall be free from debris and garbage.

C. Provide a qualified health and safety supervisor, with responsibility and full authority to coordinate, implement and enforce the Contractor's Accident Prevention Plan, Confined Space Entry Plan, and Safety Plan for the duration of this Contract. The name and telephone number of the safety supervisor shall appear in each plan.

1.5 ON-SITE CHEMICALS

A. All chemicals used during project construction or furnished for project operation, whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, reactant or of other classification, shall show approval of either the U.S. Environmental Protection Agency or the U.S. Department of Agriculture. Use of all such chemicals and disposal of residues shall be in strict accordance with the printed instructions of the manufacturer.

B. Chemicals which are onsite for Owner's use as part of daily operation of the facility include, but are not limited to, the following. Contractor shall include these chemicals in the Accident Prevention Plan. Owner will provide Material Safety Data Sheets for all chemicals currently in use at the facility.

1. Sodium Hypochlorite (NaOCl)
2. Citric Acid
3. Chlorine Gas
4. Polymer

1.6 UTILITIES

A. Take appropriate precautions in working near or with utilities and dangerous substances during the performance of work in order to protect the health and safety of the worker, the public, property, and the environment.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 SAFETY AND HEALTH COMPLIANCE

A. Owner may choose to review the Contractor's Accident Prevention Plan during construction. The Owner reserves the right to stop that portion of the Contractor's work if Owner believes there is imminent risk to injury or death.

B. Contractor shall ensure that necessary air monitoring, ventilation equipment, protective clothing, and other supplies and equipment as specified within the plans described prior are available to all personnel.

C. Contractor shall notify the Engineer and Owner immediately of accidents resulting in any serious injury or immediate or probable fatality to any employee or the public, or which result in hospitalization of any employees or the public.

3.2 EMERGENCY SERVICES NOTIFICATION

A. Contractor shall notify local Emergency Service providers as necessary during the Work. Additionally, Contractor shall provide notification prior to road closures and when work occurs where explosive hazards exist.

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SECTION 01 40 00
QUALITY ASSURANCE AND QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Related Sections

B. References

C. Conflicting Requirements

D. Definitions

E. Qualification Requirements

F. Testing and Inspection by Contractor

G. Testing and Inspection by Owner

H. Scheduling

I. Report Requirements

1.2 DEFINITIONS

A. Conform to each referenced standard, specifically the edition, which was current on the date of the Agreement, unless specifically noted otherwise or except where a specific date is established by code.

B. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.3 CONFLICTING REQUIREMENTS

A. Should any requirements within the Contract Documents appear to conflict, the Contractor shall request clarification from the Engineer before proceeding.

B. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for direction before proceeding

C. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply

exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate. Refer uncertainties to

1.4 DEFINITIONS

A. Quality Control (QC): Required testing or inspection to determine whether the quality of the Work is in conformance with the Contract Documents.

B. Quality Assurance (QA): Supplemental testing or inspection of the Work to assure the quality of the Work and the accuracy of the QC tests and/or inspections.

C. Independent Testing Firm: Third-party testing firm to provide QC or QA laboratory and/or field testing and/or inspections. Independent Testing Firm shall be selected by the Owner for all QC testing and inspections as well as for Owner's QA testing and inspections. Contractor may select their own Independent Testing Firm for their QA purposes.

D. Structural Footprint: The area circumscribed by the outermost edge of the exterior footing.

1.5 QUALIFICATION REQUIREMENTS

A. Manufacturer Qualifications: A firm which, in the opinion of the Engineer, is experienced in manufacturing products or systems like those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. The burden of proof that the proposed manufacturer(s) meet these requirements is on the Contractor. Procure products from manufacturer(s) able to meet the qualification requirements, warranty requirements, and technical or factory-authorized services representative requirements per the Contract Documents.

B. Fabricator Qualifications: A firm which, in the opinion of the Engineer, is experienced in producing products like those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. The burden of proof that the proposed fabricator(s) meet these requirements is on the Contractor. Procure products from fabricator(s) able to meet the qualification requirements, warranty requirements, and technical or factory-authorized services representative requirements per the Contract Documents.

C. Installer Qualifications: A firm or individual which, in the opinion of the Engineer, is experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, and whose work has resulted in construction with a record of successful in-service performance. The burden of proof that the proposed installers meet these requirements is on the Contractor.

   1. All installation personnel working at the project site shall be individually qualified, in the opinion of the Engineer, to perform the work.

2. Evidence of each individual installer's qualifications shall be submitted to the Engineer and noted as "no exceptions taken" prior to the individual beginning work on-site.

3. Persons applying coatings are installers.

   a. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the state where the Project is located and who is experienced in providing engineering services of the kind indicated.

   b. Independent Testing Firm Qualifications: An independent agency with the experience, capability, and training/certifications to conduct testing and inspections indicated; and where required by authorities having jurisdiction, that is acceptable to the authorities.

1.6 TESTING AND INSPECTION BY CONTRACTOR

A. General

1. The Contractor is responsible for providing all testing and/or inspections required by the Contract Documents, code requirements, and federal, state, or local law, except as explicitly stated otherwise. Requirements for the Contractor to provide quality assurance and quality control services as required by the Owner, Building Official / Inspector, Engineer, or other authorities having jurisdiction are not limited by the provisions of this Section.

2. Testing and inspections shall be performed by a testing firm, as required. Contractor shall cooperate with the testing firm by providing samples of materials, concrete and asphalt mix designs, equipment, tools, storage, site access, and assistance as requested by the testing firm, at no additional cost.

3. All tests and inspections shall be paid for by the Contractor except as explicitly stated otherwise.

4. Additional testing/inspection requested by the Contractor, or re-testing / re-inspection required because of non-conformance to the specified requirements shall be performed by the same testing firm, at no cost to the Owner. Contractor shall be responsible for payments due for additional testing or re-testing or re-inspection. Payment will be charged to the Contractor by deducting the inspection and testing charges from the Contract Price.

5. All tests and inspections shall be scheduled by the Contractor in accordance with the requirements stated herein.

6. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve the

Contractor of their responsibility to comply with the Contract Document requirements.

7. Specified tests, inspections, and related actions do not limit Contractor's right or authority to conduct other quality assurance and quality control procedures that Contractor considers necessary.

B. Quality Control

1. All QC testing and inspection services are to be coordinated by the Contractor.

2. The Contractor shall provide quality control, which shall include the initial and subsequent testing and inspections of Contractor's Work to ensure that the Work conforms to the Contract Documents.

3. Contractor shall designate the person responsible for Contractor's quality control while Work is in progress, and shall notify Engineer, in writing, prior to any change in quality control representative assignment.

4. Contractor shall provide quality control over suppliers, manufacturers, products, services, site conditions, and workmanship to produce Work of the specified quality.

5. Contractor shall comply fully with manufacturers' instructions, requirements, and recommendations, including each step in each sequence (e.g., installation sequence, etc.). The use or installation of any product in a manner that differs from the manufacturer's requirements, recommendations, or instructions shall not be acceptable unless prior written approval from the manufacturer has been received and reviewed by the Engineer and noted as "no exceptions taken".

6. Should manufacturers' instructions, requirements, or recommendations conflict with the Contract Documents, Contractor shall request clarification from the Engineer before proceeding.

7. Perform work by persons qualified to produce workmanship of specified quality.

8. The Contractor is responsible for providing testing and/or inspection by a third-party, testing firm for the following, at minimum:

    a. Grading, Excavation, Backfilling, and Compaction: Contractor shall provide testing and retesting during earthwork excavations, trench backfilling, grading, and backfilling operations outside of the Structural Footprint.

    b. Hot Mix Asphalt (HMA) in-place density testing, collection of loose mix field samples and laboratory testing.

c. Concrete: Contractor shall provide testing and documentation of concrete not covered under the IBC, including non-structural slabs on grade, concrete for electrical duct banks, etc.

d. Epoxy-set Rebar: Contractor shall provide inspection of all epoxy-set rebar including preparatory work.

e. The Contractor shall provide all equipment, supplies, manpower, etc., to conduct all acceptance (leak/watertightness, pressure, etc.) tests on utilities and structures.

f. And any other such tests as required for Contractor's QC measures.

i. Contractor shall arrange with independent firm and pay for additional samples and tests required for Contractor's use.

C. Quality Assurance

1. The Contractor shall provide quality assurance testing and inspections as necessary to confirm the accuracy of the QC tests and inspections. The Contractor may provide QA testing in addition to that provided by the Owner, at Contractor's expense.

D. Manufacturer's Field Services and Reports

1. Reference Section 01 65 00 Commissioning of Systems.

2. Where specified in individual specification Sections, Contractor shall require material or product suppliers and/or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, and quality of workmanship on-site.

a. Contractor shall report observations and site decisions, or instructions given to applicators or installers by the suppliers' or manufacturer's personnel that are supplemental or contrary to manufacturers' written instructions.

b. Contractor shall submit a site report within two business days of manufacturers' or suppliers' visit to the site to the Engineer for review.

E. Tolerances

1. Contractor shall monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

2. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from the Engineer before proceeding.

F. Field Samples

1. Store field samples at the site for review as required by individual specification sections.

2. Approved samples represent a quality level for the Work.

3. Where field sample(s) are specified in individual Sections to be removed, clear area after field sample has been accepted by the Engineer.

4. For concrete samples, the Contractor shall provide a temperature-controlled space (i.e., cure box or approved equivalent) on-site that allows the testing firm to store up to 12, 6-inch by 12-inch concrete cylinders for the initial 24-hours after casting. The controlled space shall maintain a temperature between 60- and 80-degrees Fahrenheit as required by ACI.

1.7 TESTING AND INSPECTION BY OWNER

A. General

1. The Owner has the right to test or inspect any portion of the Work at their expense, as a means of quality assurance. QA testing or inspection by the Owner does not relieve the Contractor of the requirement to provide tests or inspections for quality control purposes.

2. All testing and inspections which shall be paid for by the Owner shall be coordinated and scheduled by the Contractor. Contractor shall copy Owner and Engineer on all requests for testing and inspections.

B. Quality Control

1. Owner will support, appoint, employ, and pay for services of an Independent Testing Firm to perform special inspecting and testing as required per International Building Code (IBC) Chapter 17 within the Structural Footprint.

C. Quality Assurance

1. The Owner or the Owner's Representative will perform Quality Assurance, at the Owner’s expense, as deemed necessary by the Owner or the Owner's Representative. Quality Assurance will include the observation and testing of Contractor's work. Testing will occur after or in conjunction with the Contractor's Quality Control measures. Quality Assurance may be any of the following:

a. Tests by an Independent Testing Firm or Engineer

b. Observation of work

i. Contractor shall cooperate with the Observer/Engineer's Resident Project Representative.

ii. The Contractor shall keep the Owner, Engineer, and Engineer's Resident Project Representative (RPR) apprised of all site activities and cooperate with them so that they are able to provide QA testing and inspection.

c. Contractor shall meet with Engineer's RPR each morning and review with them the proposed activities for the day. Engineer's RPR will notify Contractor which of the proposed day's activities require QA testing or observation by the RPR. Contractor shall give the RPR a minimum of 60 minutes advance warning before an activity occurs which requires QA testing or observation by the RPR.

d. The Owner, Engineer, and Engineer's RPR will utilize the Contractor's schedule to determine if any Work activities require QA by an Independent Testing Firm. Engineer's RPR will notify the Contractor of the required third-party QA, and the Contractor shall coordinate with the Independent Testing Firm to obtain QA.

1.8 SCHEDULING

A. Contractor shall:

1. Submit weekly schedules and updates with days requiring QC testing, inspection, and/or observation services clearly identified.

2. For QC testing, inspection, and observation services requested to occur on Tuesday through Friday: notify Engineer and Independent Testing Firm by 9:00 a.m. the day prior to requiring services.

3. For QC testing, inspection, and observation services requested to occur on Monday: Notify Engineer and Independent Testing Firm by 9:00 a.m. the Friday prior.

4. For QC testing, inspection, and observation services requested immediately following a holiday, as recognized/observed by the Owner: Notify Engineer and Independent Testing Firm by 9:00 am on the business day preceding the holiday.

5. Failure of Contractor to provide adequate notice shall not be grounds for claims of delay by the Contractor.

6. The Contractor shall not proceed with Work requiring testing and inspections if the Independent Testing Firm is unable to accommodate schedule requests.

B. Notify Engineer/Engineer's RPR of all third-party inspections or tests to be performed for Contractor's Quality Assurance purposes.

C. Services of the Independent Testing Firm and the Engineer's RPR shall be performed between the hours of 8:00 AM and 5:00 PM Monday through Friday excluding travel time to the job site, exclusive of recognized federal, state, and local holidays. Contractor shall reimburse Owner for Independent Testing Firm's and RPR's services required outside the specified timeframe. Efforts should be taken by the Contractor to prevent the need for services outside of this timeframe.

D. Contractor shall schedule re-test/re-inspections in accordance with the scheduling requirements herein.

1.9 REPORT REQUIREMENTS

A. Test and Inspection Reports: The Independent Testing Firm shall prepare and submit written reports for each test and/or inspection, and as specifically required in other Specification Sections, to the Contractor, Owner, Building Official / Inspector, and Engineer indicating observations and compliance or non-compliance with the Contract Documents. The Independent Testing Firm shall provide preliminary field reports to the Contractor, Owner, Building Official, and Engineer within 24 hours of leaving the project site. The Independent Testing Firm shall provide reviewed and signed field reports on a bi-weekly basis. They shall include the following with each report:

1. Date of issue.

2. Project title and number.

3. Name, address, telephone number, and email address of testing firm.

4. Date and locations of samples and tests or inspections.

5. Names of individuals making tests and inspections.

6. Description of the Work and test and inspection method.

7. Identification of product and Specification Section.

8. Complete test or inspection data.

9. Test and inspection results and an interpretation of test results when appropriate.

10. Record of temperature and weather conditions at time of sample taking and testing and inspection.

11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.

12. Name or laboratory inspector and signature of reviewer.

13. Recommendations on re-testing and re-inspection.

B. Concrete test reports shall show time and date samples were taken, specific location of concrete placement, slump, air content, ambient air temperature, concrete temperature, date received by lab, field data submitted by, mix number, delivery ticket number, specified strength requirement, requested lab-cure and field-cure break results, day projected high and low temperatures and weather conditions. The Independent Testing Firm shall collect and provide scanned copies of original batch tickets to the Contractor, Owner, Building Official, and Engineer.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

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SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities

B. Barriers

C. Water Control

D. Water Usage

E. Dust Control

F. Erosion and Sediment Control

G. Pollution Control

H. Security

I. Noise Control

J. Protection of Existing Surfaces and Vegetation

K. Protection of Existing and Installed Work

L. Access Roads

M. Parking

N. Progress Cleaning

O. Fire Prevention

P. Field Offices and Sheds

Q. Removal of Utilities, Facilities and Controls

R. Pedestrian Access

1.2 TEMPORARY UTILITIES

A. Provide, maintain, and pay for suitable quality water required for construction operations.

B. Provide potable water for consumption at the construction job sites in conformance with Standard 1926.51 of the OSHA Safety and Health Regulations for Construction.

C. Provide and maintain required sanitary facilities and enclosures. Fixed or portable chemical toilets shall be provided by the Contractor, wherever needed, for use by employees and visitors to the site. Toilets at construction job sites shall conform to the requirements of Standard 1926.51 of the OSHA Safety and Health Regulations for Construction. All toilets shall be provided with hand sanitizer at all times. Sanitary facilities shall be stabilized to prevent being knocked over. Sanitary facilities shall be cleaned, and all debris removed regularly to the satisfaction of the Engineer. Existing facilities shall not be used.

D. The Contractor shall establish a regular collection of all sanitary waste, organic wastes, and other garbage/refuse created from construction activities or personnel. All wastes and refuse from sanitary facilities provided by the Contractor, or organic material wastes from any other source related to the Contractor's operations, shall be disposed of away from the site in accordance with all laws and regulations pertaining thereto. Disposal of all such wastes shall be at the Contractor's expense.

E. Provide, maintain, and pay for temporary electricity as needed for construction. Contractor may utilize the existing power service; however, all of Contractor’s electrical shall be metered separately from the Owner’s electrical usage. Contractor shall reimburse Owner for electrical costs associated with the Work. Contractor’s use of electrical service shall not disrupt Owner’s use of electrical service. Contractor shall coordinate with Owner and utility provider.

F. Provide heating, cooling, and ventilation as necessary for job-site personnel and to protect existing and new Work as required in the Contract Documents. Before operating permanent equipment for construction heating, cooling, or ventilating purposes, verify installation is ready for operation with the Engineer. Provide and pay for operation and maintenance of the systems.

G. Provide telephone and internet service to Contractor’s job office/shed throughout construction. Contractor shall make telephone and internet services available to Engineer / RPR.

H. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.3 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to protect Contractor’s, Engineer’s, and Owner’s personnel from potential hazards thereby allowing for Owner's use of site, to protect public safety, and to protect existing facilities and adjacent properties from damage due to construction activities.

B. Provide protection for plant life designated to remain. Replace damaged plant life to a condition equal to or better than that present prior to beginning work.

C. Protect vehicular traffic, stored materials, site, and structures from damage.

1.4 WATER CONTROL

A. Maintain site drainage during temporary excavations, stockpiling, grading, backfill, etc.

B. Maintain excavations free of water. Provide, operate, and maintain pumping equipment as needed.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion and puddling.

D. Contractor shall follow Best Management Practices as established in the Stormwater Pollution Protection Plan for water control and dewatering activities.

1.5 WATER USAGE

A. Potable water shall be applied at the locations and in the amounts required to properly compact the Work. An adequate potable water supply shall be provided by the Contractor. The equipment used for watering shall be of ample capacity and of such design as to assure uniform application of water in the amounts required.

B. In watering of subgrades, the Engineer may request the Contractor to apply water in such quantities that the subgrade shall be compacted at a moisture content in excess of the optimum moisture point. In no case will the Contractor be required to apply water in excess of three percent (3%) of optimum moisture.

C. Potable water shall be utilized for all construction activities, including but not limited to watertightness, leak, and pressure tests, unless specifically noted otherwise or agreed to by the Engineer and Owner. Disposal of potable water that has been utilized for construction activities shall be coordinated with the Owner and shall be in accordance with all local, state, and federal laws, codes, and regulations.

D. If acceptable to the Owner and the Water Purveyor (if different than Owner), the Contractor may acquire potable water from onsite hydrants for construction use. Contractor shall pay the Water Purveyor directly for water used onsite for construction activities. Hydrants shall be metered and shall have a reduced pressure backflow assembly (RPBA) provided to prevent contamination. Meter, RPBA, and any other appurtenances required by the Water Purveyor shall be provided by the Contractor at no additional expense to the Owner. RPBA shall be required at minimum, regardless of Water Purveyor's requirements.

1.6 DUST CONTROL

A. This Contractor shall furnish and apply POTABLE water for dust control in accordance with the requirements of these specifications.

B. The Contractor shall apply water during the course of the work to control dust, maintaining all embankment and base courses in a damp condition.

C. The Contractor shall provide sufficient equipment to apply water as directed for controlling dust caused by construction activities.

D. Dust control shall be done on Saturdays, Sundays, and Holidays at the same frequency and amounts as specified for workdays at the Contractor's expense.

E. Watering equipment shall consist of water-tight tanks mounted on trucks, adequately powered, and capable of applying water as required. The water shall be applied under pressure from the tank through a spray apparatus. The spray apparatus shall be equipped as to provide uniform, unbroken spread of water over the surface being watered. A suitable device for positive shut-off and for regulating the flow of water shall be located so as to permit positive drive control from the cab.

1.7 EROSION AND SEDIMENT CONTROL

A. Contractor shall comply with all provisions and requirements of the United States Environmental Protection Agency, including, but not limited to, the Utah Pollutant Discharge Elimination System (UPDES) Construction General Permit for Storm Water Discharges from Construction Activities (**SEE LINK BELOW**) and the Construction Storm Water Pollution Prevention Plan (SWPPP).

B. https://deq.utah.gov/water-quality/general-construction-storm-water-updes-permits

C. Contractor shall submit all required elements, including a Notice of Intent (NOI), and complete the UPDES Permit (as necessary) and SWPPP for Engineer's review prior to construction. The SWPPP must be submitted for Engineer review and Owner's approval prior to filing the NOI. Construction will not be permitted without Engineer's review and Owner's approval. Contractor shall comply with all requirements of the UPDES General Permit and SWPPP or such additional requirements as may be required throughout construction as specified by UDWQ, UDEQ, US Environmental Protection Agency, and US Army Corps of Engineers. Engineer and Owner shall not be responsible for Contractor's failure to maintain compliance with such permits or additional requirements.

D. In addition, the Contractor is required to submit an Erosion Control Plan prior to construction that provides a list of the controls and Best Management Practices (BMPs) that will be implemented during construction.

E. Plan and execute construction methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

F. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.

G. Construct fill and waste areas to avoid erosion of surface materials.

H. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

1.8 POLLUTION CONTROL

A. 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.

B. Equipment and fuel storage shall be kept secured. Waste oil and waste fluids shall not be stored or changed at any construction site.

C. Spills of hazardous, dangerous, or toxic materials shall be promptly reported to UDWQ. Contractor shall take emergency measures to stop and contain the spill and limit the amount of material released into the surrounding environment, at Contractor's own expense. Contractor shall be solely responsible for removing and disposing of hazardous, dangerous, and/or toxic materials, as well as any contaminated material in accordance with all applicable laws, codes, and regulations. Contractor shall be solely responsible for cleaning the spill site in accordance with all federal, state, and local laws, regulations, and requirements.

D. Spillage of any liquid other than potable water to the ground is not allowed. Contractor shall implement all necessary Best Management Practices as necessary to prevent spillage. If any spills occur, notify Owner and UDWQ immediately. Contractor shall contain, clean, and remediate the area / site as required by applicable federal, state, and local regulations.

1.9 SECURITY

A. Provide security and temporary fencing of facilities to protect work from unauthorized entry, vandalism, and/or theft.

1.10 NOISE CONTROL

A. Construction involving noisy operations, including starting and warming up of equipment, shall be restricted to the hours noted in Section 01 10 00 – Summary of Work. Noisy operations shall be scheduled to minimize their duration and to ensure their completion within the contract working hours.

1.11 PROTECTION OF EXISTING SURFACES AND VEGETATION

A. All landscaped areas, including trees, grass, or other plants, and other surfaces which are not noted for demolition or modification, but which are damaged by actions of the Contractor, shall be restored to a condition equal to or better than it was prior to construction.

B. Areas shall not be cleared until related construction activities require the work.

1.12 PROTECTION OF EXISTING AND INSTALLED WORK

A. Contractor shall retain and protect all existing components not specifically noted for modification, demolition, and/or removal. Any damage to existing components or facilities within the active construction site which occurs during the course of construction shall be repaired or replaced, at Owner's discretion, to a condition acceptable to the Owner at Contractor's expense.

1. The active construction site shall include any area where Work is shown to occur in the Contract Documents, all access roads or paths used by construction personnel, and any areas where construction materials or equipment are stored.

2. Contractor shall submit their proposed plan for repair or replacement to the Engineer and Owner for review and acceptance prior to making repairs or replacements.

B. Protect Work installed as part of this project and provide special protection where required in the Contract Documents.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide temporary partitions to separate work areas from Owner-occupied areas as required in the Contract Documents, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment. Temporary partitions shall consist of framing and reinforced polyethylene, at minimum.

E. Existing and new components, including but not limited to electrical vaults, manholes, or other components, may not be rated for construction traffic or point loading due to equipment used during construction. Contractor is responsible for protecting all existing and new components from loads which exceed their rated values.

F. If the Contractor is required to provide Work within an existing structure and the Contractor is either required by the Contract Documents, or as part of their means and methods decides to remove windows, doors, or other items to obtain access for construction, the Contractor shall provide weather protection, heating and cooling to the satisfaction of the Owner and at no additional cost. Openings in exterior surfaces shall be closed when not in use with a material acceptable to the Engineer.

G. Where new Work abuts or aligns with existing Work, provide smooth and even transitions. Patch Work to match the original condition of the existing adjacent Work in texture and appearance, unless specifically noted otherwise.

H. Where a smooth transition with the new Work is not possible, the Contractor shall coordinate with the Engineer to determine termination and transition requirements.

1.13 ACCESS ROADS

A. Construct and maintain temporary roads accessing public thoroughfares to serve construction area. Contractor shall provide temporary roadways when, in the opinion of the Owner, construction activities limit the Owner's access and use of existing roads or access to buildings.

B. Provide and maintain access to fire hydrants free of obstructions.

C. Provide and maintain access for emergency vehicles, mail delivery, trash pickup, etc.

D. Provide and maintain access to existing driveways and approaches to private residences.

E. Tracking of dirt and mud offsite is not permitted. Provide means of removing dirt and mud from vehicles before leaving the Project site. If tracking off the Project site occurs, Contractor shall be responsible for cleaning impacted areas offsite at no additional cost to Owner.

1.14 PARKING

A. Do not allow construction personnel to park in any way which may affect the access and egress of plant personnel, deliveries, emergency vehicles, etc. The Contractor shall designate a separate parking area for Contractor's personnel and equipment, which shall be reviewed and approved by Owner if located on the Project site. Provide off-site parking as necessary in compliance with local requirements.

1.15 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition. Establish regular intervals of collection and disposal of waste.

B. Remove debris from pipe chases, attics, crawl spaces, and other closed or remote spaces before enclosing.

C. At no additional cost to Owner, remove waste materials, debris, and rubbish from the site and dispose it off-site at a solid waste facility in accordance with local codes and ordinances governing locations and methods of disposal.

1.16 FIRE PREVENTION

A. Prohibit smoking, including the use of e-cigarettes and vaping, except in a designated smoking area. Smoking area shall be in an area acceptable to the Owner. Contractor shall provide approved ashtrays in designated smoking area.

B. Establish fire watch for cutting, welding, and other hazardous operations capable of starting fires. Maintain fire watch before, during, and after hazardous operations until threat of fire does not exist.

C. Portable Fire Extinguishers: NFPA 10; 10-pound capacity, 4A-60B: C UL rating.

1. Provide one fire extinguisher at each stairway on each floor of buildings under construction.

2. Provide a minimum of one fire extinguisher in each field office and enclosed storage space.

3. Provide a minimum of one fire extinguisher on each roof during roofing operations using heat-producing equipment.

1.17 FIELD OFFICES AND SHEDS

A. Contractor's Job Office

1. Contractor shall provide a temporary office to house record drawings as well as other project documents, and for their job superintendent's use.

2. Office Requirements: Weather-tight, with lighting, electrical outlets, telephone service, internet, and heating and cooling equipment. Office shall be equipped with sturdy furniture and drawing display table. Office shall also include a color printer, with ink and paper, capable of making 8 1/2" x 11" and 11" x 17" prints as well as copies. Engineer and their Resident Project Representative shall be allowed to use the printer to make color copies and print documents in color for onsite project use at any time, at no additional cost to the Owner.

3. Size shall be sufficient for Contractor's needs and to provide space for Project meetings, including but not limited to weekly progress meetings, and shall include a table and chairs to accommodate ten persons.

B. Resident Project Representative (RPR) Work Area

1. Contractor shall provide a dedicated area for RPR's use, which may be part of Contractor's Job Office or a in separate building.

2. Provide a desk and chair, electrical outlets (minimum of two), internet connection, HVAC to maintain interior temperatures between 60 and 75°F.

C. Existing facilities shall not be used for field offices.

D. Field offices shall not be used for storage of products.

E. Coordinate location of field offices with Owner and Engineer. Fill and grade site for temporary structures, sloping away from buildings for drainage. Contractor shall always maintain access to field offices.

F. Field offices shall be ready for occupancy 15 days after Notice to Proceed.

1.18 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary above grade or buried utilities, equipment, facilities, and/or materials prior to Substantial Completion.

B. Clean and repair damage caused by installation or use of temporary work.

C. Restore existing facilities used during construction to original condition unless specifically noted otherwise.

1.19 PEDESTRIAN ACCESS

A. Provide access by pedestrian foot traffic to the facility during construction.

B. Protect pedestrians from potentially dangerous areas by barricades, walkways, signs, or other means as appropriate and necessary.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

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SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products

B. Transportation and handling

C. Storage and protection

D. Product options

E. Substitutions

1.2 PRODUCTS

A. Products: For the purposes of this Specification Section, “product” is defined as any material, machinery, components, equipment, fixtures, and/or system(s), including any and all spare parts, forming the Work. Products do not include machinery and equipment used for the preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.

B. All products, except those specifically identified within the Contract Documents as existing or intended for reuse, shall be new, unused, unopened, and in their original containers.

C. Products which have a “best by” or “expiration” date shall be incorporated into the Work prior to the date stated on the product or its container. Products which have been opened prior to the date stated on the product or its container, but not incorporated into the Work prior to the “best by” or “expiration” date, shall be disposed of in accordance with all federal, state, and local laws, regulations, and requirements. The use of products past their “best by” or expiration date is strictly prohibited.

D. Provide products produced by qualified manufacturers that are suitable for the intended use. Provide products of each type by a single manufacturer unless specifically noted otherwise. Products from different manufacturers which are intended for the same use shall not be mixed.

E. Do not use materials and equipment from the existing premises, except as specifically permitted by the Contract Documents.

1.3 TRANSPORTATION AND HANDLING

A. Transport and handle products in accordance with manufacturer's instructions, requirements, and recommendations.

B. Promptly review shipments to assure that products comply with the Contract Documents and submittals, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products in accordance with the manufacturer's requirements and recommendations, and by methods which prevent soiling, disfigurement, or damage.

1.4 STORAGE AND PROTECTION

A. Existing facilities shall not be used for storage unless agreed to in writing by the Owner. If use of existing facilities is agreed to by Owner, Contractor assumes all responsibility for monitoring and maintaining suitable environmental conditions for products in accordance with the manufacturer's requirements.

B. Store and protect products in accordance with manufacturer's instructions, requirements, and recommendations. All seals and labels shall remain intact and legible. Store products to prevent soiling, disfigurement, or damage.

C. Spare sparts shall be stored by the Contractor until Substantial Completion. Any spare parts which are used during start-up or commissioning shall be replaced in kind by the Contractor prior to Substantial Completion.

D. For exterior storage of products where permitted by the manufacturer, place on sloped supports, above ground.

E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

1. All PVC products shall be stored in a manner that prevents UV damage including, but not limited to, sun fading and discoloration.

2. All products with a primer or coating shall be stored in a manner which protects the primer or coating. Primed surfaces shall not be exposed to weather for more than two months before being top-coated, or less time if recommended by the coating manufacturer.

F. Store loose granular materials on solid, flat surfaces in a well-drained area. Prevent mixing with foreign matter.

G. Arrange storage of products to permit access for review by Owner and Engineer. Contractor shall periodically review stored products (not less frequently than monthly) to assure products are undamaged and are maintained under specified conditions.

H. Contractor shall be solely responsible for any damage which occurs due to, in the opinion of the Engineer, improper storage, transportation, or handling. Contractor shall repair or replace, at Engineer's discretion, any damaged product at no additional cost to the Owner.

1.5 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product, which in the opinion of the Engineer, satisfies those standards or description.

B. Products Specified by Naming One or More Manufacturers with a Provision for 'Or Equals" or Substitutions: Contractor shall provide the listed product or submit a request for "or equal" or "substitution" for any manufacturer or product not named.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

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SECTION 01 60 10
DESIGN REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS AND NON-BUILDING STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes: Minimum structural requirements for the design, anchorage, and bracing of Non-Structural Components such as architectural, process mechanical, mechanical/HVAC, electrical components, equipment, or systems, and Non-Building Structures such as tanks.

B. The requirements of this section apply to design of the structural elements and features of equipment and to platforms/walkways that are provided with equipment or Non-Building Structures .

C. This section applies to Non-Building Structures and Non-Structural Components that are permanently attached to structures as defined below and in American Society of Civil Engineers (ASCE) 7.

D. Design shall conform to criteria and design codes listed within this section. Engineering design is not required for attachments, anchorage, or bracing when specifically detailed on the Drawings, nor where the size of attachments, anchorage, or bracing is specifically defined in individual equipment technical specification sections.

E. The following Non-Structural Components are exempt from seismic design loading requirements of this section.

1. Mechanical and electrical components in Seismic Design Categories C, D, E, or F where all of the following apply:

   a. The component importance factor, Ip, is equal to 1.0;

   b. The component is positively attached to the structure;

   c. Flexible connections are provided between the component and associated ductwork, piping, and conduit;

   d. And either:

      i. the component weighs 400 pounds or less and has a center of mass located four feet or less above the adjacent floor level; or

      ii. the component weighs 20 pounds or less, or in the case of a distributed systems, five pounds per foot or less.

1.2 REFERENCES

A. The references listed below are a part of this section. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
Aluminum Design Manual	Aluminum Association, Aluminum Design Manual with Specifications and Guidelines for Aluminum Structures
AAMA	American Architectural Manufacturer's Association
ACI 318	Building Code Requirements for Structural Concrete
AISC 341	Seismic Provisions for Structural Steel Buildings
ACI 360	Specification for Structural Steel Buildings
ASCE 7	Minimum Design Loads for Buildings and Other Structures
AWS D1.1	Structural Welding Code – Steel
AWS D1.2	Structural Welding Code - Aluminum
AWS D1.6	Structural Welding Code – Stainless Steel
AWS D1.8	Structural Welding Code – Seismic Supplement
IBC	International Building Code with local amendments
NFPA-13	Installation of Sprinkler Systems
OSHA	U.S. Dept. of Labor, Occupational Safety and Health Administration
SMACNA	Seismic Restraint Manual Guidelines for Mechanical Systems

1.3 DEFINITIONS

A. Structure: The structural elements of a building or tank that resist gravity, seismic, wind, and other types of loads. Structural components include columns, posts, beams, girders, joists, bracing, floor or roof sheathing, slabs or decking, load-bearing walls, stairs, and foundations.

B. Non-Structural Components: Non-structural portions of a building include every part of the building and all its contents, except the structural portions, that carry gravity loads and that may also be required to resist effects of wind, snow, impact, temperature and seismic loads. Non-structural components include, but are not limited to, ceilings, partitions, windows, equipment, piping, ductwork, furnishings, lights, etc.

C. Non-Building Structures: Self-supporting structures that carry gravity loads and that may also be required to resist the effects of wind, snow, impact, temperature and seismic loads. Non-building structures include, but are not limited to, pipe racks, storage racks, stacks, vessels and structural towers that support pipes, pre-fabricated tanks and vessels.

1.4 SUBMITTALS

A. Action Submittals:

1. Procedures: Section 01 33 00.

2. For structural elements of Non-Structural Components and Non-Building Structures required to be designed per the Contract Documents, provide drawings and design calculations stamped by a licensed professional engineer qualified to perform structural engineering in the state the project resides.

3. List of Non-Structural Components and Non-Building Structures requiring seismic design and anchorage.

4. Shop drawings showing details of complete seismic bracing and anchorage attachment assemblies including connection hardware, and embedment into concrete.

5. Shop drawings showing plans, elevations, sections and details of equipment support structures and Non-Building Structures, including anchor bolts, structural members, platforms, ladders, and related attachments.

6. Identify interface points with supporting structures or foundations, as well as size, location, and grip of required attachments and anchor bolts. Clearly indicate who will be providing each type of attachment/anchor bolt. Equipment manufacturers shall design anchor bolts, including embedment into concrete, and submit stamped calculations.

7. Calculations for supports, bracing, and attachments shall clearly indicate design criteria applied. Coordinate concrete embedment calculations with thickness and strength of concrete members. Submit a tabulation of the magnitude of unfactored (service level) equipment loads at each support point, broken down by type of loading (dead, live, wind, seismic, etc.). Indicate impact factors applied to these loads in design calculations.

1.5 QUALITY ASSURANCE

A. Quality Control By Owner:

1. Special Inspection of Non-Structural Components and Non-Building Structures , and their anchorages shall be performed by the Special Inspector under contract with the Owner and in conformance with International Building Code (IBC) Chapter 17. Special Inspector(s) and laboratory shall be acceptable to the Owner in their sole discretion. Special Inspection is in addition to, but not replacing, other inspections and quality control requirements. Where sampling and testing required conforms to Special Inspection standards, such sampling and testing need not be duplicated. Reference Section 01 40 00 Quality Assurance and Quality Control.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide materials in conformance with information shown on the Drawings and in other technical specification sections. See individual component and equipment specifications for additional requirements.

2.2 2.2 DESIGN CRITERIA

A. Design Codes

Design	Code
Buildings/Structures:	International Building Code 2018 and ASCE 7-16
Reinforced concrete:	Structures, ACI 318-14
Structural steel:	AISC 360-16 and AISC 341-16
Aluminum:	Aluminum Design Manual, Latest Edition
Welding:	AWS Welding Codes, Latest Edition
Occupational health and safety requirements:	OSHA

Note: When conflicting requirements occur, the most stringent requirements will govern the design.

B. Design Loads

1. Design Non-Structural Components and Non-Building Structures for the following minimum loads:

2. Dead Loads:

   a. Add an additional allowance for piping and conduit when supported and hung from the underside of equipment and platforms.

   b. Typical allowance for piping and conduit: 15 psf

3. Seismic Loads:

Code:	IBC 2018 & ASCE 7-16
Risk Category:	III (Wastewater Treatment Facilities are Risk Category III)
0.2 Sec. Mapped Spectral Response, S_S:	0.388 g
1.0 Sec. Mapped Spectral Response, S_1:	0.140 g
Site Class:	C
0.2 Sec. Design Spectral Response, S_{DS}:	0.336 g
1.0 Sec. Design Spectral Response, S_{D1}:	0.140 g
Importance Factor (I_e):	1.25
Component Importance Factor (I_p):	1.0, except I_p=1.5 for components identified in Section 13.1.3 of ASCE 7
Seismic Design Category	C

Notes:

1. *Calculate seismic loads on the basis of governing building code. Include equipment operating loads in structure dead load.*
2. *Check individual members for seismic and full member live load acting simultaneously, except that flooded equipment loads (infrequent occurrence) need not be combined with seismic loads. Combine equipment operating loads with seismic loads.*

4. Impact Loads:

   a. Consider impact loads in design of support systems.

   b. Use the following impact load factors unless recommendations of the equipment manufacturer will cause a more severe load case:

Rotating machinery:	20% of moving load
Reciprocating machinery:	50% of moving load

C. Load Combinations

1. Design Non-Structural Components and Non-Building Structures to withstand load combinations as specified in the governing building code. Where the exclusion of live load or impact load would cause a more severe load condition for the member under investigation, ignore the load when evaluating that member.

D. Deflection

1. Maximum total load deflection for equipment support: L/450.

PART 3 EXECUTION

3.1 GENERAL

A. Make attachments and braces in such a manner that component force is transferred to the lateral force-resisting system of the structure. Base attachment requirements and size and number of braces per calculations submitted by Contractor.

B. Anchorage of equipment is specified to be made by cast-in anchor bolts in concrete elements unless specifically noted otherwise on the Drawings or other specification sections. Contractor is responsible for remedial work or strengthening (of concrete elements because of superimposed seismic loading) if anchor bolts are improperly installed or omitted due to lack of submittal review or improper placement for any reason, at no additional cost to Owner.

C. Submit details of and calculations for anchorages prior to placement of concrete or erection of other structural supporting members. Submittals received after structural supports are in place will be rejected if proposed anchorage method would create an overstressed condition of the supporting member. Contractor is responsible for revisions to anchorages and/or strengthening of structural support so that there is no overstress condition, at no additional cost to Owner.

END OF SECTION

SECTION 01 60 25
PRE-PROCURED EQUIPMENT COORDINATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description of Pre-Procured Equipment

B. Coordination and Delivery

C. Schedule

D. Payment

1.2 REFERENCES

A. Section 01 10 00 – Summary of Work

B. Section 01 20 00 – Measurement and Payment

C. Section 01 32 17 – Work Sequence

D. Section 11 30 10 – MBR Equipment Coordination & Installation

E. Volume IV – Veolia MBR Equipment Documentation (procured by Owner), including:
   1. Executed Contract Documents
   2. Shop Drawings

1.3 DESCRIPTION OF PRE-PROCURED EQUIPMENT

A. The Owner has previously entered into agreement with the equipment supplier listed below to provide Special Engineering Services and to Furnish the Goods according to Pre-Procured Contract Documents for each system.

   1. Veolia Water Technologies & Solutions – MBR Equipment

      a. The Owner has previously purchased a portion of the equipment for this work, which generally includes the membrane filtration equipment, permeate pumping systems, air scour blower instrumentation, chemical feed systems, instrumentation, and control system. The Contractor will be required to coordinate with Veolia and will be responsible for installation and startup of the equipment. This equipment has been purchased through the Owner-Veolia Procurement Agreement.

      b. Reference Volume IV: Membrane Equipment Manufacturer Documents for pre-procured agreement and contract documents.

c. Equipment submittals are currently not approved.

B. Owner has completed the Special Engineering Services portion of the contract for each Equipment item. Owner will assign each contract for pre-procurement equipment to the Contractor per the Agreement. Upon assignment, Contractor will be responsible for coordinating with equipment suppliers for fabrication, furnishing, delivery, payment, installation, inspection, commissioning, and owner training.

1.4 COORDINATION AND DELIVERY

A. Contractor is required to attend coordination meetings with pre-procured equipment Suppliers, Owner, and Engineer at no additional cost to Owner.

B. Contractor shall coordinate with the equipment Suppliers and Owner as required during the course of this project during all work phases. Coordination shall include, but not be limited to, scheduling for delivery, unpacking, warehousing, shutdowns, equipment installation, startups, testing, meetings, and demonstration period operation to minimize conflicts and to facilitate usage of the facility by the Owner.

C. Contractor will coordinate with equipment Suppliers to inspect all packing lists (bills of lading) for completeness of orders during delivery and unloading of pre-procured equipment.

D. Contractor shall provide storage for all goods from equipment Suppliers as outlined in the Contract Documents and Procurement Documents, at no additional cost to Owner.

1.5 SCHEDULE

A. The delivery schedule for the pre-procured equipment is outlined in the Procurement Agreements between the Owner and the equipment Suppliers which are assigned to the Contractor as part of this Contract. The Contractor shall coordinate their work to comply with the schedule specified in the Procurement Contracts.

1.6 PAYMENT

A. The Contractor is required to pay applicable use-taxes under State of Utah Tax Law.

B. Requests for payment from pre-procured equipment suppliers shall be sent to the Contractor. Contractor will include these requests in Contractor's Applications for Payment for review by Engineer and Owner. Payment for pre-procured equipment goods and special services will be made to the Contractor who shall be responsible for paying the pre-procured equipment suppliers.

C. Contractor will provide documentation regarding coordinated work, inspections, delivery inspections, etc. as requested by the Owner/Engineer to support or deny claims for payment.

D. Progress payment to equipment Suppliers shall be made in accordance with the applicable Procurement Agreement schedule milestones, terms, and conditions.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

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SECTION 01 65 00
COMMISSIONING OF SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Section includes overall coordination, scheduling, submittals and checklists for equipment and system Start-up and Testing, Owner Training, Acceptance Testing, and Commissioning.

B. The order of events shall be as follows:

1. Initial starting and testing of equipment

2. Owner Training

3. Owner Programming Period (and support through Acceptance Testing)

4. Acceptance Testing

   a. Initial Acceptance Testing: Closed-loop testing of individual unit processes

   b. Final Acceptance Testing: Full-scale testing of interconnected unit processes

5. Commissioning

1.2 RELATED SECTIONS

A. Section 01 32 17 – Work Sequence

B. Section 01 70 00 – Closeout Requirements

C. Section 01 73 00 – Installation, Operation, and Maintenance Manuals

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. Throughout the activities discussed in this section, Contractor, and Contractor's subcontractors (as deemed appropriate by Owner and Engineer) shall be present for repair, correction of incomplete work, alteration, or unscheduled/unforeseen adjustments to any equipment and associated systems.

B. "Equipment" consists of individual items (e.g. a pump, blower, etc.), which must function properly with interconnected and ancillary equipment and components to form a "system". "Process Areas" consist of one or more interconnected systems.

C. Contractor shall provide all labor, power, fuel, supervision, utilities, chemicals, maintenance, equipment, vehicles, water, or any other item necessary to proceed with the steps discussed in this section and other applicable portions of the Contract Documents. This includes all temporary systems, plugs, piping, and equipment required for testing individual systems in closed loops as noted herein, or as otherwise deemed necessary by the Engineer.

D. If Contractor must reschedule any activities covered in this specification once a date has been agreed upon by all parties, Contractor shall provide a minimum of one working day's notice of cancellation prior to the agreed-upon date. The activity shall then be rescheduled based on Owner's and Engineer's availability.

3.2 INITIAL STARTING AND TESTING

A. Establish a schedule for initial starting and testing of all equipment / systems in the project. The schedule shall be included in Contractor's weekly schedule updates (reference Section 01 32 17).

B. To minimize overwhelming the Owner's staff, the Contractor shall undertake no more than one major process component (e.g. a membrane system) or two equipment items or systems (e.g. a pump, blower, or similar) per week.

C. Prepare and submit a separate detailed schedule for activities, including dates for activities, personnel involved, contact information for vendors, and other pertinent information.

D. Contractor shall conduct a meeting at least 10 working days prior to initial starting and testing of each item. Required attendance includes the following: Contractor, critical subcontractors (e.g. electrical, control system integrators), equipment vendors (remote attendance is permissible), Engineer, Owner, and others as applicable.

E. Prior to energizing the equipment or system:

1. Verify that each piece of equipment in a system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions that may cause damage.

2. Verify wiring and support components for equipment are complete and have been previously tested.

3. Verify all instrumentation and controls are complete in the system and have undergone testing in accordance with Division 26 requirements, including performing loop checks on all installed wiring. No further testing, programming, or commissioning activities can be completed until all loop checks have been completed.

4. Manufacturer shall provide an authorized representative to be present at site to inspect, check, and approve equipment / system installation prior to initial starting and testing, and to supervise placing equipment or system in operation.

F. Contractor shall confirm that additional tests and inspections as required by the manufacturer, technical specifications, and Pre-Procured Equipment Contract Documents have been completed.

G. Verify that tests, meter readings, and specified electrical characteristics agree with those required by Contract Documents and the equipment or system manufacturer.

H. Execute initial starting and testing under supervision of responsible manufacturer's representative and in accordance with manufacturers' instructions, recommendations, and requirements.

1. Minimum time on-site and number of trips to site by manufacturer's representative are listed in the respective technical specifications.

2. If not listed in the technical specifications, provide at least one 8-hour day for each equipment item.

I. Equipment / systems shall be capable of full-time operation with all associated controls, instruments, sensors, etc. completely functional (less Owner's Programming). "Bump Tests" (i.e. operating a piece of equipment for several seconds to confirm proper rotation) do not constitute starting and testing of equipment / systems. Contractor shall provide temporary pump(s), piping, and other items necessary to replicate design flows for the purpose of providing flow to system facilities for testing. Contractor is required to provide all equipment, fuel, controls, and necessary piping for suction and discharge from the pump(s) as necessary for start-up and testing purposes.

J. Notice of Completed Installation

1. Once an equipment / system has undergone Initial Starting and Testing, Contractor shall submit a certified report to Engineer (using the form inserted at the end of this specification and supplemented with manufacturer's checklists and forms) that the requirements are complete. Certificate shall be signed by Contractor and Manufacturer/Supplier. Contractor shall include a letter to Engineer titled, "Request for Notice of Completed Installation of Equipment/System *[Item]*".

2. Engineer shall review the Contractor's request, and if all obligations have been fulfilled to the satisfaction of the Engineer, the Engineer shall issue a letter to the Contractor and Owner titled: "Notice of Completed Installation of Equipment/System *[Item]*".

3. Upon issuance of "Notice of Completed Installation of Equipment/System *[Item]*" by Engineer, Contractor may proceed with Owner Training for that system/piece of equipment.

4. Once all equipment items and systems in a Process Area have undergone Initial Starting and Testing, Contractor shall issue a letter to Engineer titled, "Request for Notice of Completed Installation of Process Area *[Item]*".

5. Engineer shall review the Contractor's request, and if all obligations have been fulfilled to the satisfaction of the Engineer, the Engineer shall issue a letter to the Contractor and Owner titled: "Notice of Completed Installation of Process Area *[Item]*".

3.3 OWNER TRAINING

A. Owner Training shall not commence until "Initial Starting and Testing of Equipment/Systems" is complete and the equipment or system is able to operate satisfactorily with all associated controls, instruments, sensors, etc.

B. Contractor shall coordinate the training day and time with the Owner for an occasion when Owner's operating personnel are available. Notify Owner and Engineer a minimum of ten working days prior to intended start date of training. Training shall only occur on Tuesdays, Wednesdays, or Thursdays, unless previously approved by the Owner.

C. To minimize overwhelming the Owner's staff, the Contractor shall undertake no more than one major process component (e.g. a membrane system) or two equipment items or systems (e.g. a pump, blower, or similar) per week.

D. Manufacturer's Representative, in conjunction with Contractor, shall conduct Operator/Owner Training. Training duration shall be as listed below. Training may be completed during the same trip to site as the Initial Starting and Testing of System, if adequate time is available.

1. Minimum training time by manufacturer's representative is listed in the respective technical specifications.

2. If not listed in the technical specifications, provide at least one 8-hour day for each system.

E. Utilize operation and maintenance manuals as the basis for instruction. A complete draft copy of the Preliminary Operation and Maintenance (O&M) Manuals (see Section 01 73 00) shall be available for each of the Owner's operating personnel who attend the training. Contractor shall provide a printed copy of the Preliminary O&M for each operator who attends the training at no additional cost. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance. Owner Training shall include the use of slides, videos, literature, diagrams, and/or oral presentations as necessary to present comprehensive, detailed instruction of operation and maintenance requirements of the equipment.

F. Training shall be divided into two parts: Classroom and Field Training.

1. Classroom training shall include a slide presentation and shall utilize the Preliminary operation and maintenance manual as the basis of instruction. Contractor shall provide a printed hard copy of the slide presentation to the Owner, as well as a digital copy of the presentation on a USB.

2. Upon satisfactory completion of the classroom training, continue training with a field training session utilizing the installed equipment. Equipment shall be run in all available control modes and sequences of operation as part of the Training.

G. The Owner/Engineer may record the training sessions. The recording produced shall be the sole property of the Owner and Engineer.

H. Upon completion of "Operator/Owner Training" for each equipment item or system, submit a certified report to the Engineer (using the form inserted at the end of this specification and supplemented with manufacturer's checklists and forms) that the requirements are complete and that system is ready for the start of the "Owner's Programming Period."

3.4 OWNER'S PROGRAMMING PERIOD

A. Owner shall contract separately for SCADA programming for the facility, excluding vendor-provided control packages included with equipment.

B. Duration:

1. Owner's Programming Period shall not commence until Initial Starting and Testing of each Process Area is complete. Owner Programming Periods shall not overlap.

2. Owner reserves the right to begin portions of the programming upon Notice of Completed Installation of an individual Process Area; however, such work shall not reduce the calendar days established herein.

3. Delays to the Programmer caused by correction or troubleshooting of Contractor's Work shall be grounds for an extension of the Owner's Programming period a commensurate amount of time at no additional cost to the Owner.

C. The installation, programming, and testing of the Work requires considerable coordination between the Owner, Owner's SCADA Programmer, and the Contractor. The Contractor will provide on-site assistance through testing of the SCADA Programming.

D. Contractor shall provide on-site support during Owner's programming period to expedite system SCADA programming and testing. Contractor shall provide skilled labor capable of troubleshooting and making modifications to the various Work trades, including but not limited to mechanical, electrical, and instrumentation systems as necessary and within the Contract Document requirements. The Contractor shall be responsible for making any adjustments and/or modifications to the installation process that may become necessary to ensure that all equipment is properly installed.

E. Contractor (including the electrical contractor and control systems integrator) shall attend weekly controls coordination meetings with the SCADA Programmer, Owner, and Engineer at no additional cost to the Owner. Controls coordination meetings will be held during Initial Starting and Testing of Systems through completion of the Owner's Programming Period.

F. Upon completion of "Owner's Programming Period", Engineer shall issue a letter to Contractor titled: "Notice of Completed Owner Programming". Upon Notice of Completed Programming, Contractor shall commence with Acceptance Testing of Systems.

G. Owner's programmer shall be available for troubleshooting and coordination with Contractor during Acceptance Testing period.

3.5 ACCEPTANCE TESTING

A. Following completion of Contractor's Initial Starting and Testing Activities, Owner Training, and Owners Programming Period, and provided ancillary Work is sufficiently complete to permit operation of components (as determined by the Engineer), Acceptance Testing may begin.

B. At least fifteen calendar days prior to intended start date of Acceptance Testing of Systems, Contractor shall schedule a meeting with Owner and Engineer to review Contractor's plan for Acceptance Testing.

C. Acceptance Testing shall be performed in two phases to minimize disruption to the existing facility and to facilitate troubleshooting during testing.

1. Initial Acceptance Testing

a. Shall be performed in a “closed-loop” for individual unit processes as defined by the Engineer.

b. Initial Acceptance Testing shall use potable water for “closed-loop” testing.

c. Contractor shall provide all equipment, fuel, controls, piping, and other appurtenances as necessary for acceptance testing purposes in a closed-loop, including temporary items if necessary.

d. Demonstrate functional integrity under full operational conditions, including normal, alternate, and emergency conditions, as defined by the Engineer. Temporary pumping systems shall be capable of turn-down to simulate diurnal or other anticipated variation through the process, as required by the Engineer. The pumping system turn-down shall meet the intended operating flow regime for the unit process from 20% of peak flow through 100% of peak flow, unless specifically noted otherwise.

e. Period shall be a minimum of 7 calendar days with uninterrupted, continuous, and automatic operation (i.e., 24 hours a day), unless a longer period or more restrictive performance testing requirements are specified in a separate technical specification or Pre-Procured Equipment Contract Document.

f. Schedule Initial Acceptance Testing sequentially among Process Areas to allow for Owner and Engineer involvement with each system. Initial Acceptance Testing may only be scheduled concurrent with testing of another Process Area upon written approval by Owner and Engineer. Initial Acceptance Testing for all process areas shall be completed before Final Acceptance Testing begins.

g. Dates for the beginning and ending of Initial Acceptance Testing shall be agreed upon by Contractor, Owner, and Engineer in advance of initiating Initial Acceptance Testing Period.

h. If, during Initial Acceptance Testing, the aggregate amount of time used for repair, correction of incomplete work, alteration, or unscheduled adjustments to any equipment or system renders the affected equipment or system inoperative for more than 8 hours of the scheduled Acceptance Testing period, the demonstration of functional integrity will be deemed to have failed. In the event of failure, a new Acceptance Testing Period shall commence after correction of the cause

of failure. The new Acceptance Testing Period shall have the same requirements and duration as the Acceptance Testing Period previously conducted. Repairs, alterations, and adjustments, as well as failed and restarted Acceptance Testing periods shall be at no additional cost to the Owner and shall not be eligible for claims of delay by the Contractor.

2. Final Acceptance Testing

   a. Upon successful completion of Initial Acceptance Testing, and approval by Owner and Engineer, Final Acceptance Testing may commence. Dates for the of beginning of Final Acceptance Testing shall be agreed upon by Contractor, Owner, and Engineer in advance of initiating Final Acceptance Testing Period.

   b. Testing shall be performed "live" with influent flow to test and demonstrate operation and functionality of the system. Final Acceptance Testing shall not begin until after Initial Acceptance Testing has been successfully completed for all process areas.

   c. Period shall be a minimum of 14 calendar days with uninterrupted, continuous, and automatic operation (i.e., 24 hours a day), unless a longer period or more restrictive performance testing requirements are specified in a separate technical specification or Pre-Procured Equipment Contract Document. Final Acceptance Testing shall not be concurrent with Initial Acceptance testing.

D. Demonstrate the operation, control, adjustment, and functional integrity of the process mechanical, mechanical, electrical, and control interfaces of the respective equipment and components comprising the facility or system.

E. Owner shall provide operational personnel to provide process decisions affecting plant performance during Owner's regular work hours. Owner's assistance shall only be available for process decisions. Contractor shall perform all other functions, including, but not limited to, equipment operation and maintenance throughout the Acceptance Testing period.

F. Owner and Engineer reserve the right to simulate operational variables, equipment failures, routine maintenance scenarios, etc. to verify the functional integrity of automatic and manual backup systems and alternate operating modes during Acceptance Testing. Should any simulation cause the system to fail or operate in an unsatisfactory manner, in the opinion of the Engineer or Owner, the Contractor shall be responsible for repairs and/or corrections.

G. Provide knowledgeable personnel to answer Owner's questions throughout the Acceptance Testing Period.

H. Provide field instruction on systems and respond to any system problems or failures that may occur.

I. Upon completion of Acceptance Testing, submit a certified report to Engineer (using the form inserted at the end of this specification and supplemented with manufacturer's checklists and forms) that the requirements are complete and that system is ready for Commissioning. Certificate shall be signed by Contractor and Manufacturer/Supplier.

3.6 COMMISSIONING

A. When adequate Training, Owner Programming, and successful Acceptance Testing of all systems within a Process Area is completed to the satisfaction of the Owner and Engineer, the Process Areas may be considered Commissioned.

B. Commissioning is defined as full integration of the equipment, including all electrical, controls, instrumentation, and all other support systems necessary for operation of the entire Process Area as designed.

C. Owner reserves the right to withhold payment on individual equipment items until such time as Commissioning may commence.

D. Submit a certified report to Engineer (using the form inserted at the end of this specification and supplemented with manufacturer's checklists and forms) stating that all preceding requirements have been completed and that the system is ready for Commissioning by Owner. Certificate shall be signed by Contractor and Manufacturer/Supplier.

E. Substantial Completion of the Work, or portions thereof, shall be no earlier than the date of completed Commissioning for the Process Areas.

3.7 OVERALL COMMISSIONING SEQUENCE

A. Reference Section 01 32 17 Work Sequence for coordination of process areas, including required predecessors and operational impacts. Not all components or support systems in the Work are shown or discussed. Contractor is responsible for developing an overall startup sequencing plan to meet the Contract requirements:

CONTRACTOR & MANUFACTURER/ SUPPLIER CERTIFICATE
Section 01 65 00 Commissioning of Systems
Initial Starting and Testing of Systems (Paragraph 3.2)

The following certificate shall be completed for each equipment item or system

Project Name _____ Equip Item/ Tag _____

Owner _____ Specification No. _____

Engineer _____ Serial No. _____

Contractor _____

Equip Mfg./ Supplier Start-up Representative and Contact Information:

Item No.	Description	Date Completed
1	(3.2.D) Conduct a meeting at least 10 working days prior to initial starting and testing of each item.	
2	(3.2.E.1) Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions that may cause damage	
3	(3.2.E.2) Verify wiring and support components for equipment are complete and have been previously tested.	
4	(3.2.E.3) Verify all instrumentation and controls are complete and have undergone testing in accordance with Division 26 requirements	
5	(3.2.D.4) Provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to initial starting and testing, and to supervise placing equipment or system in operation	
6	(3.2.G) Verify that tests, meter readings, and specified electrical characteristics agree with those required by Contract Documents and the equipment or system manufacturer	
7	(3.2.H) Execute initial starting and testing under supervision of responsible manufacturer's representative and in accordance with manufacturers' instructions, recommendations, and requirements	
8	(3.2.J.1) Submit a certified report to Engineer that the requirements are complete.	

Observations/ Recommendations/ Comments:	
_____ MANUFACTURER/ SUPPLIER SIGNATURE	_____ DATE
_____ CONTRACTOR SIGNATURE	_____ DATE

CONTRACTOR & MANUFACTURER / SUPPLIER CERTIFICATE
Section 01 65 00 Commissioning of Systems
Operator / Owner Training (Paragraph 3.3)

The following certificate shall be completed for each equipment item or system.

Project Name _____ Equip Item/ Tag _____

Owner _____ Specification No. _____

Engineer _____ Serial No. _____

Contractor _____

Equip Mfg./ Supplier Start-up Representative and Contact Information:

Item No.	Description	Date Completed
1	(3.3.D) Provide a complete draft copy of the Preliminary Operation and Maintenance (O&M) Manuals for each of the Owner's operating personnel who attend the training.	
2	(3.3.D) Review contents of O&M manual with Owner's operating personnel in detail to explain all aspects of operation and maintenance.	
3	(3.3.D) Include the use of slides, videos, literature, diagrams, and/or oral presentations as necessary to present comprehensive, detailed instruction of operation and maintenance requirements of the equipment.	
4	(3.3.E) Upon satisfactory completion of the classroom training, continue training with a field training session utilizing the installed equipment. Equipment shall be run in all available control modes and sequences of operation.	
5	(3.3.G) Submit a certified report to Engineer that the requirements are complete and that system is ready for Commissioning.	

Observations/ Recommendations/ Comments:

_____ _____
MANUFACTURER/ SUPPLIER SIGNATURE DATE

_____ _____
CONTRACTOR SIGNATURE DATE

CONTRACTOR & MANUFACTURER/ SUPPLIER CERTIFICATE
Section 01 65 00 Commissioning of Systems
Notice of Completed Owner Programming (Paragraph 3.4)

The following certificate shall be completed for each equipment item or system

Project Name _____

Owner _____

Engineer _____

Contractor _____

Process Area/Equipment _____

Observations/ Recommendations/ Comments:
_____ _____ OWNER SIGNATURE DATE

CONTRACTOR & MANUFACTURER/ SUPPLIER CERTIFICATE
Section 01 65 00 Commissioning of Systems
Acceptance Testing of Systems (Paragraph 3.5)

The following certificate shall be completed for each equipment item or system

Project Name _____ Equip Item/ Tag _____

Owner _____ Specification No. _____

Engineer _____ Serial No. _____

Contractor _____

Equip Mfg./ Supplier Start-up Representative and Contact Information:

Dates of Initial Acceptance Testing: _____ to _____

Dates of Final Acceptance Testing: _____ to _____

Item No.	Description	Date Completed
1	(3.5.B) Schedule a meeting with Owner and Engineer 15 calendar days prior to intended start date of Acceptance Testing in order to review Contractor's plan for Acceptance Testing.	
2	(3.5.C.1.d) Conduct the demonstration of functional integrity under full operational conditions, including normal, alternate, and emergency conditions, as defined by the Engineer.	
3	(3.5.D) Demonstrate the functional integrity of the process mechanical, mechanical, electrical, and control interfaces of the respective equipment and components comprising the facility or system	
4	(3.5.G) Provide knowledgeable personnel to answer Owner's questions throughout the Demonstration Period	
5	(3.5.H) Provide field instruction on systems and respond to any system problems or failures that may occur	
6	(3.5.I) Submit a certified report to Engineer that the requirements are complete and the system is ready for Commissioning.	

Observations/ Recommendations/ Comments:

_____ _____
MANUFACTURER/ SUPPLIER SIGNATURE DATE

_____ _____
CONTRACTOR SIGNATURE DATE

CONTRACTOR & MANUFACTURER/ SUPPLIER CERTIFICATE
Section 01 65 00 Commissioning of Systems
Commissioning of Systems (Paragraph 3.6)

The following certificate shall be completed for each equipment item or system

Project Name _____ Equip Item/ Tag _____

Owner _____ Specification No. _____

Engineer _____ Serial No. _____

Contractor _____

Equip Mfg./ Supplier Start-up Representative and Contact Information:

Item No.	Description	Date Completed
1	(3.6.D) Submit a certified report to Engineer that all preceding requirements have been completed and that the system is ready for commissioning by Owner.	
Observations/ Recommendations/ Comments:		
Certification by Manufacturer/Supplier and Contractor		
_____ MANUFACTURER/ SUPPLIER SIGNATURE		_____ DATE
_____ CONTRACTOR SIGNATURE		_____ DATE
Acceptance by Owner		
_____ OWNER'S SIGNATURE		_____ DATE

TRAINING OUTLINE

Below is a basic training outline stating the general requirements that are to be provided with each training listed in Section 01 65 00 Commissioning of Systems.

A. General Description

Classroom: Provide a basic description of the overall equipment system function and operation. Identify the major components of the equipment system. (i.e., for a pump system: motor, drive, pump, instrumentation, and controls). Provide a general description of equipment functional capacities (i.e., for a pump system: pumping capacity and maximum/minimum ranges, and reverse operation if applicable, etc.). Review the organization of the Preliminary O&M Manual and the general contents of each section.

B. Equipment System Components

Classroom: Identify by name and location the components that make up the equipment system. In the classroom use photos or videos that clearly identify the components. Provide a functional description of what each component does in the operation of the equipment system. (i.e., proximity switch provides feedback for rotation of equipment by sensing a metal bar passing through the switch magnetic field). Describe each component's inputs, outputs, normal and abnormal conditions, safety issues, routine maintenance and disassembly/reassembly of the component.

Field training: Repeat the classroom information in the field clearly identifying components by touching or pointing to them.

C. Equipment System Function & Operation

Classroom: Describe how each equipment system component contributes to the function and operation of the equipment system. Discuss equipment system checkout prior to operation, equipment startup, routine operation, abnormal operation, remote operation, equipment shut down, and emergency conditions. Provide methods to obtain the most efficient equipment system operation. Discuss troubleshooting abnormal operating conditions and typical solutions. Alarm conditions shall be described as to the causes, solutions, and effects on the equipment system.

Field Training: Repeat the classroom information applying it to the installed equipment. Direct the Owner's personnel in the step-by-step procedures required to operate the equipment system properly. Perform normal operational checks to verify proper operation. Identify conditions and indications of improper operation. Provide training on how the automatic operating controls function and adjustments available to the operators. Provide

training on how the manual operating controls function and adjustments available to the operators.

D. Equipment System Maintenance

Classroom: Describe and discuss the routine and preventative maintenance activities and associated procedures. Use the Preliminary O&M manual to identify the lubricants needed and their proper application. Use video or pictures to provide classroom training on equipment disassembly and reassembly for the replacement of components. Discuss the equipment system spare parts needed and the sources for the spare parts.

Field training: Review the classroom information, including disassembly and reassembly of the equipment system and its components. Manufacturer's representative shall disassemble and reassemble equipment to demonstrate the procedure. Such disassembly and reassembly shall not void the manufacturer's warranty.

E. Equipment System Safety

Classroom: Identify all safety issues with the equipment system: mechanical, electrical, chemical, and any other safety items. Provide step-by-step procedures to control the safety hazards.

Field training: Review the classroom information for the equipment system mechanical, electrical, chemical, and other safety items. Provide hands-on training of step-by-step safety procedures.

END OF SECTION

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SECTION 01 70 00
CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Closeout Procedures

B. Final Cleaning

C. Project Record Documents

1.2 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been reviewed, and that Work is complete in accordance with Contract Documents and ready for review by the Engineer and Owner.

B. Submit Warranty certificates.

C. Provide submittals to Engineer that are required by governing, funding or other authorities.

D. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.3 FINAL CLEANING

A. Execute final cleaning prior to requesting Final Inspection by the Engineer.

B. Clean site, including, but not limited to, the following. Site shall be clean, in the opinion of the Owner, before Final Payment will be issued.

1. Sweep paved and concrete surfaces. Sweep and wash interior floors.

2. Clean and disinfect all sanitary facilities constructed by Contractor's personnel during the course of the Work.

3. Clean debris from drainage systems.

4. Clean all windows and other glass surfaces, interior and exterior.

5. Remove temporary labels, stains, and foreign substances.

6. Vacuum soft surfaces.

7. Remove debris from gutters.

8. Clean debris from the interior of electrical cabinets, junction boxes, MCCs…etc.

9. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.4 PROJECT RECORD DOCUMENTS

A. Maintain and provide record documents in accordance with the General Conditions and as required by this Section. Contractor's record documents shall be in hard copy format and all annotations shall be legible to the Engineer; use of electronic format is permissible if the markups include author, date, time, and are searchable. Contractor is responsible for obtaining hard copy of all required record documents, including all printing and/or copying fees.

B. Contractor shall record the following at minimum:

1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

2. Measured locations of utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.

3. Field changes including dimensions and descriptive details/information.

4. Modifications or changes made to the Work and items uncovered during the course of the Work, including location, elevation, and dimensions.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress. Record documents shall be updated by the Contractor weekly, at minimum. Record documents shall be readily available to the Engineer for review at any time.

E. Submit final record/as-built drawings for all manufacturer-provided, pre-packaged building plans or other systems designed by a manufacturer. Submit in 11"x17" PDF format and Paper Copy.

F. All documents housed on the Web-Based Construction Administration Software – reference Section 01 33 00 Submittal Procedures

G. Submit all documents noted prior to Engineer with final Application for Payment.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

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SECTION 01 73 00
INSTALLATION, OPERATION, AND MAINTENANCE MANUALS

PART 1 GENERAL

1.1 DESCRIPTION

A. Description of Work

1. Provide Installation, Preliminary, and Final Operation and Maintenance (O&M) Manuals for use by the Contractor and the Owner.

2. Installation Manuals, as well as Preliminary and Final O&M Manuals shall be provided for all equipment incorporated into the Work. Manufacturer's Instructions shall be submitted for all other products. Reference Section 01 33 00 Submittal Procedures. Installation Manuals and/or Manufacturer's Installation Instructions shall be maintained at the job site.

3. The term "Operation and Maintenance Manual" includes all product-related information and documents that are required herein, as well as data that is required for inclusion by current regulations of any participating government agency or as a provision of a system warranty.

4. Required delivery schedule for Installation and O&M Manuals is as follows:

   a. Installation Manuals are due a minimum of 30 days before individual Goods are delivered to the project.

   b. Preliminary O&M Manuals are due a minimum of 30 days before Initial Starting and Testing (reference Section 01 65 00 Commissioning of Systems).

   c. Final O&M Manuals are due 30 days after the completion of Final Acceptance Testing. Final payment will not be made until all O&M Manuals are complete and noted as "no exceptions taken" by the Engineer.

B. The Installation Manual shall include, at minimum, the following:

1. The Project's established tag and descriptive name for each product and component, as well as the manufacturer's serial number. The use of cryptic model or catalog numbers or letters for identification shall not be acceptable.

2. Manufacturer's instructions for delivery, storage, assembly, and installation.

3. Name, address, telephone number, and email for manufacturer and manufacturer's local service representative.

C. The O&M Manual shall include, at minimum, the following:

1. Equipment description, including equipment function, operating characteristics, limiting operating conditions (minimum, average, and maximum input, output, temperatures, speeds, and production limits… etc.).

2. Equipment operating instructions and procedures for startup, normal and emergency conditions, shutdown, and storage.

3. Photos or diagrams of equipment shall identify each component comprising the equipment. Provide description and function information for each component.

4. Equipment safety considerations relating to storage, handing, installation, operation, and maintenance procedures.

5. Installation procedures.

6. Calibration procedures, or a statement that calibration is not required.

7. Routine and preventive maintenance instructions for all maintenance activities, including instructions to keep equipment properly lubricated, adjusted, and maintained so that the item functions as intended throughout its full design life. Routine and preventive maintenance instructions shall include, but not limited to, the following:

a. Written explanations with illustrations or photographs for each preventive maintenance task.

b. Recommended schedule for execution of preventive and routine maintenance tasks.

c. Lubrication charts including a table of alternative lubricants naming at least two alternate lubricant manufacturers, with applicable product numbers, for each application.

d. Troubleshooting instructions.

e. List of required maintenance tools and equipment.

f. Procedures for disassembly, reassembly, alignment, adjustment, and inspection instructions. Instructions shall include photographs and/or video of the stages of the procedures. Provide photos or diagrams which indicate alignment and adjustment equipment/component locations.

g. Recommended spare parts list to maintain equipment in service. Include serial numbers and other pertinent ordering information.

h. Special Tools: For equipment, provide a list of special tools, materials, and supplies included and required for installation, checking, testing, parts replacement, and maintenance.

i. Name, address, and telephone number for local sources of equipment and/or replacement parts.

j. Name, address, telephone number, and email for manufacturer and manufacturer's local service representative.

k. Material Safety Data Sheets (SDS) for any applicable item (chemicals, oils, lubricants, etc.) provided by the supplier. SDS shall be in the standard 16-section format as described under the Hazard Communication Standard (29 CFR 1910.1200(g) and 29 CRF 1910.1200 Appendix D).

l. Warranty Information, Bond(s), and Service contract(s), if applicable. Warranty periods shall be as required by the Contract Documents.

m. Project-specific tag number, and the associated manufacturer's model and serial number for the equipment provided.

n. Factory Test Reports, if required per the equipment-specific technical specification.

o. Commissioning Test Reports shall be included in the Final O&M Manual, including:

8. Results of all installation inspection, field calibration, and field-testing reports prepared during the commissioning of the facility.

9. Results of Acceptance Testing.

    i. "No exceptions taken" shop drawings (including equipment drawings, schematics, circuit diagrams).

    ii. Non-Project-Related Information Deleted: Non-project-related components, information, descriptions, or other reference information shall be deleted or crossed out or otherwise deleted. Indicate all components of the equipment on catalog pages by bold markings or some other clearly definable medium for ease of identification. All markings shall be readable if photocopied.

D. Coordination: The Contractor shall coordinate the delivery and incorporation of all O&M Manuals prepared for this project from their component equipment suppliers.

E. If applicable, the Contractor shall develop an O&M Manual for the equipment and systems designed and provided by the Contractor under this contract.

1.2 SUBMITTALS

A. Installation Manuals and Preliminary O&M Manuals shall be submitted digitally per Section 01 33 00.

B. Final O&M Manuals shall be submitted per Section 01 33 00 as a digital copy and as hardcopies in three ring binders. The Final O&M shall be an updated version of the Preliminary O&M Manual. Contractor shall prepare and insert additional data in the Final O&M when the need for additional data becomes apparent during Operator/Owner Training, or as otherwise deemed necessary by the Engineer. Contractor shall indicate in their transmittal all modifications made from the Preliminary O&M and on which pages those modifications can be found. Contractor shall provide additional information as part of the transmittal detailing how these modifications reflect the as-built conditions.

1. Final O&M Hardcopies shall meet the following requirements:

   a. The table of contents shall be included in each volume of multi-volume manuals.

   b. Manuals shall use dividers and indexed tabs for each section or item delineated in the table of contents. Dividers shall be cardstock or plastic.

   c. Manuals shall use 8½-inch by 11-inch acid free paper of high rag content and quality. All text must be legible, type-written or machine printed originals or high-quality copies. Paper shall be white.

   d. Each page shall have a binding margin of approximately 1½ inches and be punched for placement in a three-ring “D” style loose-leaf binder, which shall be provided by the Contractor along with the submittal. Each binder shall be no more than 3 inches. Binders for a single manual shall be all of the same color.

   e. Drawings provided as part of the Final O&M Manual shall be half-size black line (11” x 17”) reproductions.

2. Provide three (3) hard copies of the Final O&M Manuals. Contractor shall deliver the O&M manuals directly to Owner.

3. Final O&M Digital Copies shall be in PDF format and satisfy the requirements of Section 01 33 00 Submittal Procedures. The document shall include bookmarks

corresponding to the hard-copy dividers and be completely searchable. A copy of the digital Final O&M shall be included on a USB inside of the hardcopy binder.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

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SECTION 03 01 00
MAINTENANCE OF CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. All concrete on the project shall be maintained in good and acceptable condition until the warranty period is completed. Until the end of the specified warranty period, concrete deemed by the Engineer to be unacceptable shall be repaired per this section or as directed by the Engineer.

B. Section Includes:

1. Submittals
2. Closeout Submittals
3. Quality Assurance
4. Qualifications
5. Delivery, Storage, and Handling
6. Examination
7. Preparation
8. Repair Work
9. Injection – Epoxy Resin
10. Application – Epoxy Mortar
11. Application Cementitious Mortar
12. Field Quality Control

C. Related Sections:

1. Section 01 20 00 – Measurement and Payment
2. Section 03 30 00 – Cast-In-Place Concrete

1.2 REFERENCES

A. ASTM International (ASTM):

1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

2. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

3. ASTM C33 - Standard Specification for Concrete Aggregates.

4. ASTM C109 - Standard Test Method for Compressive strength of Hydraulic Cement Mortars (Using 2-in. or (50 mm) Cube Specimens).

5. ASTM C150 - Standard Specification for Portland Cement.

6. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.

7. ASTM C293 - Standard Test Method for Flexural Strength of Concrete (Using Simple Beam With Center-Point Loading).

8. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.

9. ASTM C882 - Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.

10. ASTM C1042 - Standard Test Method for Bond Strength of Latex Systems Used With Concrete By Slant Shear.

11. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.

12. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics.

13. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

B. American Welding Society (AWS):

1. AWS D1.4 - Structural Welding Code - Reinforcing Steel

1.3 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures

B. Product Data: Submit product standards, physical and chemical characteristics, technical specifications, limitations, maintenance instructions, and general recommendations regarding each material.

C. Manufacturer's Instructions: Submit mixing instructions.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 –Closeout Requirements: Closeout procedures

B. Project Record Documents: Accurately record actual locations of structural reinforcement repairs, type of repair, and procedures.

C. Operation and Maintenance Data: Procedures for submittals

1.5 QUALITY ASSURANCE

A. Perform welding work in accordance with AWS D1.4.

1.6 QUALIFICATIONS

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

B. Applicator: Company specializing in concrete repair with minimum three years documented experience or approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements: Product storage and handling requirements

B. Comply with instructions for storage, shelf-life limitations, and handling.

PART 2 PRODUCTS

2.1 EPOXY ADHESIVE INJECTION MATERIALS

A. Epoxy Adhesive: Two-part epoxy adhesive containing 100 percent solids, meeting the following minimum characteristics:

Characteristic	Test Method	Results
Bond Strength	ASTM C882	2,700 psi
Tensile Strength	ASTM D638	6,600 psi
Elongation	ASTM D638	2 percent at 7 days 70˚F
Flexural Strength	ASTM D790	8,000 psi
Compressive Strength	ASTM D695	6,500 psi

2.2 EPOXY MORTAR MATERIALS

A. Epoxy Mortar: Three-part epoxy binding resin and aggregate mortar mixture.

B. Epoxy Binding Resin: Two-part epoxy resin containing 100 percent solids, meeting the following minimum characteristics:

Characteristic	Test Method	Results
Bond Strength	ASTM C882	2,700 psi
Tensile Strength	ASTM D638	6,600 psi
Elongation	ASTM D638	2 percent at 7 days 70˚F
Flexural Strength	ASTM D790	8,000 psi
Compressive Strength	ASTM D695	6,500 psi

C. Aggregate: Type recommended by mortar manufacturer.

2.3 CEMENTITIOUS MORTAR MATERIALS

A. Cementitious Mortar: Packaged Portland cement patching mortar with the following properties:

1. Compressive Strength: ASTM C109; minimum 2,000 psi after one day and 5,000 psi after 28 days.

2. Bond Strength: ASTM C882; minimum 1,400 psi after 28 days

3. Flexural Strength; ASTM C293; minimum 1,500 psi after 28 days

B. Water: Clean and potable

C. Calcium Chloride: Not permitted

D. Bonding Agent: Polyvinyl acetate emulsion, dispersed in water while mixing, non-coagulant in mix, water resistant when cured.

E. Cleaning Agent: Commercial muriatic acid

2.4 REINFORCEMENT MATERIALS

A. Per Section 03 20 00 – Concrete Reinforcement

2.5 MIXING EPOXY MORTAR

A. Mix epoxy mortars to consistency for purpose intended.

B. Mix components in clean equipment or containers. Conform to pot life and workability limits.

2.6 MIXING CEMENTITIOUS MORTAR

A. Mix cementitious mortar to consistency required for purpose intended.

B. Include bonding agent as additive to mix.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify surfaces are ready to receive work.

B. Beginning of installation means acceptance of substrate.

3.2 PREPARATION

A. Clean concrete surfaces of dirt, laitance, corrosion, or other contamination; wire brush using water; rinse surface and allow to dry.

B. Flush out cracks and voids with water to remove laitance and dirt.

C. Provide temporary entry ports spaced to accomplish movement of fluids between ports; no deeper than depth of crack to be filled or port size diameter no greater than thickness of crack. Provide temporary seal at concrete surface to prevent leakage of adhesive.

D. For areas patched with epoxy mortar, remove broken and soft concrete 1/4 inch deep. Remove corrosion from steel. Clean surfaces mechanically; wash with acid; rinse with water.

E. Sandblast clean exposed reinforcement steel surfaces. Mechanically cut away damaged portions of bar.

3.3 REPAIR WORK

A. Repair reinforcement as directed by Engineer to meet or exceed original stress values.

B. Repair exposed structural, shrinkage, and settlement cracks of concrete by epoxy injection method.

C. Repair pockets, voids, or spalling. Fill voids flush with surface. Apply surface finish.

3.4 INJECTION - EPOXY RESIN

A. Inject epoxy resin adhesive into prepared ports under pressure using equipment appropriate for the application.

B. Begin injection at lower entry port and continue until adhesive appears in adjacent entry port. Continue from port to port until entire crack is filled.

C. Remove temporary seal and excess adhesive.

D. Clean surfaces adjacent to repair and blend finish.

3.5 APPLICATION - EPOXY MORTAR

A. Trowel applies mortar mix to required surface. Tamp into place filling voids at spalled areas.

B. For patching honeycomb, trowel mortar onto surface, work mortar into honeycomb to bring surface flush with surrounding area. Finish trowel surface to match surrounding area.

C. Cover exposed steel reinforcement with epoxy mortar, feather edges to flush surface.

3.6 APPLICATION - CEMENTITIOUS MORTAR

A. Apply spray or brush coating of bonding agent to damp concrete surfaces. Provide full surface coverage.

B. Apply cementitious mortar by steel trowel to required surface. Tamp into place filling voids at spalled areas. Work mix into honeycomb.

C. Damp cure cementitious mortar for **four** days.

3.7 FIELD QUALITY CONTROL

A. Section 01 40 00 – Quality Assurance and Quality Control: Testing, inspection, and analysis requirements.

END OF SECTION

SECTION 03 10 00
CONCRETE FORMS AND ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Design Requirements
2. Submittals
3. Quality Assurance
4. Qualifications
5. Delivery, Storage, and Handling
6. Coordination
7. Examination
8. Installation
9. Application – Form Release Agent
10. Installation – Inserts, Embedded Parts, and Openings
11. Form Cleaning
12. Form Removal
13. Erection Tolerances
14. Field Quality Control

B. Related Sections:

1. Division 1
2. Division 3
3. Division 5

1.2 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials
2. ACI 301 - Specifications for Structural Concrete
3. ACI 318 - Building Code Requirements for Structural Concrete
4. ACI 347 - Guide to Formwork for Concrete

B. American Forest and Paper Association (AF&PA):

1. AF&PA - National Design Specifications for Wood Construction

C. APA – The Engineered Wood Association (EWA):

1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood

D. ASTM International (ASTM):

1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

2. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials

E. West Coast Lumber Inspection Bureau (WCLIB):

1. WCLIB - Standard Grading Rules for West Coast Lumber

1.3 DESIGN REQUIREMENTS

A. Design, engineer, and construct formwork, shoring and bracing in accordance with ACI 318 to conform to design and applicable code requirements to achieve concrete shape, line, and dimension as indicated on Drawings.

1. Engineered Design required for the following systems:

a. Elevated structural concrete slabs, beams, and joists.

b. Walls greater than eight feet in height.

1.4 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Signed and sealed by professional engineer.

1. Submit formwork, shoring, and re-shoring shop drawings.

2. Indicate the following:

a. Pertinent dimensions, openings, methods of construction, types of connections, materials, joint arrangement and details, ties and shores, location of framing, studding, and bracing, and temporary supports.

b. Means of leakage prevention for concrete exposed to view in finished construction.

c. Sequence and timing of erection and stripping assumed compressive strength at time of stripping, height of lift and height of drop during placement.

d. Vertical, horizontal, and special loads in accordance with ACI 347, Section 2.2 and camber diagrams, when applicable.

e. Notes to formwork erector showing size and location of conduits and piping embedded in concrete in accordance with ACI 318, Section 6.3.

f. Procedure and schedule for removal of shores and installation and removal of re-shores.

C. Product Data: Submit data on void form materials and installation requirements.

D. Design Data: Signed and sealed by a professional engineer.

1. Indicate design data for formwork and shoring.

2. Indicate loads transferred to structure during process of concreting, shoring, and re-shoring.

3. Include structural calculations to support design.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with ACI 347.

B. For wood products furnished for work of this Section, comply with AF&PA.

1.6 QUALIFICATIONS

A. Design formwork under direct supervision of professional engineer experienced in design of this Work and licensed at Project location.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Division 1: Products storage and handling requirements.

B. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.8 COORDINATION

A. Division 1: Coordination and project conditions.

B. Coordinate this Section with other Sections of work, requiring attachment of components to formwork.

PART 2 PRODUCTS

2.1 WOOD FORM MATERIALS

A. Softwood Plywood: APA/EWA PS 1, C Plugged Grade, Group 3.

B. Lumber Forms:

1. Application: Use for edge forms and unexposed finish concrete.

2. Boards: Six inches or eight inches in width, shiplapped or tongue and groove, “Standard” Grade Douglas Fir, conforming to WCLIB Standard Grading Rules for West Coast Lumber. Surface boards on four sides.

C. Plywood Forms:

1. Application: Use for exposed finish concrete.

2. Forms: Conform to PS 1; full size four foot by eight-foot panels; each panel labeled with grade trademark of APA/EWA.

3. Plywood for Surfaces to Receive Membrane Waterproofing: Minimum of 5/8-inch thick; APA/EWA “B-B Plyform Structural I Exterior” grade.

4. Plywood where “Smooth Finish” is required, as indicated on Drawings: APA/EWA “HD Overlay Plyform Structural I Exterior” grade, minimum of 3/4 inch thick.

2.2 PREFABRICATED FORMS

A. Preformed Steel Forms: Minimum 16 gauge matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

B. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

C. Tubular Column Type: Round, spirally wound laminated fiber material, surface treated with release agent, non-reusable, sizes.

D. Steel Forms: Sheet steel, suitably reinforced, and designed for particular use indicated on Drawings.

E. Form Liners: Smooth, durable, grainless and non-staining hardboard, unless otherwise indicated on Drawings.

F. Framing, Studding, and Bracing: Stud or No. 3 structural light framing grade.

2.3 FORMS FOR CURVED WALLS

A. All curved walls as indicated on the project drawings shall be formed with curved, prefabricated forms constructed to match the radial lines, interior and exterior, of the walls as indicated on the plans.

2.4 FORMWORK ACCESSORIES

A. Form Ties: Snap-off type, galvanized metal, fixed or adjustable length, cone type, with waterproofing washer, one inch back break dimension, free of defects capable of leaving holes larger than one inch in concrete surface.

B. Spreaders: Standard, non-corrosive metal form clamp assembly, of type acting as spreaders and leaving no metal within one inch of concrete face. Wire ties, wood spreaders, or through bolts are not permitted.

C. Form Anchors and Hangers:

1. Do not use anchors and hangers on exposed concrete leaving exposed metal at concrete surface.

2. Symmetrically arrange hangers supporting forms from structural steel members to minimize twisting or rotation of member.

3. Penetration of structural steel members is not permitted.

D. Form Release Agent: Colorless mineral oil that will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.

E. Corners: Fillet or Chamfer with rigid plastic or wood strip, dimensions as indicated on the drawings; maximum possible lengths.

F. Bituminous Joint Filler: ASTM D1751.

G. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength, and character to maintain formwork in place while placing concrete.

2.5 COATINGS

A. Coatings for Aluminum: Polyamide epoxy finish coat with paint manufacturer's recommended primer for aluminum substrate. Apply one coat primer and one coat finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 1: Coordination and project conditions.

B. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.

C. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Engineer.

3.2 INSTALLATION

A. Earth Forms:

1. Earth forms are not permitted, except for concrete encasement of pipes and conduits and as specifically indicated on the drawings.

B. Formwork - General:

1. Provide top form for sloped surfaces steeper than one and a half horizontal to one vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
5. Complete wedging and bracing before placing concrete.

C. Forms for Smooth Finish Concrete:

1. Use steel, plywood, or lined board forms.
2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
3. Install form lining with close-fitting square joints between separate sheets without springing into place.
4. Use full size sheets of form lines and plywood wherever possible.
5. Tape joints to prevent protrusions in concrete.
6. Use care in forming and stripping wood forms to protect corners and edges.
7. Level and continue horizontal joints.
8. Keep wood forms wet until stripped.

D. Forms for Surfaces to Receive Membrane Waterproofing: Use plywood or steel forms. After erection of forms, tape form joints to prevent protrusions in concrete.

E. Framing, Studding and Bracing:

1. Space studs at 16-inch center maximum for boards and 12 inches on center maximum for plywood.
2. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Construct beam soffits of material minimum of two inches thick.
4. Distribute bracing loads over base area on which bracing is erected.
5. When placed on ground, protect against undermining, settlement, or accidental impact.

F. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301.

G. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

H. Obtain Engineer's approval before framing openings in structural members not indicated on Drawings.

I. Install fillet and chamfer strips on external corners of beams, joists, columns, and other members as indicated on the drawings.

J. Install void forms in accordance with manufacturer's recommendations.

3.3 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer's specifications. Do not coat forms for concrete indicated to receive "scored finish". Apply form coatings before placing reinforcing steel.

3.4 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Install formed openings for items to be embedded in or passing through concrete work.

B. Locate and set in place items required to be cast directly into concrete.

C. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

D. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Install water stops continuous without displacing reinforcement. Heat seal joints watertight.

F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

H. Form Ties:

1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
2. Place ties at least one inch away from finished surface of concrete.
3. Leave inner rods in concrete when forms are stripped.
4. Space form ties equidistant, symmetrical, and aligned vertically and horizontally unless otherwise shown on Drawings.

I. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

J. Construction Joints:

1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
4. Arrange joints in continuous line straight, true, and sharp.

K. Embedded Items:

1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
2. Do not embed wood or uncoated aluminum in concrete.
3. Obtain installation and setting information for embedded items furnished under other Specification sections.
4. Securely anchor embedded items into the correct location and alignment prior to placing concrete.
5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.

L. Openings for Items Passing Through Concrete:

1. Frame openings in concrete as indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
2. Coordinate work to avoid cutting and patching of concrete after placement.
3. Perform cutting and repairing of concrete required as result of failure to provide required openings.

M. Screeds:

1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.

2. Slope slabs to drain where required or as shown on Drawings.

3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.

N. Screed Supports:

1. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad, or base type screed supports which will not puncture membrane.

2. Staking through membrane is not permitted.

O. Cleanouts and Access Panels:

1. Provide removable cleanout sections or access panels at the bottom of forms to permit inspection and effective cleaning of loose dirt, debris, and waste material.

2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust, and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.5 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

D. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.6 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by the Engineer.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

D. Removal of forms shall be as indicated in the drawings. Contractor shall provide sampling and testing for compressive strength as necessary to justify the time for form removal. Such sampling and testing shall occur separate from Owner-provided special inspections and the cost shall be borne by the Contractor. Submit test reports to the Engineer.

3.7 ERECTION TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

B. Camber slabs and beams 1/8 inch per 10 feet in accordance with ACI 301.

3.8 FIELD QUALITY CONTROL

A. Section 01 40 00 – Quality Assurance and Quality Control: Field inspecting, testing, adjusting, and balancing.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

C. Notify Engineer after placement of reinforcing steel in forms, but prior to placing concrete.

D. Schedule concrete placement to permit formwork inspection before placing concrete.

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittals

B. Quality Assurance

C. Coordination

D. Placement

E. Field Quality Control

1.2 RELATED SECTIONS

A. Division 1

B. Division 3

C. Division 5

1.3 REFERENCES

A. American Concrete Institute (ACI) 301 - Structural Concrete for Buildings

B. ACI 315 – Manual of Standard Practices for Detailing Concrete Structures

C. ACI 318 - Building Code Requirements for Reinforced Concrete

D. ACI 350 - Environmental Engineering Concrete Structures

E. ACI SP-66 - American Concrete Institute - Detailing Manual

F. American National Standards Institute (ANSI)/ASTM International (ASTM) A82 - Cold Drawn Steel Wire for Concrete Reinforcement

G. ANSI/ASTM A184 - Fabricated Deformed Steel Bar Mats for Concrete Reinforcement

H. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement

I. ANSI/ASTM A496 - Deformed Steel Wire Fabric for Concrete Reinforcement

J. ANSI/ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement

K. ANSI/American Welding Society (AWS) D1.4 - Structural Welding Code for Reinforcing Steel

L. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement

M. ASTM A704 - Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement

N. ASTM A706 - Low-Alloy Steel Deformed Bars for Concrete Reinforcement

O. AWS D12.1 - Welding Reinforcement Steel, Metal Inserts and Connections in Reinforced Concrete Construction

P. Concrete Reinforcing Steel Institute (CRSI) – Manual of Practice

Q. CRSI 63 - Recommended Practice for Placing Reinforcing Bars

R. CRSI 65 - Recommended Practice for Placing Bar Supports, Specifications and Nomenclature

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Shop Drawings:

1. Indicate bar sizes, spacings, locations, and quantities of reinforcing steel and wire fabric bending and cutting schedules, and supporting and spacing devices, if dissimilar from Drawings.

2. Indicate dimensions, materials, bracings, and arrangement of joints and ties.

C. Submit plan for placement of all concrete walls four weeks prior to placement.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Indicate locations of all construction joints prior to concrete placement.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301, ACI 315, ACI 318, and ACI 350.

B. Maintain one copy of each document on site.

C. Submit certified copies of mill test report of reinforcement materials analysis.

1.6 COORDINATION

A. Coordinate work under provisions of Section 01 30 00 – Coordination and Meetings.

B. Coordinate with placement of formwork, formed openings and other Work.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel: ASTM A615, 60 kilo pounds per square inch (ksi) yield grade; deformed billet steel bars (#3 bars may be grade 40 ksi), unfinished, free of dirt, oil, grease, loose scale or other substances that might reduce development of the bond strength.

B. Reinforcing Steel Mat: ASTM A704, ASTM A615, 60 ksi yield grade; steel bars or rods, unfinished.

C. Stirrup Steel: ANSI/ASTM A82, unfinished.

D. Welded Steel Wire Fabric: ASTM A185 Plain Type, or ASTM A496 Welded Deformed Type; in coiled rolls.

E. Mechanical Rebar Splicing Devices: Where indicated on the drawings, provide mechanical threaded dowel rebar splicing devices of the size type, spacing and placement indicated. The system shall be a standard two-piece threaded coupler system, with the first piece consisting of a dowel with integral female-threaded head which will accept the 2nd (future or second phase placement) male threaded dowel section. The first piece shall have an integral flat surfaced, flush mounted flange allowing for attachment to the pour stop forming in such a manner as to securely hold the device in place.

1. Mechanical splices shall meet the Acceptance Criteria of ICC Evaluation Services report AC133.
2. Mechanical Splice shall conform to Type 1 requirements and develop 100 percent of the specified ultimate strength of the bar being spliced.

2.2 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16-gauge annealed type.

B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions.

C. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type; size and shape as required.

2.3 FABRICATION

A. Fabricate concrete reinforcing in accordance with ACI 318 and ACI 350.

B. Locate reinforcing splices not indicated on drawings, at point of minimum stress.

2.4 EMBEDMENT ANCHORS

A. Simpson SET high-strength epoxy system or Hilti, HVA epoxy embedment anchors. Refer to notes or specifications for Concrete Doweling or Field-set dowels and anchors.

PART 3 EXECUTION

3.1 PLACEMENT

A. Place, support, and secure reinforcement against displacement. Do not deviate from required position.

B. Do not displace or damage vapor barrier/retarder.

C. Accommodate placement of formed openings.

D. Conform to ACI 350 for concrete cover over reinforcement.

E. Splice all bars with a minimum lap of 32 bar diameters unless otherwise noted on the Drawings.

F. Reinforcement steel shall have the concrete cover noted on the Drawings.

G. Metal clips or supports holding the reinforcement shall not be placed in contact with the forms or the subgrade.

H. Secure and support reinforcement and dowels in position with wire or other approved methods. Shoving reinforcement or dowels into freshly poured concrete is prohibited.

3.2 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01 40 00.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittal

B. Project Record Documents

C. Quality Assurance

D. Field Samples

E. Coordination

F. Examination

G. Preparation

H. Placing Concrete

I. Concrete Finishing

J. Curing and Protection

K. Field Quality Control

L. Patching

M. Defective Concrete

1.2 RELATED SECTIONS

A. Division 1

B. Division 3

1.3 REFERENCES

A. American Concrete Institute (ACI) 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

B. ACI 301 - Structural Concrete for Buildings

C. ACI 302 - Guide for Concrete Floor and Slab Construction

D. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete

E. ACI 305R - Hot Weather Concreting

F. ACI 306R - Cold Weather Concreting

G. ACI 308 - Standard Practice for Curing Concrete

H. ACI 318 – Building Code Requirements for Reinforced Concrete

I. ACI 350R – Environmental Engineering Concrete Structures

J. American National Standards Institute (ANSI)/ASTM International (ASTM) D994 - Preformed Expansion Joint Filler for Concrete (Bituminous Type)

K. ANSI/ASTM D1190 - Concrete Joint Sealer, Hot-Poured Elastic Type

L. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

M. ANSI/ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

N. ASTM C31 - Making and curing concrete test specimens in the field

O. ASTM C33 - Concrete Aggregates

P. ASTM C39 - Compressive strength of cylindrical concrete specimens

Q. ASTM C94 - Ready-Mixed Concrete

R. ASTM C150 - Portland Cement

S. ASTM C260 - Air Entraining Admixtures for Concrete

T. ASTM C494 - Chemicals Admixtures for Concrete

U. ASTM C1260 - Standard Test Method for Potential Reactivity of Aggregates (Mortar-Bar Method)

V. ASTM C618 - Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

W. ASTM C1567 – Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method).

V. American Association of State Highway and Transportation Official (AASHTO) PP65 - – Standard Practice for Determining the Reactivity of Concrete Aggregates.

1.4 SUBMITTAL

A. Submit under provisions of Section 01 33 00.

B. Product Data: Provide data on joint devices, attachment accessories, admixtures, aggregate, and cement.

C. Samples: Submit two-inch long samples of contraction joint and control joint.

D. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent work.

E. Submit mix design and certification of compliance for all admixtures and curing compounds

F. Submit aggregate source classification for the Akali-Silica Reaction (ASR).

G. Mitigation for aggregate Akali-Silica Reaction (ASR).

1. For aggregate source with non-reactive materials. Submit verification that selected source of aggregate is not susceptible to ASR within the proposed concrete mix designs for this project. Aggregate shall be classified R0 (Non-reactive).
2. For aggregate source with moderately reactive materials; aggregates classified R1. Submit verification that the proposed mix design, with the specific aggregate source selected, has been designed through the addition of appropriate amounts of Fly Ash or other accepted additives to mitigate ASR. Provide test results proving effectiveness of mix design per ASTM C 1567.
3. For aggregate source with highly or very-highly reactive materials, aggregates classified R2 or R3. Mix designs with moderately or highly reactive materials shall not be permitted for use on this project.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01 70 00.

B. Accurately record actual locations of embedded utilities and components which are concealed from view.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. Maintain one copy of each document on site.

C. Acquire cement and aggregate from same source for all work.

D. Conform to ACI 305R when concreting during hot weather.

E. Conform to ACI 306R when concreting during cold weather.

1.7 FIELD SAMPLES

A. Provide under provisions of Section 01 40 00.

1.8 COORDINATION

A. Coordinate work under provisions of Section 01 30 00 – Coordination and Meetings.

B. Coordinate the placement of joint devices with erection of concrete form work and placement of form accessories.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I, or II.

B. Fine and Coarse Aggregates: ¾-inch maximum aggregate per ASTM C33.

C. Water: Clean and not detrimental to concrete.

2.2 ADMIXTURES

A. Air Entrainment: ASTM C260; manufactured by Grace Daravair `M' or SIKA Chemical `AER'.

B. Water Reducers: ASTM C494, Type F or G.

C. Super-Plasticizer: High-Range Water Reducing (HRWR) admixture conforming to ASTM C494.

D. Fly Ash; ASTM C618.

2.3 ACCESSORIES

A. Bonding Agent: Two component modified epoxy resin.

B. Non-Shrink Grout: Per Section 03 60 00 – Grouting.

C. Epoxy/Grout Adhesive:

1. Three Component Epoxy Resin System:
   - Two liquid epoxy components.
   - One inert aggregate filtered component.
   - Each component furnished in separate package for mixing at job site.
2. Apply only to clean, dry, sound surface.
3. Mix and place in accordance with manufacturer’s instructions.
4. Completely fill all cavities and spaces around dowels and anchors without voids.

2.4 JOINT DEVICES AND FILLER MATERIALS

A. Joint Filler Type A: ASTM D1751; Asphalt impregnated fiberboard or felt, ½-inch thick; tongue and groove profile.

B. Joint Filler Type B: ASTM D1752; Closed cell polyvinyl chloride foam, resiliency recovery of 95 percent if not compressed more than 50 percent of original thickness.

C. Construction Joint Devices: Integral extruded plastic; 3/8-inch thick, formed to tongue and groove profile, with removable top strip exposing sealant trough, knockout holes spaced at six inches, ribbed steel spikes with tongue to fit top screed edge.

D. Contraction Joint Devices: ASTM B221 resilient elastomeric or neoprene filler strip with a Shore A hardness of 35 to permit plus or minus 25 percent joint movement with full recovery; of longest manufactured length at each location, flush mounted.

E. Sealant: Elastomeric sealant conforming to ASTM C920 and Federal Specification TT-S-00277E. In all joints for liquid-retaining structures provide sealants specially formulated to conform to Use Requirement I, for submerged conditions.

F. Moisture-activated Strip Waterstop: Continuous water-activated strip joint water-stop noted on the Drawings as “Swell-seal” or “Swellstop” water-stop shall be a flexible butyl rubber and swellable clay waterproofing compound in the dimensions called for on the Drawings. Provide “Swellstop” by Greenstreak, Inc. or an approved equal.

G. Flexible Waterstops: Polyvinyl chloride (PVC), minimum 2,000 pounds per square inch (psi) tensile strength with a minimum working temperature range of plus 35°F to plus 175°F. Conform to ASTM D570, D746, D1149 and CRD-C572.

Provide profile, type, and width as indicated on the drawings in maximum possible lengths with pre-formed corner, joint and intersection pieces fully heat-welded or glued together as approved by the manufacturer to form a water-tight system.

2.5 CONCRETE MIX

A. Mix and deliver concrete in accordance with ASTM C94, Alternative Number 1.

B. Provide concrete mix designs as noted under “Project Concrete Mix Types” in the Structural Materials Section of the General Structural Notes and Specifications included on the Structural Project Sheets.

C. Use accelerating admixtures in cold weather only when approved by Engineer. Use of admixtures will not relax cold weather placement requirements.

D. Do not use calcium chloride.

E. Use set retarding admixtures during hot weather only when approved by Engineer.

F. A water-reducing admixture conforming to ASTM C494 used in strict conformance with the manufacturer's specifications shall be incorporated in all concrete mix designs. For all water-retaining structures, a high-range water-reducing admixture conforming to ASTM C494 Type F or G, shall be used. Total slumps shall not exceed 10 inches and the water-cement ratios listed is not exceeded. W/C ratio listed refers to the total cement plus fly ash content.

G. When Alkali-Silica Reactive aggregate is used the design mix shall provide for mitigation of ASR.

2.6 CONCRETE BONDING ADHESIVE

A. Concresive liquid bonding adhesive (LPL) two-component, liquid epoxy bonding agent.

B. No substitutes.

2.7 FLEXIBLE WATERSTOP

A. Waterstop noted as flexible or PVC on the Drawings shall be compounded from polyvinyl chloride (PVC) and shall have the following properties:

1.	Minimum Ultimate Elongation	250 Percent
2.	Minimum Tensile Strength	2,000 psi
3.	Brittle Temperature	-23° F
4.	Shore Durometer Type "A" Hardness	80, approximately
5.	Specific Gravity	1.3, approximately

B. Waterstop shall be uniform in dimensions, homogeneous and free from porosity. Minimum thickness shall be one-quarter (1/4) inch and minimum width of six (6) inches unless otherwise shown on the Drawings. Waterstop shall be ribbed center bulb type.

C. Corrugated type waterstops are not acceptable.

2.8 CONTROLLED LOW STRENGTH MATERIAL (CONTROLLED DENSITY FILL)

A. Lean concrete mix for use under foundations and slabs on grade shall meet the following design criteria:

1. Mix type M-CDF as follows: A mixture of cement, fine sand, course aggregate, fly ash and admixtures formulated to be flowable and self-consolidating with a net 28-day compressive strength of 200 to 300 psi.

2.9 MISCELLANEOUS SITE CONCRETE

A. Miscellaneous site concrete such as concrete thrust blocks, guard post bases and fence post bases shall meet the requirements of Mix M2500-SEC as noted in General Structural Notes and Specifications unless specifically noted otherwise on the Contract Drawings.

2.10 MISCELLANEOUS CONCRETE PADS

A. Miscellaneous concrete pads such as thrust blocks, valley gutter, exterior pads at doorways, valve box collars, etc. shall meet the requirement of Concrete Mix M4500-STD as noted in the General Structural Notes and Specifications unless specifically noted otherwise on the Contract Drawings.

2.11 FOUNDATIONS AND STRUCTURAL CONCRETE

A. As noted in the General Structural Notes and Specifications, as shown on the Drawings.

1. M4000-INT for interior concrete floor slabs-on-grade.
2. M4500-STD for concrete footings, walls, elevated slabs, beams, and columns
3. M4500-SPS (Super-Plasticized Concrete) for concrete footings, walls and slabs used in water-containing structures.

2.12 SLURRY MIXTURE

A. M-SLURRY as follows: A flow-able mix for use at the bottom of horizontal wall construction joints consisting of sand, 3/8-inch aggregate, water, and a minimum of 1,150 pounds of cement per cubic yard formulated for a minimum 28-day compressive strength of 5,000 psi.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions under provisions of Section 01 10 00 –Summary of Work.

B. Verify requirements for concrete cover over reinforcement.

C. Verify that anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

3.2 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

B. In locations where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

C. Slurry Mix at Horizontal Construction Joints

1. Unless otherwise specifically directed, in all horizontal construction joints in new concrete construction containing water-stops, provide an initial layer of slurry mix to aid in consolidation of freshly placed concrete at the joint interface.
2. Place slurry mix 2-inch minimum to 4-inch maximum in thickness.

3. Place with buckets or other means permitting visual verification that only enough slurry mix is deposited in the vicinity of the concrete pour to meet the thickness requirements.

4. Place concrete over slurry mix while slurry mix is still flow-able.

5. Limit initial concrete placement on top of slurry mix to 12-inches in thickness. Thoroughly vibrate and consolidate the concrete and slurry mix.

3.3 PLACING CONCRETE

A. Place concrete in accordance with ACI 318 and ACI 350.

B. Notify Engineer minimum 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, water-stops, formed expansion and contraction joints, and are not disturbed during concrete placement.

D. Install joint fillers, primers, and sealant in accordance with the manufacturer's instructions.

E. Separate slabs on grade from vertical surfaces with ½-inch thick joint filler.

F. Extend joint filler from bottom of slab to within ¼ inch of finished slab surface.

G. Install joint devices in accordance with manufacturer's instructions.

H. Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor and wall finish.

I. Install joint covers in one piece, longest practical length, when adjacent construction activity is complete.

J. Apply sealants in joint devices in accordance with manufacturer's recommendations.

K. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

L. Place concrete continuously between predetermined control and construction joints.

M. Do not interrupt successive placement; do not permit cold joints to occur.

3.4 CONCRETE FINISHING

A. Provide formed and un-formed concrete surfaces with finishes as Scheduled. See General Structural Notes Sheet S-002 Sections 15 and 16.

B. Finish concrete slab surfaces in accordance with ACI 302, and Section 03 35 00 – Concrete Finishing.

C. In areas required to drain pitch surface uniformly to drain as indicated on drawings.

D. In areas identified for coatings, provide Surface Finish required, and Coatings per Technical Specifications Division 9 and the Architectural Finish Schedule.

E. All concrete surfaces shall receive a Surface Finish; where question arise as to finish type, contact the Project Engineer for clarification.

3.5 CURING AND PROTECTION

A. 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 the period necessary for hydration of cement and hardening of concrete.

C. Unless otherwise approved, concrete shall be maintained above 50°F and in a moist condition for a minimum of seven days after placement.

D. Cure concrete surfaces in accordance with ACI 308.

3.6 FIELD QUALITY CONTROL

A. Field review and testing will be performed in accordance with ACI 301 and under provisions of Section 01 40 00.

B. All concrete repair or restoration shall comply with the provisions of 3.8 Defective Concrete of this Section.

C. Provide free access to Work and cooperate with appointed firm.

D. Submit proposed mix design of each class of concrete to Engineer and testing firm for review prior to commencement of Work.

E. Tests of cement and aggregates may be performed to ensure conformance with specified requirements.

F. One additional test cylinder may be taken during cold weather concreting, cured on job site under same conditions as concrete it represents.

3.7 PATCHING

A. Allow Engineer to review concrete surfaces immediately upon removal of forms.

B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.

C. Patch imperfections as directed by the Engineer and in accordance with ACI 301.

D. Patch cone holes at form ties to match adjacent concrete.

E. Reference Section 03 01 00 – Maintenance of Concrete.

3.8 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements.

B. During the progress of the work, if the laboratory-cured values shown for each concrete design strength and quality as determined by compression cylinders fail to attain the requirements specified, suspend all concrete work. Concrete that has been placed in the work and does not meet the specified requirements will be reviewed by the Engineer and the Contractor. Any field testing such as core drilling required to verify in-place concrete strengths after compression tests fail to meet requirements shall be at the Contractor's expense. The Contractor shall, at his own expense, correct or remove the defective work in a manner approved by the Engineer.

C. The following criteria shall be followed in defining cracks by minimum measured crack width, using feeler gauges or other approved means:

1. Cracks with maximum widths less than 0.015 inches (1/64 inch) shall be considered hair-line cracks and shall be repaired or sealed as directed by the Project Engineer.

2. Cracks equal to or greater than 0.015 inches (1/64 inch) and less than or equal to .095 inches (3/32 inch) in width at any point shall be considered medium cracks with mandatory repair by injection required.

3. Any cracks equal to or greater than 0.095 inches (3/32 inch) in width at any point shall be considered large cracks with mandatory repair by injection or as directed by the Project Engineer.

D. Repair or replacement of defective concrete will be determined by the Engineer.

E. Repair defects in formed concrete surfaces within 24 hours of removing forms.

F. Replace defective concrete within 48 hours.

G. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

H. Cut out and remove defective area.

I. Cut edges square to avoid feathering.

J. Comply with ACI 301, Chapter 9.

K. Perform repair work so as not to interfere with curing of adjacent concrete.

L. Adequately cure repair work.

M. Reference Section 03 01 00 – Maintenance of Concrete.

END OF SECTION

SECTION 03 35 00
CONCRETE FINISHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittals
2. Closeout Submittals
3. Quality Assurance
4. Qualifications
5. Delivery, Storage and Handling
6. Environmental Requirements
7. Coordination
8. Examination
9. Floor Finishing
10. Floor Surface Treatment
11. Other Concrete Surfaces
12. Tolerances

B. Related Sections:

1. Section 01 20 00 – Measurement and Payment
2. Section 03 30 00 – Cast-In-Place Concrete
3. Section 03 39 00 – Concrete Curing
4. Section 07 92 13 – Sealants and Caulking

1.2 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 302.1 - Guide for Concrete Floor and Slab Construction.

B. ASTM International (ASTM):

1. ASTM E1155 - Standard Test Method for Determining Floor Flatness and of Levelness Using the F-number System.

C. California Department of Health Services (CA DHS):

1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

D. South Coast Air Quality Management District (SCAQMD):

1. SCAQMD Rule 1113 - Architectural Coatings.

1.3 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Submittal Procedures.

B. Product Data: Submit data on concrete hardener, sealer, curing compounds, curing papers and slip resistant treatment, compatibilities, and limitations.

C. Technical Data Sheets: For concrete hardener system, Contractor shall submit a technical data sheet from the manufacturer. The technical data sheet shall, at a minimum, provide the material name, manufacturer name, product name and number, material specification, recommended coverage, and thickness.

D. Material Safety Data Sheets (MSDS).

E. Copy of warranty to be issued.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 –Closeout Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit data on maintenance renewal of applied coatings.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301 and ACI 302.1.

1.6 QUALIFICATIONS

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

B. Applicator or Installer: Company specializing in performing work of this section with minimum three years documented experience with the product or manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements: Transportation and Handling

B. Deliver materials in manufacturer's packaging including application instructions.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 – Product Requirements: Storage and Protection

B. Temporary Heat: Ambient temperature of 50°F minimum.

C. Ventilation: Sufficient to prevent injurious gases from temporary heat or other sources affecting concrete.

1.9 COORDINATION

A. Section 01 33 00 – Submittal Procedures

B. Coordinate the Work with concrete floor placement and concrete floor curing.

PART 2 PRODUCTS

2.1 COMPOUNDS - HARDENERS AND SEALERS

A. Chemical Sealer and Hardener: Transparent chemically reactive water-based sealer/hardener.

1. Manufacturers:

   a. Ashford Formula.

   b. Sonneborn Building Products, Product Kure-N-Seal

   c. Dayton Superior, Product Safe Cure & Seal

   d. ChemMasters, Product Cure & Seal.

   e. Tennant Company, Product Eco-Hard-N-Seal.

2. Note: contractor to coordinate, verify and provide concrete hardener which is rated for exterior use when applied in exterior locations.

3. Concrete hardener is to be applied to all interior and exterior concrete floor slabs receiving foot traffic or other maintenance work. Hardener is not required inside water-retaining structures or on floors to receive architectural coverings such as tile, carpet, or vinyl flooring.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 33 00 – Submittal Procedures

B. Verify floor surfaces are acceptable to receive the Work of this section.

3.2 FLOOR FINISHING

A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.1. See General Structural Notes Sheet S-002 Section 16.

B. Wood float surfaces receiving quarry tile, ceramic tile or cementitious terrazzo with full bed setting system.

C. Steel trowel surfaces receiving carpeting, resilient flooring, seamless flooring, thin set terrazzo, thin set quarry tile or thin set ceramic tile.

D. Steel trowel surfaces which are indicated to be exposed.

E. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains at 1/8 inch per foot nominal or as indicated on Drawings.

3.3 FLOOR SURFACE TREATMENT

A. Apply Chemical Sealer and Hardener on all interior and exterior concrete work surfaces. Contractor to verify/provide product suitable for exterior applications.

3.4 OTHER CONCRETE SURFACES

A. See General Structural Notes Sheet S-002 Section 15.

3.5 TOLERANCES

A. Section 01 40 00 – Quality Assurance and Quality Control: Tolerances

B. Maximum Variation of Surface Flatness for Exposed Concrete Floors: 1/4 inch in 10 feet for office area floors.

C. Correct defects in defined traffic floor by grinding or removal and replacement of defective Work. Areas requiring corrective Work will be identified. Re-measure corrected areas by same process.

END OF SECTION

SECTION 03 39 00
CONCRETE CURING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes initial and final curing of all horizontal and vertical concrete surfaces.

B. Related Sections:

1. Division 01
2. Division 03

1.2 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 301 - Specifications for Structural Concrete
2. ACI 302.1 - Guide for Concrete Floor and Slab Construction
3. ACI 308.1 - Standard Specification for Curing Concrete
4. ACI 318 - Building Code Requirements for Structural Concrete
5. ACI 350 - Code Requirements for Environmental Engineering Concrete Structures

B. ASTM International (ASTM):

1. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete
2. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
3. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
4. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting

1.3 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Submittal procedures

B. Product Data: Submit data on curing compounds, mats, film, compatibilities, and limitations.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 308.

B. Maintain one copy of each document on site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Division 1: Product storage and handling requirements.

B. Deliver curing materials in manufacturer's packaging including application instructions.

PART 2 PRODUCTS

2.1 MATERIALS

A. Membrane Curing Compound: ASTM C1315 Type I, Class A.

B. Absorptive Mats Type C: ASTM C171, cotton fabric, burlap-polyethylene, minimum 8 oz/sq yd bonded to prevent separation during handling and placing.

C. Polyethylene Film Type E: ASTM C171, six mil thick clear, white, or black. Color use may depend on daily ambient temperatures per ACI 308.1 requirements.

D. Water: Potable, not detrimental to concrete.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 1: Coordination and Project Conditions

B. Verify substrate surfaces are ready to be cured.

3.2 INSTALLATION - HORIZONTAL SURFACES

A. Cure concrete in accordance with ACI 308.1 with one of the following methods.

B. Ponding: Maintain 100 percent coverage of water over floor slab areas, continuously for 5 days minimum.

C. Fog Spraying: Spray water using fog-spray equipment over floor slab areas and maintain wet for 7 days minimum. Direct discharge of the atomized water spray onto the surface of the concrete is unacceptable.

D. Absorptive Mat: Spread cotton fabric over floor slab areas. Spray with water until mats are saturated and maintain in saturated condition for 7 days minimum.

E. Membrane Curing Compound: Apply curing compound in two coats with second coat applied at right angles to first.

3.3 INSTALLATION - VERTICAL SURFACES

A. Cure concrete in accordance with ACI 308.1.

B. Fog Spraying: Spray water using fog-spray equipment over floor slab areas and maintain wet for seven days minimum. Direct discharge of the atomized water spray onto the surface of the concrete is unacceptable.

C. Membrane Curing Compound: Apply compound in two coats with second coat applied at right angles to first.

3.4 SURFACES INSIDE FORMWORK

A. Concrete surfaces protected by formwork require no special curing treatment as long as the formwork remains in place a minimum of seven days or until the concrete has reached the specified strength.

B. If forms are removed prior to seven days or the concrete attaining the specified strength, then all surfaces shall be cured as specified elsewhere in this Section for the remainder of the required curing period.

C. Top or other exposed portions of walls and other concrete elements covered with protecting formwork require curing as specified elsewhere in this Section.

D. In hot weather wall forms shall be hosed down with water and covered with protective polyethylene Film to prevent excessive moisture loss.

3.5 PROTECTION OF FINISHED WORK

A. Section 01 70 00 – Closeout Requirements: Protecting finished Work

B. Do not permit traffic over unprotected floor surface.

3.6 SCHEDULES

A. Liquid Retaining Structure Walls: In-form curing, fog spraying or membrane curing compound.

B. Liquid Retaining Structure Floor Slabs-on-grade: Ponding, moist absorptive mats, or membrane curing.

C. Building foundation walls and retaining walls: In-form curing, fog spraying or membrane curing compound.

D. Non-liquid Retaining Structure Floor Slabs-on-grade: Moist absorptive mats, or membrane curing.

E. All other concrete: In-form curing, moist absorptive mats, fog spraying, or membrane curing compound.

END OF SECTION

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SECTION 03 41 00
TESTING CONCRETE STRUCTURES FOR WATERTIGHTNESS

PART 1 GENERAL

1.1 SUMMARY

A. Watertightness testing requirements for manholes, process tanks, distribution boxes, channels, and similar structures that contain water (continuously or intermittently).

1.2 RELATED SECTIONS

A. Division 01

1.3 REFERENCES

A. American Concrete Institute (ACI) 350R – Environmental Engineering Concrete Structures

B. ACI 350.1 R – Testing Reinforced Concrete Structures for Watertightness

1.4 QUALITY ASSURANCE

A. Testing: Provide watertightness testing for all water-containment structures in accordance with ACI 350.1R.

B. Hydrostatic Test (HST) for open or covered tanks.

1. HST-100: The maximum overall percent loss water volume shall be 0.100 percent per day of the test. The test shall be continued for a duration sufficient to cause a 3/8-inch (10 mm) drop in the water surface assuming the loss of water is at the maximum rate.

2. HST-VIO: The Hydrostatic Visual Inspection Test (HST-VIO) has no numerical value for the allowable loss of water during the tightness test. However, no flow or seepage of water from the tank shall be present on the exterior surfaces for 24 hours after the tank is filled. For purposes of this test, seepage shall be defined as spots where moisture can be picked up on a dry hand or tissue.

C. Perform a watertightness test as required by the Engineer on any additional structure when in the opinion of the Engineer the structure contains sufficient concrete defects that could impair the watertightness of the structure.

1. Testing to conform to requirements of this specification section with allowable leakage and other criteria as established by Engineer.

2. Pay for all labor and material costs resulting from this testing.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Submit detailed plan for testing, including testing of subbasins of structures, necessary temporary bulkheads and components, personnel responsible for conducting the testing, personnel responsible for analyzing the results, testing and monitoring equipment, etc.

C. Submit to Engineer results of watertightness testing indicating the following:

1. Level of water in structure and evaporation pan at commencement and duration of final test period.

2. Level of water in structure and evaporation pan at end of final test period.

3. Tabular results of leakage testing, including water depth change, water and air temperature, precipitation, evaporation, total loss, and loss due to leak.

4. Net leakage in percent of total volume during final test period (gross leakage minus that due to evaporation).

5. Area, methods, and materials of patching to correct leakage.

6. Results of retesting if required due to leakage exceeding allowed values.

D. Testing for watertightness, with accompanying results, to be witnessed by Engineer.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 CONCRETE STRUCTURES REQUIRING TESTING

A. The following is a minimum list of concrete structures which shall be tested. The Engineer may require watertightness testing of any other structure at any time.

1. Yard Piping Manholes

2. Solids Holding Tank

3.2 PREPARATION BEFORE TESTING

A. Testing shall be performed prior to application of coatings, prior to placement of exterior backfill soil, and prior to placement of exterior concrete masonry.

B. Notify the Engineer in at least 24 hours prior to the filling of any structure for leakage testing.

C. Testing shall be performed per the Contract Documents and as recommended by ACI 350.1 R.

D. Cleaning: Thoroughly clean interior of structure to be tested of all debris and dirt and hose down surfaces of all walls and slabs.

E. Patching shall be per Section 03 30 00 and as follows:

1. Completely fill tie holes.

2. Fill voids and honeycombed areas with patching grout.

3. Cracks suspected to cause leakage shall be filled with epoxy adhesive.

4. Patching to be performed after concrete defective area is cleaned of all loose material to surface of sound concrete.

5. Finish wall surfaces per the General Concrete Notes and Specifications on the project drawings.

3.3 TESTING FOR LEAKAGE

A. The exterior of each basin shall be tested according to HST-100 and HST-VIO as defined in this section.

B. The interior walls of each basin shall be independently tested according to HST-100 as defined in this section.

C. The purpose of this test is to determine the integrity of the finished concrete and to show that the exposed wall surfaces are visually acceptable. Therefore, all other equipment (i.e., stop gates, sluice gates, valves, etc.) and temporary bulkheads shall be made watertight prior to the test and shall be monitored before and during the test to determine the watertightness of these appurtenances. Leakage at these outlets shall be repaired prior to test measurements. No allowance shall be made in test measurements for uncorrected known points of leakage. The flow from the underdrain system (if any) shall be monitored during this same period and any increases in flow shall be recorded.

D. If the tank is to be filled using the tank inlet pipe, positive means shall be provided to check that water is not entering or leaving the tank through this pipe once the tank is filled to test level.

E. The ground water level shall be maintained at a level below the top of the base slab and kept at that elevation (or lower) during the test.

F. All water-containment structures shall be subjected to leakage tests after the concrete has been cured and obtained its design strength and before backfilling or other work that will cover the concrete surfaces of the walls has begun. The minimum curing period for all concrete comprising the foundations, floor slabs, walls, and columns shall be the

time required for all concrete to reach the minimum specified compressive strengths as verified by concrete cylinder compression tests, but no less than 28-days.

G. Water Source

1. Potable water required for the testing shall be provided by the Contractor. If plant effluent is utilized, the effluent shall be following disinfection and subsequently chlorinated with an initial chlorine residual of 2 ppm minimum.

2. Contractor shall provide the necessary pump(s) and conveyance systems to fill and drain the structures, as necessary.

3. Upon completion of the testing, the water shall be disposed of back into the treatment system at the Headworks or accordance with the plant supervisor's instructions. Dispose of water such that new or existing construction is protected and to avoid overloading, interfering, or otherwise impacting plant operations. If disinfected plant effluent is used for testing, washdown surfaces and clean / disinfect as necessary to avoid putrescent odors.

H. Initial Filling

1. All water-containment structures shall be filled with potable water or disinfected and chlorinated plant effluent to one foot below top of wall (unless noted otherwise) prior to leak testing except for manholes, which shall be filled to the top of the cone prior to leak testing.

2. After these structures have been kept full for 72 hours, it will be assumed for the purposes of the test that the absorption of moisture by the concrete in the basin is complete.

3. Contractor shall refill to the starting water level for initiation of the testing.

I. Initiation of Testing

1. The change in water surface shall be measured for a 24-hour period.

2. During the test period all exposed portions of the structure shall be examined for dampness or leaks, and all visible leaks or damp spots shall be marked; such leaks or damp spots shall later be patched or corrected in a manner acceptable to the Engineer prior to additional leakage testing.

3. If the drop in water surface in the 24-hour period exceeds one gallon per thousand gallons of volume of liquid contained in the water-holding structure, after accounting for evaporation and precipitation in open basins, or if damp spots or any seepage is present on the walls or other areas exposed to view, the leakage shall be considered excessive, and the leakage test will be considered to have failed.

4. Evaporation shall be determined by floating an evaporation pan in the structure during the test period.

5. If the leakage is determined to be excessive (as defined above) or if damp spots and observed seepage are present on exposed surfaces, the water-containment structure shall be drained for repair. Cracks shall be sealed in accordance with Section 03 30 00 – Cast-in-place Concrete. Any leakage or seepage through the joints shall be repaired to the satisfaction of the Engineer. Contractor shall submit a proposed method of repair for all cracks, areas of leakage, and areas of seepage for review and approval by Engineer.

6. The water-containment structure shall then be refilled to the levels noted previously and tested again for leakage. Contractor shall repeat the testing and repair process as many times as necessary until the leakage test passes.

7. All repairs of faulty workmanship and materials, and additional tests, shall be made by the Contractor in an acceptable manner, at no additional cost to the Owner. Both the correction for excessive leakage and the removal of the damp or wet spots on walls shall be required to pass the leakage test.

J. All costs for testing the water-containment structures, including re-testing and all associated repairs, shall be borne by the Contractor.

END OF SECTION

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SECTION 03 60 00
GROUTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Portland Cement Grout
2. Non-Shrink Cementitious Grout

B. Related Sections:

1. Section 01 20 00 – Measurement and Payment
2. Section 05 12 00 – Structural Steel

1.2 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 301 - Specifications for Structural Concrete
2. ACI 318 - Building Code Requirements for Structural Concrete

B. ASTM International (ASTM):

1. ASTM C33 - Standard Specification for Concrete Aggregates
2. ASTM C40 - Test Method for Organic Impurities in Fine Aggregates for Concrete
3. ASTM C150 - Standard Specification for Portland Cement
4. ASTM C191 - Test Method for Time of Setting of Hydraulic Cement by Vicat Needle
5. ASTM C307 - Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings
6. ASTM C531 - Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
7. ASTM C579 - Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts, monolithic Surfacings and Polymer Concretes
8. ASTM C827 - Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures

1.3 SUBMITTALS

A. Product Data: Submit product data on grout.

B. Manufacturer's Installation Instructions: Submit manufacturer's instructions for mixing, handling, surface preparation and placing epoxy type and non-shrink type grouts.

C. Proposed flowable fill mix design report.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver grout in manufacturer's unopened containers with proper labels intact.

B. Store grout in a dry shelter, protect from moisture.

PART 2 PRODUCTS

2.1 PORTLAND CEMENT GROUT MATERIALS

A. Portland Cement: ASTM C150, Type II

B. Water:

1. Potable; containing no impurities, suspended particles, algae or dissolved natural salts in quantities capable of causing:
    a. Corrosion of steel
    b. Volume change increasing shrinkage cracking
    c. Efflorescence
    d. Excess air entraining

C. Fine Aggregate:

1. Washed natural sand
2. Gradation in accordance with ASTM C33 and represented by smooth granulometric curve within required limits.
3. Free from injurious amounts of organic impurities as determined by ASTM C40.

D. Mix:

1. Portland cement, sand and water. Do not use ferrous aggregate or staining ingredients in grout mixes.

2.2 NON-SHRINK CEMENTITIOUS GROUT

A. Non-shrink Cementitious Grout: Pre-mixed ready for use formulation requiring only addition of water; non-shrink, non-corrosive, non-metallic, non-gas forming, no chlorides.

B. Properties: Certified to maintain initial placement volume or expand after set and meet the following minimum properties when tested in accordance with CRD-C621, for Type D non-shrink grout:

Property	Test	Time	Result
Setting Time	ASTM C191	Initial	2 hours (Approx)
		Final	3 hours (Approx)
Expansion			0.10% - 0.4% Maximum
Compressive Strength	CRD-C621	1 day	4,000 psi
		7 days	7,000 psi
		28 days	10,000 psi to 10,800 psi

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify areas to receive grout.

3.2 PREPARATION

A. Remove defective concrete, laitance, dirt, oil, grease, and other foreign material from concrete surfaces by brushing, hammering, chipping or other similar means until sound, clean concrete surface is achieved.

B. Rough concrete lightly, but not enough to interfere with placement of grout.

C. Remove foreign materials from metal surfaces in contact with grout.

D. Align, level, and maintain final positioning of components to be grouted.

E. Saturate concrete surfaces with clean water; remove excess water, leave none standing.

3.3 INSTALLATION - FORMWORK

A. Construct leak-proof forms anchored and shored to withstand grout pressures.

B. Install formwork with clearances to permit proper placement of grout.

3.4 MIXING

A. Portland Cement Grout:

1. Use proportions of two parts sand and one part cement, measured by volume.

2. Prepare grout with water to obtain consistency to permit placing and packing.

3. Mix water and grout in two steps; pre-mix using approximately 2/3 of water; after partial mixing, add remaining water to bring mix to desired placement consistency and continue mixing two to three minutes.

4. Mix only quantities of grout capable of being placed within 30 minutes after mixing.

5. Do not add additional water after grout has been mixed.

6. Capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

B. Mix grout components in proximity to work area and transport mixture quickly and in manner not permitting segregation of materials.

3.5 PLACING GROUT

A. Place grout material quickly and continuously.

B. Do not use pneumatic-pressure or dry-packing methods.

C. Apply grout from one side only to avoid entrapping air.

D. Do not vibrate placed grout mixture, or permit placement when area is being vibrated by nearby equipment.

E. Thoroughly compact final installation and eliminate air pockets.

F. Do not remove leveling shims for at least 48 hours after grout has been placed.

3.6 CURING

A. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. After grout has attained its initial set, keep damp for minimum of three days.

3.7 FIELD QUALITY CONTROL

A. Submit proposed mix design of each class of grout to inspection and testing firm for review prior to commencement of work.

B. Tests of grout components may be performed to ensure conformance with specified requirements.

END OF SECTION

SECTION 04 01 00
MAINTENANCE OF MASONRY

PART 1 GENERAL

1.1 SUMMARY

A. Section includes water, steam, and chemical cleaning of masonry surfaces; replacement of masonry units; sand blast cleaning of masonry surfaces; repointing mortar joints; and repair of damaged masonry.

B. Related Sections:

1. Division 1

2. Division 3

3. Division 4

1.2 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 530 - Building Code Requirements for Masonry Structures.

2. ACI 530.1 - Specifications for Masonry Structures.

1.3 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures

B. Product Data: Submit data on cleaning compounds and cleaning solutions.

C. Manufacturer's Installation Instructions: Submit installation procedures for products selected for use, manufacturer's installation instructions, perimeter conditions requiring special attention.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 530 and ACI 530.1 requirements.

1.5 QUALIFICATIONS

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

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Division 1: Product storage and handling requirements.

B. Deliver masonry neatly stacked and tied on pallets. Store clear of ground with adequate waterproof covering.

C. Store sand blasting, acid solution and restoration cleaner materials in manufacturer's packaging.

D. Store mortar ingredients in manufacturer's packaging, or when delivered loose, with adequate weatherproof covering.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Division 1.

B. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40°F.

C. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100°F or ambient temperature is greater than 90°F with wind velocity greater than eight miles per hour (mph).

PART 2 PRODUCTS

2.1 COMPONENTS

A. Cleaning Agent: Detergent, solvent cleaner, or acid solution.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 1: Coordination and project conditions.

B. Verify surfaces to be cleaned or restored are ready for work of this section.

3.2 PREPARATION

A. Protect elements surrounding work of this section from damage or disfiguration.

B. Immediately remove stains, efflorescence, or other excess resulting from work of this section.

C. Protect roof membrane and flashings from damage.

D. Provide dams to divert flowing water to exterior drains.

E. Carefully remove and store fixtures, fittings, finishing hardware and accessories.

F. Close off, seal, mask, and/or board up areas, landscaping, materials, and surfaces not receiving work of this section to protect from damage.

G. Construct dust proof and weatherproof partitions to close off occupied areas.

3.3 INSTALLATION

A. Cleaning New Masonry:

1. Verify mortar is fully set and cured.

2. Clean surfaces and remove large particles with wood scrapers, brass, or nylon wire brushes.

3. Scrub walls with detergent solution using stiff brush. Thoroughly rinse and wash off cleaning solution, dirt and mortar crumbs using clean, pressurized water.

4. Use acid solution mixed with water. Apply acid solution and scrub masonry with stiff fiber brushes. Do not scrub mortar joints.

5. Protect area below cleaning operation and keep masonry soaked with water and flushed free of acid and dissolved mortar continuously for duration of cleaning.

6. Before solution dries, rinse and remove acid solution and dissolved mortar, using clean, pressurized water.

3.4 CLEANING

A. Section 01 70 00 – Closeout Requirements: Final cleaning.

B. As work proceeds and on completion, remove excess mortar, smears, droppings.

C. Clean surrounding surfaces.

END OF SECTION

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SECTION 04 10 00
MORTAR AND GROUT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Mortar and grout for masonry.

1.2 SUBMITTALS

A. Samples: Submit two samples of mortar illustrating mortar color and color range to Engineer and Architect per Section 01 33 00.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with American Concrete Institute (ACI) 530 and ACI 530.1.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Hot Weather Requirements: International Masonry Industry All-Weather Council (IMIAC) - Recommended Practices and Guide Specifications for Hot Weather Masonry Construction.

B. Cold Weather Requirements: IMIAC – Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.

PART 2 PRODUCTS

2.1 MATERIALS

A. Portland Cement: ASTM International (ASTM) C150, Type I, gray color

B. Mortar Aggregate: ASTM C144, standard masonry type

C. Hydrated Lime: ASTM C207, Type S

D. Mortar Color: Mineral oxide pigment; color as selected

E. Grout Aggregate: ASTM C404

F. Water: Clean and potable

G. Bonding Agent: Epoxy type

2.2 MORTAR MIXES

A. Mortar for Load Bearing Walls and Partitions: ASTM C270, Type S using the Property Method.

B. Mortar for Reinforced Masonry: ASTM C270, Type S using the Property Method.

C. Stain Resistant Pointing Mortar: One part Portland cement, 1/8-part hydrated lime, and two parts graded (80 mesh) aggregate, proportioned by volume. Add aluminum tristearate, calcium stearate or ammonium stearate equal to two percent of Portland cement by weight.

D. Integral Water-Repellent Mortar Admixture:

1. Integral liquid polymeric admixture for mortar added during mixing. Dry-Block Mortar Admixture manufactured by Grace Construction Products. Subject to compliance with requirements, equivalent products by the following manufacturers are acceptable.

a. ACM Chemistries, Inc.: Rain Bloc for Mortar

b. BASF: Rheopel Mortar Admixture

c. Approved equal

2.3 MORTAR MIXING

A. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C270.

B. Add mortar color and admixtures in accordance with manufacturer's instructions.

C. Do not use anti-freeze compounds to lower the freezing point of mortar.

2.4 GROUT MIXES

A. Bond Beams, Lintels and Engineered Masonry: 2,000 psi strength at 28 days; 8”-11” slump; mixed in accordance with ASTM C476 Fine Grout

2.5 GROUT MIXING

A. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C476 Fine grout.

B. Do not use anti-freeze compounds to lower the freezing point of grout.

2.6 MIX TESTS

A. Test mortar and grout in accordance with Section 01 40 00 and the General Structural Notes in the Plans.

B. Testing of Mortar Mix: In accordance with ASTM C780.

C. Testing of Grout Mix: In accordance with ASTM C1019.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install mortar in accordance with ASTM C780. Install grout in accordance with ASTM C1019.

B. Work grout into masonry cores and cavities to eliminate voids. Do not displace reinforcement.

END OF SECTION

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SECTION 04 30 00
REINFORCED UNIT MASONRY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete Masonry Units (CMUs).

B. Related Requirements:

1. Division 1
2. Division 3
3. Division 4
4. Division 5
5. Division 6
6. Division 7
7. Division 8
8. Division 9
9. Division 10

1.2 REFERENCE STANDARDS

A. American Concrete Institute (ACI):

1. ACI 530 - Building Code Requirements for Masonry Structures.
2. ACI 530.1 - Specification for Masonry Structures.

B. ASTM International (ASTM):

1. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
2. ASTM A240 - Standard Specification for Chromium and Chromium Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

3. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 pounds per square inch (psi) Tensile Strength.

4. ASTM A580 - Standard Specification for Stainless Steel Wire.

5. ASTM A615 - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.

6. ASTM A653 - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

7. ASTM A951 - Standard Specification for Steel Wire for Masonry Joint Reinforcement.

8. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction.

9. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.

10. ASTM C27 - Standard Classification of Fireclay and High Alumina Refractory Brick.

11. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.

12. ASTM C140 - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.

13. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.

14. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

15. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

1.3 COORDINATION

A. Division 2: Requirements for coordination.

B. Coordinate Work of this Section with installation of window and door anchors.

C. Direct and coordinate placement of metal anchors supplied to other Sections.

D. Coordinate Work of this Section with installation of emergency key cabinets.

1.4 PREINSTALLATION MEETINGS

A. Division 2: Requirements for pre-installation meeting.

1.5 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit data for masonry units, fabricated wire reinforcement, anchors, and other accessories.

C. Shop Drawings:

1. Indicate bar sizes, spacing, laps, locations, reinforcement quantities, bending and cutting schedules, supporting, and spacing devices for reinforcement, and accessories.

2. Describe geometry of the masonry structure(s), location of any vertical or horizontal construction and/or control joints, penetrations, block-outs, anchor bolts, embedded electrical and instrumentation conduits and other embedded items.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Samples: For initial verification submit the following:

1. Unit masonry samples in small-scale form showing colors and textures for each different exposed masonry unit indicated.

2. Colored mortar samples showing full extend of colors available.

3. Provide full size block samples of matching shape, size, and color

F. Data Sheet:

1. Integral CMU and Mortar Water-Repellent Admixture.

a. Test Reports prepared by a qualified independent laboratory indicating compliance with the performance requirements for integral water-repellency as tested using:

i. ASTM E 514, Extended to 72 hours.

ii. ASTM C 1357

iii. ASTM C 1314

iv. ASTM C 1148

1.6 QUALITY ASSURANCE

A. Structural Tests and Special Inspections: Conform to International Building Code (IBC) Chapter 17 and IBC Chapter 21 for special inspections and quality assurance verification testing of compressive strength of each unit masonry wythe using prism test method as tested to ASTM C1314.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Division 1: Requirements for transporting, handling, storing, and protecting products.

1.8 AMBIENT CONDITIONS

A. Division 1: Requirements for ambient condition control facilities for product storage and installation.

B. Cold Weather Requirements: Conform to ACI 530.1 when ambient temperature or temperature of masonry units is less than 40˚F.

C. Hot Weather Requirements: Conform to ACI 530.1 when ambient temperature is greater than 100˚F, or ambient temperature is greater than 90˚F with wind velocity greater than eight miles per hour.

PART 2 PRODUCTS

2.1 REINFORCED UNIT MASONRY ASSEMBLIES

A. Concrete Unit Masonry Compressive Strength (f'm): Minimum 2,000 psi minimum net area compressive strength as determined by prism test method.

2.2 MATERIALS

A. Hollow Load-Bearing Concrete Masonry Units (CMU): ASTM C90; medium weight.

B. Concrete Masonry Unit Size and Shape: Furnish special units for 90-degree corners, bond beams, bases, lintels, and fillers to match and complement block units. Nominal modular sizes:

1. 8 inches by 8 inches by 16 inches nominal.

2. 12 inches by 8 inches by 16 inches nominal.

C. Style: Color and textures and indicated in the Architectural drawings. Interior walls are to be smooth face units.

D. Color: Exterior CMU walls to be colored block. Interior CMU walls can be natural grey if painted, if clear sealer is specified, the interior CMU block color is to match the exterior walls. Refer to Architectural drawings and Section 09 91 00 for coating requirements.

E. Integral CMU Water-Repellent:

1. Integral liquid polymeric admixture mixed with the concrete during production of CMUs. Dry-Block Block Admixture manufactured by Grace Construction Products. Subject to compliance with requirements, equivalent products by the following manufacturers are acceptable.

   a. ACM Chemistries, Inc.: Rain Bloc.

   b. BASF: Rheopel Plus.

   c. Approved Equal.

2. Water Permeance of Masonry: Capable of achieving a Class E Rating when evaluated using ASTM E 514 with the test extended to 72 hours, using the rating criteria specified in ASTM E 514-74.

3. Bond strength as determined by ASTM E 72 shall not be reduced using water repellent admixture.

F. Painting: CMU is to be painted in accordance with Division 9 of this specification, and the drawings. See room finish schedule in the drawings.

2.3 ACCESSORIES

A. Reinforcing Steel: Deformed type, as specified in Section 03 20 00 - Concrete Reinforcement, uncoated finish.

B. Reinforcing Bar Positioners: Cold-drawn steel wire, 11 gage, ASTM A153, hot-dip galvanized ASTM A580, designed to prevent displacement of reinforcing steel and maintain adequate grout coverage within unit masonry cells.

1. Vertical Bar: Fabricate for positioning each vertical bar lap splice.

2. Horizontal Bar Positioners: Fabricate for positioning bar at top of bond beam.

C. Anchor Rods: ASTM A307, Grade A (60 yield strength); J-shaped or L-shaped; complete with washers and heavy hex nuts; sized for minimum 15-in embedment or as specified on drawings; galvanized finish.

1. Hot-Dip Galvanizing: ASTM A153.

2. Mechanical Galvanizing: ASTM B695; Class 55.

D. Mortar and Grout: As specified in Section 04 10 00 – Mortar and Grout.

E. Masonry Control Joint, Expansion Joint, and Relief Angle Sealant: Double weather seal, as specified Section 07 92 00 – Joint Sealants – Architectural.

1. Exposed Joint Sealers: As specified in Division 7.

2. Back-up Sealant: As Specified in Division 7.

F. Control Joints:

1. Standard Preformed Control Joints: Molded Rubber, Neoprene or Polyvinylchloride material; Durometer hardness 70 + 5 nominal, 3/8-inch thick. Furnish with corner and tee accessories; heat cement-fused joints.

2. 3-Hour Fire Rated Control Joints: Reference notes and plans identified in Architectural Details on the Architectural Drawings.

G. Cleaning Solution: Commercial masonry cleaner that is not harmful to masonry or adjacent materials. Conform to manufacturer instructions. Muriatic acid and other acidic solutions not permitted.

H. Through-Wall Flashing.

1. Material

a. Galvanized sheet steel of at least 20 gauge.

2.4 SOURCE QUALITY CONTROL

A. Division 1: Requirements for testing, inspection, and analysis requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 1: Requirements for installation examination.

B. Verify field conditions are acceptable and are ready to receive Work prior to beginning.

C. Verify items provided by other Sections of Work are properly sized and located.

D. Verify built-in items are in proper location and ready for roughing into masonry work.

E. Verify masonry units free of cracks, spalling, disfigurements, face chips, or edge chips more than 1/4 inch in length or depth. Clean free of bond breakers and other foreign substances.

3.2 PREPARATION

A. Section 01 70 00 – Execution and Closeout Requirements: Requirements for installation preparation.

3.3 INSTALLATION

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

B. Establish lines, levels, and coursing indicated. Protect from displacement.

C. Maintain masonry courses to uniform dimension. Form bed and head joints of uniform thickness.

D. Align exposed exterior faces of masonry flush, allowing block thickness variations to appear on unexposed or interior face.

E. Coursing of Concrete Masonry Units:

1. Bond: Running.

2. Coursing: One unit and one mortar joint to equal eight inches.

3. Mortar Joints: Concave.

F. Placing and Bonding:

1. Lay hollow masonry units with face shell bedding on head and bed joints.

2. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.

3. Remove excess mortar as Work progresses.

4. Interlock intersections and external corners.

5. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is required, remove mortar, and replace.

6. Perform jobsite cutting of masonry units with proper tools to assure straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

G. Lintels:

1. Install reinforced unit masonry lintels as indicated on the Drawings over openings where steel or precast concrete lintels are not scheduled or indicated.

2. Do not splice longitudinal reinforcing bars over openings.

3. Support and secure reinforcing bars from displacement.

4. Place and consolidate grout fill without displacing reinforcing.

5. Allow masonry lintels to attain specified strength before removing temporary supports.

6. Maintain minimum 8-inch minimum bearing on each side of opening

7. Grout lintels solid to a minimum depth of 16-inches or two courses of block. Grout solid to a greater depth where indicated on the drawings.

8. Standard open core blocks cannot be used as lintel blocks.

H. Grouted Components:

1. Reinforce bond beam with as indicated on the drawings.

2. Lap splices' bar diameters as required by code or indicated on the drawings.

3. Support and secure reinforcing bars from displacement.

4. Place and consolidate grout fill without displacing reinforcing.

5. At bearing locations, fill masonry cores with grout for a minimum of 12 inches either side of opening.

I. Reinforced Masonry:

1. Lay masonry units with cells vertically aligned and clear of mortar and unobstructed.

2. Place reinforcing, reinforcement bars, and grout as indicated on Drawings.

3. Splice reinforcement as indicated on the Drawings.

4. Support and secure reinforcement from displacement.

5. Place and consolidate grout fill without displacing reinforcing.

6. Place grout according to ACI 530.1

J. Control and Expansion Joints:

1. Install control and expansion joints as indicated on Drawings:

2. Do not continue horizontal joint reinforcement through control and expansion joints except as noted on the Drawings.

3. Install preformed control joint device in continuous lengths. Seal butt and corner joints.

4. Size control joint according to Section 07 92 00 – Joint Sealants – Architectural for sealant performance.

K. Built-in Work:

1. As Work progresses, install built-in metal door frames, fabricated metal frames, window frames, anchor bolts, plates, and other items to be built in the Work and furnished by other Sections.

2. Install built-in items plumb and level.

3. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout or mortar. Fill adjacent masonry cores with grout minimum eight inches from framed openings.

4. Do not build in materials subject to deterioration.

L. Cutting and Fitting:

1. Cut and fit for chases, pipes, conduit, sleeves, grounds, and other items required. Coordinate with other Sections of Work to provide correct size, shape, and location.

2. Obtain Architect/Engineer's approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

M. Cleanouts at Solid-Grouted, Hollow-Core Masonry:

1. Locate at bottom course of each grout lift at each vertical reinforcing bar with maximum 32 inches o.c. at solid grouted walls for grout pours exceeding five feet in height, according to ACI 530.1.

2. Make cleanout by removing and reinstalling entire face of masonry unit at exterior wall surfaces.

3. Clean grout space prior to grouting to remove mortar droppings, mortar projections larger than 1/2 inch, and other foreign matter.

4. Seal cleanouts after inspection and before grouting.

N. Repairs and Infill in Existing Masonry

1. Provide matching block and mortar (no water repellent admixture). Apply CMU water repellent per Division 9.

2. Submit shop drawings and samples for masonry units to match existing structures.

3.4 ERECTION TOLERANCES

A. Section 01 40 00 – Quality Requirements: Requirements for tolerances.

B. Maximum Variation from Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet 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 from Level Coursing: 1/8 inch in three feet and 1/4 inch in 10 feet; ½ inch in 30 feet.

F. Maximum Variation of Joint Thickness: 1/8 inch in three feet.

G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

H. Maximum Variation for Steel Reinforcement:

1. Install reinforcement within the tolerances specified in ACI 530.1 for foundation walls.

2. Plus or minus 1/2 inch when distance from centerline of steel to opposite face of masonry is eight inches or less.

3. Plus or minus one inch when distance is between eight and 24 inches.

4. Plus or minus 1-1/4 inch when distance is greater than 24 inches.

5. Plus or minus two inches from location along face of wall.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 – Quality Requirements specifies requirements for inspecting and testing.

B. Test each type of concrete masonry units according to ASTM C140.

C. Cut out damaged and defective work, reconstruct with new masonry materials, and repoint with mortar.

D. Remove excess mortar on masonry and adjacent surfaces.

3.6 CLEANING

A. Section 01 70 00 – Closeout Requirements: Requirements for cleaning.

B. Remove excess mortar and mortar smears as Work progresses.

C. Promptly remove excess wet mortar containing integral water repellent mortar admixture from the face of the masonry as work progresses. Refer to admixture manufacturer for proper cleaning procedures.

D. Replace defective mortar. Match adjacent Work.

E. Clean soiled surfaces with cleaning solution.

F. Use non-metallic tools in cleaning operations.

G. Remove efflorescence from masonry wall exposed in the finished work in accordance with manufacturers' recommendations and NCMA TEK Bulletin #8-01A, #8-02A, #8-03A & #8-04A.

3.7 CMU WATER REPELLENT

A. Immediately after final cleaning. Apply CMU water repellent to exterior and interior surfaces as called out in Room Finish Schedule. See Section 07 19 00 –Water Repellents (Masonry).

3.8 PROTECTION

A. Section 01 70 00 –Closeout Requirements: Requirements for protecting finished Work.

B. Hot and Cold Weather Construction: Perform Work according to ACI 530.1, 1.8.

C. Protect exposed external corners subject to damage.

D. Protect base of walls from mud and mortar splatter.

E. Protect masonry and other items built into masonry walls from mortar droppings and staining caused by mortar.

F. Protect tops of masonry work with waterproof coverings secured in place without damaging masonry. Provide coverings where masonry is exposed to weather when Work is not in progress.

G. Protect Work from rain by performing Work under protective cover.

END OF SECTION

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SECTION 05 04 10
HOT-DIP GALVANIZING

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section specifies hot-dip galvanizing for all miscellaneous and structural steel exposed to the weather, moisture, or corrosive atmosphere including but not limited to the following:

1. Structural steel where indicated on the Drawings and in these Specifications.

2. Items identified in other Sections of these Specifications.

B. Definitions

1. Hot-Dip Galvanizing: The dipping of steel members and assemblies into an alloy of molten special high-grade zinc and other earthly materials for lasting long-term protection.

2. The resultant zinc alloys with the base metal.

1.2 REFERENCE STANDARDS

A. Comply with applicable portions of the following reference standards:

1. American Galvanizers Association Inc. (AGA): Publication entitled "Inspection Manual for Hot-Dip Galvanized Products."

2. ASTM International (ASTM):

a. A123 - Zinc (Hot Galvanized) Coating on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, and Hardware.

b. A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware.

c. A143 - Safeguarding Against Embrittlement.

d. A384 - Safeguarding Against Warpage.

e. A385 - Providing High Quality Zinc Coatings.

f. A780 - Repair of Hot-Dip Galvanizing.

1.3 SUBMITTALS

A. Certificate of Compliance from Galvanizer: Submit notarized Certificate of Compliance with application for payment for galvanizing, signed by galvanizer, indicating compliance with requirements of specifications. Include scope of services provided, and quantity and itemized description of items processed.

B. Visual Stamp: The galvanizer shall mark all lots of material with a clearly visible stamp or tag indicating the name of the galvanizer, the weight of the zinc coating, and the applicable ASTM Specification Numbers.

1.4 QUALITY ASSURANCE

A. Coordination Between Fabricator and Galvanizer: Prior to fabrication, direct fabricator to submit approved shop drawings to the galvanizer for all fabrications. Direct galvanizer to review fabricator's shop drawings for suitability of materials for galvanizing and coatings and coordinate any required modifications to fabrications required to be done by the fabricator.

B. Steel Materials: For steel to be hot dip galvanized, provide steel chemically suitable for metal coatings complying with the following requirements: Carbon below 0.25 percent, silicon below 0.24 percent, phosphorous below 0.05 percent, and manganese below 1.35 percent. Notify galvanizer if steel does not comply with these requirements to determine suitability for processing.

1. To prevent unnecessary damage to the galvanized coating by field welding, provide slip fit method of connecting pipe railings. Fabricate pipe railing from mechanical steel tubing internally vented with holes 3/4 the size of the pipe's internal diameter. For other fabrications, bolted connections shall be used wherever possible.

2. Assemblies: Where size of assembly is too large for galvanizing kettle, galvanize components prior to fabrication and assemble after galvanizing.

C. Engage the service of a galvanizer who has demonstrated a minimum of five (5) years experience in the successful performance of the processes outlined in this specification in the facility where the work is to be done and who will apply the galvanizing and coatings within the same facility as outlined herein. The Authority has the right to inspect and approve or reject the galvanizer/ galvanizing facility.

D. The galvanizer/galvanizing facility must have an ongoing Quality Control/Quality Assurance program acceptable to the Authority which has been in effect for a minimum of five years and shall provide the Authority with process and final inspection documentation.

E. The galvanizer/galvanizing facility must have an on-premises testing facility capable of measuring the chemical and metallurgical composition of the galvanizing bath and pickling tanks.

F. In process paint application shall be monitored with a wet film gage and the measurements recorded. Dry film thickness measurement shall be by Tooke Gage and Magnetic Coating Thickness gage.

G. Provide and apply materials complying with environmental requirements of authority having jurisdiction. All materials shall be delivered to the galvanizer with label or product data sheet affixed to the manufacturer's containers showing the manufacturer's name, batch number, type of paint, stock number, label analysis of solids and vehicle, reducing and thinning instructions, drying and recoat time, Material Safety Data Sheets (MSDSs), recommended application procedures and environmental restrictions. Paint materials shall be stored in an acceptable location reserved only for such materials and related equipment in compliance with applicable local health and fire regulations and Occupational Safety and Health Administration (OSHA) requirements.

H. The galvanizer/galvanizing facility must have a dedicated, on-premises painting and curing facility for the exclusive use of coating galvanized steel. Said facility shall utilize the following:

1. Recording hygrometer to measure air temperature and humidity.

2. A spray booth confirming OSHA regulations with filtered exhaust.

3. A convection hot air curing system with solvent vapor removal liability.

4. The curing booth shall be heated using an indirect thermostat-controlled gas fired forced hot air blower. The booth shall be protected with a sprinkler system complying with National Fire Protection Agency (NFPA) 15. The air in the curing booth shall be continuously monitored by a lower explosive limit (LEL) monitoring device connected to the ventilation system. The booth shall be capable of reaching 150°F with a sustained capability of 100°F.

PART 2 PRODUCTS

2.1 HOT-DIP GALVANIZING

A. Provide coating for iron and steel fabrications applied by the hot-dip process, Comply with ASTM A123 for fabricated products and ASTM A 153 for hardware. Provide thickness of galvanizing specified in referenced standards. The galvanizing bath shall contain special high-grade zinc.

B. If, for any reason, the galvanizing item is to be primed (for future field painting or finish coated), the coatings shall be applied by the galvanizer at same facility, within 12 hours of galvanizing, in accordance with Section 09 91 00.

C. Field priming of hot dip galvanizing will not be permitted.

D. Safeguard against embrittlement in conformance with ASTM A143.

E. Warpage or Distortion Prevention:

1. To safeguard against warpage or distortion of steel members, in conformance with ASTM A384, steel fabricator shall submit shop drawings of non-standard fabrications, all tubular fabrications, all fabrications involving any dimension which exceeds the size of the galvanizer's kettle, and any fabrication involving materials of different thicknesses.

2. Submit these drawings to the galvanizer before fabrication to determine the suitability of the material for galvanizing.

F. To prevent unnecessary damage to the finished coating by field welding, use bolted connections for field connections wherever possible.

G. To ensure a smooth even coating, pipe rails should be fabricated from mechanical steel tubing with "slip fit" type connections.

PART 3 EXECUTION

3.1 APPLICATION OF GALVANIZING AND METAL COATINGS

A. Galvanize materials in accordance with referenced standards and this specification.

B. Galvanizing shall provide an acceptable substrate for applied coatings.

C. The dry kettle process shall be used to eliminate any flux inclusions on the surface of the galvanized material. Prior to galvanizing, the steel shall be immersed in a pre-flux solution (zinc ammonium chloride). The pre-flux tanks must be 12o to 14o Baume' and contain less than 0.4 percent iron. The wet kettle process shall be prohibited.

D. To provide the galvanized surface required, the following procedures shall be implemented:

1. A monitoring recorder shall be utilized and inspected regularly to observe any variances in the galvanizing bath temperature.

2. The pickling tanks shall contain hydrochloric acid with a constant range between 10-14 percent, iron content less than eight percent and zinc content less than three percent. Titrations shall be taken weekly at a minimum.

3. Rinse tanks, for the removal of cleaning chemicals, shall contain water.

4. Water quenching of galvanized steel shall be prohibited.

E. Installation: Comply with fabricator's and galvanizer's requirements for installation of materials and fabrications, including use of nylon slings or padded cables for handling factory-primed or factory-finished materials.

F. Touch-Up and Repair: For damaged and field-welded metal coated surfaces, clean welds, bolted connections, and abraded areas.

1. At galvanized surfaces, apply organic zinc repair paint complying with requirements of ASTM A780. Galvanizing repair paint shall have 95 percent zinc by weight, ZIRP by Duncan Galvanizing. Thickness of applied galvanizing repair paint shall be not less than coating thickness required ASTM A123 or A153 ass applicable. Touch-up of galvanized surfaces with aerosol spray, silver paint, bright paint, brite paint, or aluminum paints is not acceptable.

2. At factory-primed or factory-finished surfaces, touch-up finish in conformance with manufacturer's recommendations. Provide touch-up such that repair is not visible from six feet away.

3. The galvanizer/galvanizing facility must have an ongoing touch-up and repair program acceptable to the Authority which has been in effect for a minimum of five years.

4. A touch-up repair kit shall be provided with each order.

PART 4 MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

A. Measurement for hot-dip galvanizing will be measured as being included in the contract lump sum or unit price for said item.

4.2 PAYMENT

A. Hot-Dip galvanizing will be paid for at the Contract price as specified above.

END OF SECTION

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SECTION 05 12 00
STRUCTURAL STEEL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Structural Shapes

B. Channels and Angles

C. Hollow Structural Sections

D. Structural Pipe

E. Structural Plates and Bars

F. Floor Plates

G. Fasteners, Connectors, and Anchors

H. Grout

1.2 RELATED SECTIONS

A. Division 1

B. Division 3

C. Division 4

D. Division 5

E. Division 9

1.3 REFERENCES

A. American Institute of Steel Construction (AISC)

1. AISC Code of Standard Practice for Steel Buildings and Bridges

2. AISC Seismic Provisions for Structural Steel Buildings

3. AISC Specification for Allowable Stress Design of Single-Angle Members

4. AISC Specification for the Design of Steel Hollow Structural Sections

5. AISC Specification for Structural Steel Buildings Allowable Stress Design, and Plastic Design

B. ASTM International (ASTM):

1. ASTM A36 - Standard Specification for Carbon Structural Steel

2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

3. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

4. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

5. ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service

6. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

7. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

8. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners

9. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

10. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

11. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts

12. ASTM A786 - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates

13. ASTM A992 - Standard Specification for Structural Steel Shapes

14. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel

15. ASTM E94 - Standard Guide for Radiographic Examination

16. ASTM E164 - Standard Practice for Ultrasonic Contact Examination of Weldments

17. ASTM E165 - Standard Test Method for Liquid Penetrant Examination

18. ASTM E709 - Standard Guide for Magnetic Particle Examination

19. ASTM F436 - Standard Specification for Hardened Steel Washers

20. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

C. American Welding Society (AWS):

1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination

2. AWS D1.1 - Structural Welding Code - Steel

D. Research Council on Structural Connections (RCSC):

1. RCSC - Specification for Structural Joints Using ASTM A325 or A490 Bolts

E. The Society for Protective Coatings (SSPC):

1. SSPC - Steel Structures Painting Manual

2. SSPC Paint 15 - Steel Joist Shop Paint

3. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic)

4. SSPC SP 3 - Power Tool Cleaning

5. SSPC SP 6 - Commercial Blast Cleaning

6. SSPC SP 10 - Near-White Blast Cleaning

1.4 SUBMITTALS

A. Submit under provision of Section 01 33 00.

B. Shop Drawings:

1. Indicate profiles, sizes, spacing, location of structural members, openings, attachments, and fasteners.

2. Connections.

3. Cambers.

4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with the following:

1. AISC Code of Standard Practice for Steel Buildings and Bridges.

1.6 QUALIFICATIONS

A. Fabricator: Company specializing in performing Work of this Section with minimum five years experience.

B. Erector: Company specializing in performing Work of this Section with minimum five years experience.

C. Shop Painter: Company specializing in performing Work of this Section with minimum five years experience.

D. Welders and Welding Procedures: AWS D.1 qualified within previous 12 months.

1.7 COORDINATION

A. Coordinate work with all effected trades.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

A. Structural W-Shapes: ASTM A992; Grade 50

B. Structural T-Shapes: Cut from structural W-shapes

C. Channels and Angles: ASTM A36

D. Square and Rectangular Hollow Structural Sections: ASTM A500, Grade C

E. Structural Pipe: ASTM A53, Grade B

F. Structural Plates and Bars: ASTM A36

G. Floor Plates: ASTM A786; raised pattern

2.2 FASTENERS, CONNECTORS, AND ANCHORS

A. High Strength Bolts: ASTM A325; Type 1

1. Finish: Unfinished

B. Nuts: ASTM A563 heavy hex type, Grade DH

1. Finish: Unfinished

C. Washers: ASTM F436; Type 1, circular. Furnish clipped washers where space limitations require

1. Finish: Unfinished

D. Anchor Rods: (Bolts set into concrete) ASTM F1554; Grade 55

1. Shape: Straight-Headed

2. Nuts for anchor rods to be ASTM A563, Grade A, Heavy Hex.

2.3 WELDING MATERIALS

A. Welding Materials: AWS D1.1; type required for materials being welded

2.4 ACCESSORIES

A. Grout for Steel Bearing Plates: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing minimum compressive strength of 7,000 psi.

B. Shop and Touch-Up Primer and Paint: Per Division 9.

2.5 FABRICATION

A. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

B. Fabricate connections for bolt, nut, and washer connectors.

C. Develop required camber for members.

2.6 FINISH

A. Prepare structural component surfaces in accordance with SSPC SP 3.

B. Painting and Coatings: Per Division 9. Do not prime surfaces that will be field welded, in contact with concrete, or high strength bolted.

2.7 SOURCE QUALITY CONTROL AND TESTS

A. Section 01 40 00 – Quality Assurance and Quality Control: Construction observation and testing laboratory service.

B. Shop test bolted and welded connections as specified for field quality control tests.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify bearing surfaces are at correct elevation.

B. Verify anchors rods are set in correct locations and arrangements with correct exposure for steel attachment.

3.2 PREPARATION

A. Furnish templates for installation of anchor rods and embedments in concrete and masonry work.

3.3 ERECTION

A. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.

B. Field weld components indicated on shop drawings.

C. Field connect members with threaded fasteners; torque to required resistance.

D. Do not field cut or alter structural members without approval of Architect/Engineer.

E. After erection, touch up welds and abrasions to match shop finishes.

3.4 GROUT INSTALLATION

A. Grout under base plates in accordance with Section 03 60 00.

B. Remove forms after grout is set. Trim grout edges to from smooth surface, splayed 45 degrees.

C. Tighten anchor bolts after grout has cured for a minimum of three days.

3.5 ERECTION TOLERANCES

A. Section 01 40 00 – Quality Assurance and Quality Control: Tolerances.

B. Maximum Variation from Plumb: ¼ inch per story, non-cumulative.

C. Maximum Offset from Alignment: ¼ inch.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 – Quality Assurance and Quality Control.

B. Bolted Connections: Inspect in accordance with AISC specifications.

1. Visually inspect all bolted connections.

C. Welding:

1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.

2. Visually inspect all welds.

D. Correct defective bolted connections and welds.

END OF SECTION

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SECTION 05 14 05
SURFACE MOUNTED ALUMINUM TRUSS COVER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This section covers the work necessary to furnish and install a surface mounted aluminum truss cover on the solids holding tank, 80-TK-1100. Furnish all labor, materials, and equipment to provide a complete, installed system of fixed and removable, custom fit, flat aluminum covers. The Tank Cover system includes cover panels, structural supports, and attaching hardware.

B. This specification is for a fully engineered, substantially airtight, surface mounted aluminum cover structure comprised of panels, beams, and above grade structural Warren type trusses.

C. This specification shall be regarded as a minimum standard for design and fabrication. Other cover system types such as formed aluminum, dome, fiberglass, carbon steel, or geomembrane shall not be acceptable and will not be considered for this project.

1.2 RELATED SECTIONS

A. Section 01 20 00 – Measurement and Payment

B. Section 01 33 00 – Submittal Procedures

C. Section 01 40 00 – Quality Assurance and Quality Control

D. Section 01 65 00 – Commissiong of Systems

E. Section 01 73 00 – Installations, Operation, and Maintenance Manuals

F. Division 3 – Concrete

1.3 REFERENCES

1.4 SUBMITTALS

A. Submittals shall be provided in accordance with Section 01 33 00, Submittal Procedures. The following information shall be provided:

1. Product Data: Manufacturer's data sheets on each product to be used including:

a. Calculations, design data, and test reports as applicable indicating compliance with requirements.

b. Complete structural calculations stamped by a Utah PE showing the governing stresses in all members and connections, and detailed shop drawings.

c. Storage and handling instructions.

d. Installation instructions.

2. Drawings shall be stamped by cover manufacturer's PE and include layouts, product description, connection and framing details, fastener types and spacing.

3. Miscellaneous certifications.

4. Manufacturer's standard guarantee.

5. A letter of certification signed and sealed by a registered Professional Civil Engineer confirming that the aluminum cover is in full compliance with the plans and specifications including any testing provisions included therein.

6. Provide written copies of manufacturer's warranties on products described in this specification section.

7. Provide Equipment Operation and Maintenance Manuals to the Owner per Section 01 73 00.

8. Submit a copy of this specification section, with addendum updates included, with each paragraph clearly marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. If deviations from the specifications are indicated and therefore requested by the Contractor, the submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification for any requested deviations to the specification requirements, with the submittal shall be cause for rejection of the entire submittal with no further consideration. The Owner retains the right to reject any proposed deviations in favor of this specification, as written.

1.5 QUALITY ASSURANCE

A. Manufacturer shall be a company specialized in providing engineered aluminum covers for wastewater treatment tanks/troughs for at least ten (10) years. When requested by the Engineer, submit written evidence to show experience qualifications and adequacy of plant capability and facilities for performance of contract requirements.

B. Contractor shall verify all field dimensions for development of manufacturer's drawings.

C. Contractor shall review and confirm in writing approval of manufacturer's drawings.

D. Erector:
1. Regularly engaged for at least ten (10) years in the erection of aluminum covers for wastewater treatment tanks.

E. Welders:
1. Qualified within the past two (2) years in accordance with AWS.

1.6 WARRANTY

A. The truss cover manufacturer shall warrant that the work described herein shall be free from defects, workmanship and material. The truss cover manufacturer shall replace, or repair only faulty workmanship or defective material furnished by it that is reported to it within one (1) year from the date of substantial completion.

1.7 MANUFACTURER'S SERVICES

A. The contractor shall provide a manufacturer's representative for the equipment specified herein for the person-days listed for the services hereunder, travel time excluded:

1. ½ person-day for functional testing, certification of the installation with written documentation, and plant startup.
2. ½ person-day for training.

B. Refer to specification section 01 65 00 Commissioning of Systems for additional requirements.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Provide a surface mounted aluminum truss cover system meeting the requirements of this specification from one of the following manufacturers. Manufacturers meeting the requirements of this specification but not listed here may be considered in accordance with the Contract Documents and the Instructions to Bidders.

1. Hallsten Corporation, Sacramento, California (800) 473-7440 (basis of design)
2. Or approved equal

2.2 DESIGN CRITERIA

A. Design Loads shall comply with local codes with combined loads determined by Allowable Stress Method.

1. Live load: 50 psf
2. Snow load (ground): 43 psf
3. Wind load: 12 psf
4. Other Load: 400# concentrated live load noncurrent

2.3 PERFORMANCE REQUIREMENTS

A. Span:

1. The clear span length of the cover shall be as noted in the scope of work.

B. Width:
   1. The inside width of the cover shall be as noted in the scope of work.

C. Walking surface elevation:
   1. Installed cover system walking surface elevation to be approximately two inches above top elevation of tank/basin walls.

D. Distributed Design Live Load and Deflection:
   1. All structural components shall be designed to support the dead weight of the structure, plus a live load no less than 50 pounds per square foot of surface. The maximum deflection of any component under this load shall not exceed L/240 of the span of that component. In no event shall the dead load deflection exceed the rise of any component in order to avoid surface ponding.

E. Concentrated Live Load:
   1. The structural components shall be designed to support a 400-pound load on a 6" X 6" area located anywhere on the surface of the structure without permanently deforming the tested area.

F. Design Stresses:
   1. All allowable design stresses in structural aluminum shall be in accordance with the "Specifications for Aluminum Structures" for building type structures by the Aluminum Association.

G. Skid Resistance:
   1. The cover shall possess an integral non skid surface and no exposed area of cover system wider than one inch shall be without ribs/non-skid surface. The aluminum-decking surface of the structure shall be Hallsten's Deck Slat, which is ribbed to provide an aggressively non-skid surface. The edges of adjacent deck slats shall double interlock so that the slats shall act together. The decking surface shall be manufactured form 6061-T6 alloy. The Manufacturer of the non-skid surface shall demonstrate in writing satisfactory performance for a minimum period of 10 years in the wastewater industry for the intended purpose. This surface shall not be achieved by the use of paint, adhesive tapes, sand blasting or any other meanse other than an extruded process.

H. Chemical Resistance:
   1. Panels shall be fabricated entirely of 6061 T6 corrosion resistant aluminum extrusions. Every panel to beam connection shall be chemical resistant and will not weaken or corrode and will interlock. A mechanical and replaceable Santoprene seal shall isolate the cover perimeter from the concrete wall. No foam tape or caulk shall be allowed.

I. Configuration:

1. The aluminum cover shall be composed of panels and beams. All panels shall interlock with the adjoining beam/beams without the use of threaded fasteners. Uplift of each panel will be resisted with the use of an integral latch system. The weight of an individual panel shall not exceed 150 pounds. Each removable panel shall be easy to remove without disruption of adjacent panels and the lifting force required shall not exceed the dead weight of the panel.

2.4 MATERIALS

A. Aluminum:
   1. All aluminum used in the fabrication of the cover shall be alloy 6061-T6. All plate shall be alloy 6061-T6. Material shall be new and of top quality.

B. Welding Electrodes:
   1. Welding shall be with electrodes of an alloy, which shall produce welds with strength and corrosion resistant characteristics compatible to the base metal.

C. Fasteners:
   1. All fasteners between aluminum components shall be stainless steel or structural plastic. Aluminum shall be isolated from dissimilar materials by means of a stainless steel spacer or an elastomeric isolator. Beams and panels shall be fastened to concrete using stainless steel drill in place anchor bolts.

D. Steel Accessories:
   1. No carbon steel components shall be used.

E. Seals:
   1. A mechanical and replaceable Santoprene seal shall isolate the cover perimeter from dissimilar materials such as concrete and steel. No foam tape or caulk shall be allowed for isolation of cover system.

F. Access Hatch Panels:
   1. Access to any location under the cover shall be gained through integral gear hinged access hatches. The Access Hatch Panels shall have the identical properties as the rest of the aluminum cover including loads, deflection and slip resistance specifications. The access-hinged panels shall be the full panel width. The length of the access panel shall be clearly indicated on drawings. Hinged panel components including hinges, decking and lifting handles shall be extruded 6061-T6. While in the closed position the hatches will be completely flush therefore posing no tripping hazard. In the open position the panel shall lie flat on the cover and will not need a hold open device.

G. Handles:
   1. Handles shall be an integral flush mounted aluminum and incorporated into the non skid deck slat.

PART 3 EXECUTION

3.1 FABRICATION AND WORKMANSHIP

A. Workmanship:
   1. The quality of workmanship shall be equal to the best general practice in modern structural fabrication shops. Workmanship, fabrication, and shop connections shall be in accordance with the latest edition of ANSI/AWS D1.2 "Structural Welding Code Aluminum".

B. Experience:
   1. The manufacturer must furnish adequate evidence of a minimum of ten (10) years of ongoing experience in the manufacture of similar structures.

C. Preparation for Welding:
   1. All components to be welded shall be free of dirt, grease, and other contaminants and shall fit up properly for sound welding. Surfaces to be welded may not be cut with oxygen. Sawing, shearing, or machining may be used.

D. Welding Procedures:
   1. All welding shall be with an inert gas shield arc process. Machine settings shall be developed with test welds of the same material, alloy and geometry as the work pieces and samples will be tested destructively.

E. At time of delivery, all materials shall be inspected for shipping damage. Freight company and manufacturer shall be notified immediately of any damage or quantity shortages.
   1. Contractor shall protect all materials from cuts, scratches, gouges, abrasions, and impacts.

3.2 DELIVERY AND INSTALLATION

A. In accordance with manufacturer's written instructions.

B. Delivery of the components of the structure shall be made to a location nearest the site that is accessible to over the road trucks, unless otherwise specified.

C. Storage:
   1. The components shall be stored off the ground on level surface in such a manner as to prevent damage.

D. The manufacturer shall furnish such personnel, tools, equipment, and materials as required to install the cover using the recommended procedure.

E. The cover manufacturer can provide installation instructions, on site supervision, and inspection if desired.

F. The manufacturer shall provide an O&M manual that includes drawings, maintenance instructions, and removal and replacement instructions for the installed cover.

3.3 PERFORMANCE TESTING

A. Materials shall comply with Federal and Local laws or ordinances, applicable codes, standards, regulations, and/or regulatory agency requirements.

B. Loads:

1. After installation the cover structure will be tested for conformance with the deflection limits. A load of 400 pounds will be placed as directed by the Engineer and the maximum deflection created by the load will be measured.

C. Prequalified Shop Testing:

1. MANUFACTURER shall perform a prequalified shop air tightness test and certification for the cover components proposed. This test shall be performed in accordance with the "Procedural Standards for Testing, Adjusting and Balancing of Environment System" as published by the National Environmental Balancing Bureau (NEBB) on cover components of not less than 80 square feet. Said test shall be conducted and witnessed by a NEBB certified technician. The method of testing, test apparatus and proposed contents of the test report shall be submitted to the ENGINEER for approval. Subsequent to the receipt of ENGINEER'S approval, the MANUFACTURER shall set up testing protocol and schedule the test. The MANUFACTURER will provide the ENGINEER with at least 72 hours notice prior to the scheduled test. A report of the test shall be prepared by the certified technician and shall be sealed with the NEBB seal. The report shall include a description and illustration of the test components, a description and illustration of the test apparatus and a report of the results. The cover shall maintain an air intrusion leakage rate not to exceed 0.2 cfm per square foot at an applied negative pressure of 0.2 inches of water column for a 5-minute duration.

END OF SECTION

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SECTION 05 21 00
STEEL JOIST FRAMING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Open web steel joists, with bridging, attached seats and anchors.

2. Loose bearing plates and anchor bolts for site placement.

3. Framed roof openings greater than 18 inches.

B. Related Requirements:

1. Section 05 12 00 – Structural Steel

2. Section 05 32 00 – Steel Roof Decking

1.2 REFERENCE STANDARDS

A. American Institute of Steel Construction (AISC):

1. AISC 341 - Seismic Provisions for Structural Steel Buildings.

B. ASTM International (ASTM):

1. ASTM A36 - Standard Specification for Carbon Structural Steel.

2. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.

3. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

4. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

5. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

6. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.

7. ASTM A449 - Standard Specification for Quenched and Tempered Steel Bolts and Studs.

8. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.

9. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.

10. ASTM F436 - Standard Specification for Hardened Steel Washers.

11. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

12. ASTM F2329 - Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.

C. American Welding Society (AWS):

1. AWS D1.1 – Structural Welding Code – Steel.

D. Steel Joist Institute (SJI):

1. SJI K-1.1 - Standard Specifications for Open Web Steel Joists, K-series.

2. SJI LH/DLH-1.1 - Standard Specifications for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series.

E. The Society for Protective Coatings (SSPC):

1. SSPC - Steel Structures Painting Manual.

2. SSPC SP 1 - Solvent Cleaning.

3. SSPC SP 10 - Near-White Blast Cleaning.

1.3 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Submittal requirements.

B. Shop Drawings:

1. Indicate standard designations, configuration, sizes, spacing, locations of joists, joist leg extensions.

2. Joist coding, bridging, connections, attachments, and cambers.

3. Connection details.

C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

D. Welders' Certificates: Submit manufacturer's certificates, certifying welders employed on the Work, verifying AWS qualification within previous 12 months.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following:

1. SJI K-1.1, SJI LH/DLH-1.1, and SJI JG-1.1, including headers and other supplementary framing.

2. AISC 341 Seismic Provisions for Structural Steel Buildings.

1.5 QUALIFICATIONS

A. Fabricator: Company specializing in performing Work of this section with minimum five years of documented experience.

B. Erector: Company specializing in performing Work of this section with minimum five years of documented experience.

C. Design connections not detailed on drawings under direct supervision of Professional Engineer experienced in design of this Work and licensed in the State of Washington.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements: Product storage and handling requirements.

PART 2 PRODUCTS

2.1 MATERIALS

A. Open Web Joists Members: SJI Type K or LH Longspan or DLH Deep Longspan as indicated on the Drawings.

B. Bolts: ASTM A325; Type 1, plain, or Type 3, plain; heavy hex, structural type.

C. Nuts: ASTM A563 heavy hex type.

1. Finish: Unfinished.

D. Washers: ASTM F436; Type 1, circular or beveled as required. Furnish clipped washers where space limitations require.

1. Finish: Unfinished.

E. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36.

F. Welding Materials: AWS D1.1; type required for materials being welded.

G. Paint and Coatings:

1. Shop Primer: SSPC Paint 15, Type 1, color per owner

2. Touch-Up Primer: Match shop primer.

3. Final coating system including prep, removal of existing primer systems, re-prime, stripe and finish coats shall be fully coordinated and applied per Section 09 96 00 – Protective Coatings.

2.2 FABRICATION

A. Furnish bottom and top chord extensions as indicated on Drawings.

B. Fabricate to achieve end bearing as indicated on the Drawings.

2.3 FINISHES

A. Prepare joist component surfaces in accordance with SSPC SP 2**.**

B. Shop prime joists and supplementary framing members. Do not prime surfaces that will be fireproofed, field welded, or in contact with concrete.

2.4 SOURCE QUALITY CONTROL

A. Section 01 40 00 – Quality Requirements: Testing, inspection, and analysis requirements.

B. Furnish shop testing and analysis of steel sections.

C. When fabricator is approved by authority having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

1. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 – Execution and Closeout Requirements: Requirements for installation examination.

B. Verify bearing plates are set to required location and elevation.

C. Verify bearing surfaces are ready to receive joists.

3.2 ERECTION

A. Erect and bear joists on supports.

B. Allow for erection loads. Install sufficient temporary bracing to maintain framing safe, plumb, and in alignment.

C. Coordinate placement of anchors in concrete construction for securing bearing plates or angles.

D. After joist alignment and installation of framing, field weld joist seat to bearing plates or angles.

E. Position and field weld joist chord extensions and wall attachments as detailed.

F. Frame floor and roof openings greater than 18 inches with supplementary framing.

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 Architect/Engineer.

I. After erection, prime welds, abrasions, and surfaces not shop primed except surfaces to be in contact with concrete.

3.3 TOLERANCES

A. Section 01 40 00 – Quality Requirements: Tolerances.

B. Maximum Variation From Plumb: ¼ inch.

C. Maximum Offset From Alignment: ¼ inch.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 – Quality Requirements: Requirements for inspecting, testing.

B. Section 01 70 00 – Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

C. Field inspect members, connections, welds, and tightening of high strength bolts in slip-critical connections.

END OF SECTION

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SECTION 05 32 00
STEEL ROOF DECKING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel roof deck and accessories.

2. Framing for openings up to and including 18 inches.

B. Related Sections:

1. Section 05 12 00 – Structural Steel

2. Section 05 21 00 – Steel Joist Framing: Support framing for deck openings.

3. Section 09 90 00 – Protective Coatings *(including preparation of decking for paint and coatings)*

1.2 REFERENCES

A. American Society of Civil Engineers (ASCE):

1. ASCE 3 - Standard Practice for the Construction and Inspection of Composite Slabs.

B. ASTM International:

1. ASTM A36 - Standard Specification for Carbon Structural Steel.

2. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

3. ASTM A1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Baked Hardenable.

C. American Welding Society (AWS):

1. AWS D1.1 - Structural Welding Code - Steel.

D. Steel Deck Institute (SDI):

1. SDI 29 - Design Manual for Composite Decks, Form Decks and Roof Decks.

E. The Society for Protective Coatings (SSPC):

1. SSPC Paint 15 - Steel Joist Shop Paint.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Shop Drawings: Indicate deck plan, support locations, Projections, openings and reinforcement, pertinent details, and accessories.

C. Product Data: Submit deck profile characteristics and dimensions, structural properties, and finishes.

D. Manufacturer's Installation Instructions: Submit manufacturer's installation instructions.

E. Manufacturer's Certificates: Certify Products meet or exceed specified requirements.

F. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ASCE 3 for composite decks.

1.5 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this Section with minimum five years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements: Product storage and handling requirements.

B. Cut plastic wrap to encourage ventilation.

C. Store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.1 MATERIALS

A. Sheet Steel: ASTM A653, Grade 50 Structural Quality; with G90 galvanized coating.

B. Bearing Plates or Angles: ASTM A36.

C. Welding Materials: AWS D1.1.

D. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20 Type I Inorganic.

2.2 ACCESSORIES

A. Flute Closures: Closed cell foam rubber one inch thick; profiled to fit tight to deck.

B. Sump Pans and plates: Fabricated of metal of same type and finish as deck.

2.3 FABRICATION

A. Metal Deck: Sheet steel, configured as follows:

1. Span Design: multiple.

2. Minimum Metal Thickness Excluding Finish: 20 gauge. G-90 Galvanized Coating

3. Minimum Section Properties (per foot width): S=0.233 in^3, I=0.207 in^4.

4. Nominal Height: 1-1/2 inch fluted profile WR.

5. Formed Sheet Width: 24 inch minimum.

6. Side Joints: lapped.

7. Flute Sides: plain vertical face.

B. Related Deck Accessories: Metal closure strips, cover plates, cant strips, 22 gauge thick galvanized sheet steel; of profile and size as indicated on drawings.

C. Roof Sump Pan or Plate: Fabricate of 14 gage sheet steel, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, sealed watertight.

D. Fasteners: Galvanized hardened steel, self-tapping.

E. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.

PART 3 EXECUTION

3.1 INSTALLATION

A. Erect metal deck in accordance with SDI Manual.

B. Bear deck on steel supports with 1-1/2 minimum bearing. Align and level.

C. Fasten roof deck to steel support members at ends and intermediate supports as noted on the Drawings.

D. Weld in accordance with AWS D1.1.

E. Mechanically clinch or fasten male/female side laps as specified on the Drawings.

F. Seal deck joints, laps, ends, and penetrations with sealant to achieve permanent air seal consistent with air barrier system specified in Section 07 92 13.

G. Reinforce steel deck openings from 6 to 18 inches in size with 2- by 2- by ¼-inch steel angles. Place framing angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and fusion weld or mechanically attach to deck at each flute.

H. Install 6 inch minimum wide sheet steel cover plates, of same thickness as deck, where deck changes direction. Fusion weld or mechanically attach 12 inches oc maximum.

I. Install single row of foam flute closures above walls and partitions perpendicular to deck flutes.

J. Position roof sump pans with flange bearing on top surface of deck. Fusion weld at each deck flute.

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

3.2 FIELD QUALITY CONTROL

A. Welding: Inspect welds in accordance with AWS D1.1.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes shop fabricated metal items.

1. Bollards
2. Ladders
3. Miscellaneous piping and duct support frames.
4. Structural supports for miscellaneous attachments.
5. Entry Canopies
6. Window Shades
7. Roof Access Ladders
8. Exterior Fire Extinguisher Support *(at Bulk Chemical Storage)*
9. Miscellaneous metal items and fabrications not otherwise covered in the plans or specifications.
10. Anchors for Equipment.
11. Garage door shelf angle and anchors.

B. Related Sections:

1. Division 1
2. Division 3
3. Division 4
4. Division 5
5. Division 9

1.2 REFERENCES

A. Aluminum Association (AA):

1. AA DAF-45 - Designation System for Aluminum Finishes

B. American Architectural Manufacturers Association (AAMA):

1. AAMA 611 – Voluntary Specification for Anodized Architectural Aluminum

C. ASTM International (ASTM):

1. ASTM A36 – Standard Specification for Carbon Structural Steel

2. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

3. ASTM A123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

4. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

5. ASTM A167 – Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

6. ASTM A276 – Standard Specification for Stainless Steel Bars and Shapes.

7. ASTM A297 – Standard Specification for Steel Castings, Iron-Chromium and Iron-Chromium-Nickel, Heat Resistant, for General Application

8. ASTM A283 – Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates

9. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

10. ASTM A312 – Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes

11. ASTM A325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

12. ASTM A354 – Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners

13. ASTM A479 – Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels

14. ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

15. ASTM A501 – Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

16. ASTM A554 – Standard Specification for Welded Stainless Steel Mechanical Tubing

17. ASTM A563 – Standard Specification for Carbon and Alloy Steel Nuts

18. ASTM A572 – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel

19. ASTM A992 – Standard Specification for Structural Steel Shapes

20. ASTM B26 – Standard Specification for Aluminum-Alloy Sand Castings

21. ASTM B85 – Standard Specification for Aluminum-Alloy Die Castings

22. ASTM B177 – Standard Guide for Chromium Electroplating on Steel for Engineering Use

23. ASTM B209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

24. ASTM B210 – Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes

25. ASTM B211 – Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire

26. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

27. ASTM B695 – Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel

28. ASTM F436 – Standard Specification for Hardened Steel Washers

29. ASTM F1554 – Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

D. American Welding Society (AWS):

1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination

2. AWS D1.1 - Structural Welding Code - Steel

3. AWS D1.6 - Structural Welding Code - Stainless Steel

E. National Ornamental & Miscellaneous Metals Association (NOMMA):

1. NOMMA Guideline 1 - Joint Finishes

F. The Society for Protective Coatings (SSPC):

1. SSPC - Steel Structures Painting Manual

2. SSPC SP 1 - Solvent Cleaning

3. SSPC SP 10 - Near-White Blast Cleaning

4. SSPC Paint 15 - Steel Joist Shop Paint

5. SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type II - Organic)

1.3 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Submittal requirements.

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. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Division 1: Product storage and handling requirements.

B. Accept metal fabrications on site in labeled shipments. Inspect for damage.

C. Protect metal fabrications from damage by exposure to weather.

1.5 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on drawings.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

A. Steel Sections: ASTM A992; Grade 50.

B. Steel Plate: ASTM A36.

C. Hollow Structural Sections: ASTM A500, Grade C.

D. Steel Pipe: ASTM A53, Grade B Schedule 40, unless noted otherwise on plans.

E. Sheet Steel: ASTM A653, Grade 33 Structural Quality with galvanized coating.

F. Bolts: ASTM A307; Grade A or B.

1. Finish: Hot dipped galvanized.

G. Nuts: ASTM A563 heavy hex type.

1. Finish: Hot dipped galvanized.

H. Washers: ASTM F436; Type 1.

1. Finish: Hot dipped galvanized.

I. Welding Materials: AWS D1.1; type required for materials being welded.

J. Shop and Touch-Up Primer: SSPC Paint 15, Type 1, red oxide.

K. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20 Type I Inorganic zinc rich.

2.2 MATERIALS - STAINLESS STEEL

A. Bars and Shapes: ASTM A276; Type 316.

B. Tubing: ASTM A269; Type 316.

C. Pipe: ASTM A312, seamless; Type 316.

D. Plate, Sheet, and Strip: ASTM A167; Type 316.

E. Bolts, Nuts, and Washers: ASTM A354.

F. Welding Materials: AWS D1.6; type required for materials being welded.

2.3 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221, Alloy 6061, Temper T6.

B. Sheet Aluminum: ASTM B209, Alloy 6061, Temper T6.

C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210, Alloy 6061, Temper T6.

D. Aluminum-Alloy Bars: ASTM B211, Alloy 6061, Temper T6.

E. Bolts, Nuts, and Washers: Stainless steel.

F. Welding Materials: AWS D1.1; type required for materials being welded.

2.4 MATERIALS – BLIND SIDE FASTENERS

A. Where bolted connections are indicated to be made to HSS shapes or other places where access is unavailable to the back side of the fastener provide Type HB - Hollo-Bolt by Lindapter or approved equal.

B. Bolt size shall be as indicated on the plans for the thickness of materials to be joined as indicated. Install bolts per the manufacturer's specifications. Provide stainless steel fasteners for all exterior applications and where indicated.

2.5 COORDINATION:

A. BOLLARDS

1. Bollards: Steel pipe, concrete filled, crowned cap, 6-inches diameter, length as indicated on Drawings; prime paint plus one coat of high-visibility yellow paint. Coordinate with typical bollard detail (CD-114).

2. Concrete Fill: Mix number M2500-GFM per General Concrete Notes on the project drawings and as referenced/specified in Section 03 30 00.

3. Anchors: Concealed type as indicated on Drawings.

B. LADDERS

1. Fixed Ladders shall be in conformance with American National Standards Institute (ANSI) Standard A14.3 – Safety Requirements for Fixed Ladders; and Occupational Safety and Health Administration (OSHA) Regulation 1910.27 – Standards for Fixed Ladders.

2. Fixed Ladder: Stainless Steel or Aluminum, welded construction:

3. Side Rails: 3/8- by 2-inch minimum side rails spaced at 16-inches clear, minimum.

4. Rungs: Minimum one-inch diameter solid rod with gritted surface or manufactured rungs with safety gripping surface, uniformly spaced 12-inches on center.

5. Mounting: Space rungs a minimum of seven inches clear from wall surfaces; with mounting brackets and attachments.

6. Finish: Stainless Steel, Mill finish. Aluminum, Clear anodized finish.

7. Ladder Walk-through Extensions: Where indicated on the plans or required by Safety Codes provide walk-through ladder rail extensions in conformance with ANSI and OSHA regulations. Same material and finish as ladder.

C. Miscellaneous piping and duct support frames.

1. Provide where indicated on the drawings or required to provide safe/stable support to piping and ducting for both gravity, dynamic and seismic loads.

2. Steel per Article 2.1 of this Specification.

3. Hot-dip galvanized where noted on the Drawings.

4. Three coat paint system per Section 09 96 00 – Protective Coatings, where not otherwise indicated on the Drawings.

D. Garage door shelf angle.

1. See architectural plans.

2.6 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. Continuously seal joined members by continuous welds.

D. 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.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.7 FACTORY APPLIED FINISHES - STEEL

A. Galvanizing: ASTM A123; minimum 2.0 ounces/square foot coating thickness; galvanize after fabrication.

1. Galvanizing for Fasteners, Connectors, and Anchors:

2. Hot-Dipped Galvanizing: ASTM A153.

B. Painted: Provide three coat paint system per Section 09 96 00 – Protective Coatings, where finish is not otherwise indicated on the Drawings.

2.8 FACTORY APPLIED FINISHES - STAINLESS STEEL

A. Satin Polished Finish: Number 4, satin directional polish parallel with long dimension of finished face.

2.9 FACTORY APPLIED FINISHES - ALUMINUM

A. Finish coatings to conform to AAMA 2603. Comply with AA DAF-45.

B. Exterior Aluminum Surfaces: AAMA A41 anodized, prepared with chemical pre-treatment, anodized to clear color.

2.10 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 48-inches.

E. Maximum Deviation from Plane: 1/16-inch in 48-inches.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 1: Coordination and project conditions.

B. Verify field conditions are acceptable and are ready to receive Work.

3.2 PREPARATION

A. Clean and strip galvanized steel items to bare metal where site welding is required. After welding coat affected surfaces with a cold galvanizing compound.

B. Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Make provisions for erection stresses. Install temporary bracing to maintain alignment, until permanent bracing and attachments are installed.

C. Field weld components only as indicated on Drawings.

D. Perform field welding in accordance with AWS D1.1.

E. Obtain approval of Engineer prior to site cutting or making adjustments not scheduled.

F. After erection, touch up welds, abrasions, and damaged finishes with galvanizing repair paint to match shop finishes.

3.4 ERECTION TOLERANCES

A. Section 01 40 00 – Quality Assurance and Quality Control: Tolerances.

B. Maximum Variation from Plumb: ¼-inch per story or for every 12 ft in height whichever is greater, non-cumulative.

C. Maximum Offset from Alignment: ¼-inch.

D. Maximum Out-of-Position: ¼-inch.

END OF SECTION

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SECTION 05 51 00
METAL STAIRS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal stair systems with integral landings, balusters and railings consisting of painted steel or aluminum stingers and support structure.

2. Aluminum treads, grating, balusters, and railings.

3. Painted steel or aluminum support frames of structural sections.

4. Open grate stair treads with open risers and landings.

5. Integral balusters and guard railing.

6. Separate hand-railing.

7. Provide all aluminum stair systems unless specifically approved otherwise on the Drawings or by the Engineer.

B. Related Requirements:

1. Section 03 30 00 – Cast-In-Place Concrete

2. Section 05 50 00 – Metal Fabrications

3. Section 05 52 50 – Aluminum Handrails and Railings

4. Section 09 96 00 – Protective Coatings

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM):

1. ASTM A36 - Standard Specification for Carbon Structural Steel.

2. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.

3. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

4. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

5. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

6. ASTM A513 - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.

7. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.

8. ASTM A786 - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.

9. ASTM A992 - Standard Specification for Structural Steel Shapes.

10. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.

11. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.

12. ASTM F436 - Standard Specification for Hardened Steel Washers.

13. ASTM F844 - Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.

B. American Welding Society (AWS):

1. AWS A2.4 - Standard Symbols for Welding, Brazing, Nondestructive Examination.

2. AWS D1.1 - Structural Welding Code - Steel.

C. National Association of Architectural Metal Manufacturers (NAAMM):

1. NAAMM AMP 510 - Metal Stairs Manual.

2. NAAMM MBG 531 - Metal Bar Grating Manual.

D. National Ornamental & Miscellaneous Metals Association (NOMMA):

1. NOMMA Guideline 1 - Joint Finishes.

1.3 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Requirements for submittals.

B. Shop Drawings:

1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Certificates: Certify welders and welding procedures employed on the Work, verifying AWS qualification within previous 12 months.

D. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations for each stair system required for the project.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.4 QUALITY ASSURANCE

A. Perform railing work according to ASTM E985.

B. Finish joints according to NOMMA Guideline 1.

1.5 QUALIFICATIONS

A. Welders and Welding Procedures: AWS D.1 qualified within previous 12 months for employed weld types.

B. Fabricator: Company specializing in fabricating products specified in this Section with minimum three years' experience.

C. Erector: Company specializing in performing Work of this Section with minimum three years’ experience.

D. Licensed Professional: When required, Professional engineer experienced in design of specified Work and licensed in State of Utah.

1.6 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Fabricate stair assembly to support uniform live load of 100-pounds/square feet and/or concentrated load of 300 pounds, whichever imposes the maximum effect on the member.

B. Deflection of stringer or landing framing not to exceed 1/360 of span.

C. Railing assembly, wall rails, and attachments to resist lateral force of 200-pounds at any point without damage or permanent set.

D. At a minimum all structural (lateral) systems shall be designed to support a minimum lateral point load of 500-pounds applied at the point of maximum effect.

E. Fabricate stair assembly to NAAMM AMP 510, industrial service class.

F. Design to be performed under the supervision of a Professional Structural Engineer currently registered in the State of Utah.

2.2 MATERIALS

A. Structural W-Shapes: ASTM A992.

B. Structural T-Shapes: Cut from structural W-shapes.

C. Channels and Angles: ASTM A36.

D. Round Hollow Structural Sections: ASTM A500, Grade C.

E. Square and Rectangular Hollow Structural Sections: ASTM A500, Grade C.

F. Structural Pipe: ASTM A53, Grade B.

G. Tubing: ASTM A513, Type 5, minimum 50 ksi yield strength.

H. Structural Plates: ASTM A53.

I. Aluminum Sections (Channels & I-Beams): ASTM B221 Alloy 6061 Temper T6

J. Bolts: ASTM A193, Grade B8M, Class 1 or 2, Type 316.

1. Finish: Stainless Steel.

K. Nuts: ASTM A194, Grade 8M, heavy-hex.

1. Finish: Stainless Steel.

L. Washers:

1. For ASTM A193 Bolts: SS316.

a. Finish: Stainless Steel.

2. For ASTM A325 Bolts: ASTM F436, Type 1.

a. Finish: Stainless Steel.

M. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; consistent with design of stair structure.

N. Welding Materials: AWS D1.1; type required for materials being welded.

O. Gratings: NAAMM MBG 531, Type: Welded Aluminum.

P. Stair Treads: Aluminum fabricated bar grate stair treads with rolled plate nosing with abrasive nosing.

2.3 FABRICATION

A. Fit and shop-assemble components in largest practical sections, for delivery to Site.

B. Fabricate components with joints tightly fitted and secured.

C. Continuously seal joined pieces by continuous welds.

D. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.

E. 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.

F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

G. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

H. Accurately form components required for anchorage of stairs, landings and railings to each other and to building structure.

I. Open Grating Stairs and Landings:

1. Fabricate treads 1 1/2-inch minimum depth according to NAAMM MBG 531, of welded aluminum bar grating bolted to supports; factory finish.

2. Form stringers with rolled-steel channels.

3. Form landings 1 ½-inch minimum depth according to NAAMM MBG 531, of welded aluminum bar grating with factory finish. Reinforce underside with steel angles or tees to attain design load requirements.

4. Balusters, guard rail and hand-railing per Section 05 52 50 – Aluminum Handrails and Railings; Anodized finish.

J. Stair Support Frames:

1. Fabricate self-supporting steel/aluminum stair support frames including support columns, beams and bracing to support the stair system; sectioned for transport.

K. Painted Finish; All supporting steel stringers and framework shall be painted per Section 09 96 00 after fabrication.

1. Touch-up damaged painted areas as approved by the Engineer.

2.4 FINISHES

A. Aluminum:

1. Clear anodized.

2. Fasteners shall be stainless steel as specified on sheet S-001

B. Steel:

1. Painted.

2. Fasteners: Stainless Steel.

PART 3 EXECUTION

3.1 EXAMINATION

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

B. Verify that concealed blocking and reinforcement is installed and correctly located to receive wall-mounted handrails.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where Site welding is required.

1. Paint welded areas per Section 09 96 00 when complete.

B. Supply items required to be cast into concrete and or embedded in masonry with setting templates.

3.3 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Install anchors, plates and angles required for connecting stairs to structure.

C. Allow for erection loads. Install sufficient temporary bracing to maintain framing safe, plumb, and in alignment.

D. Field-weld components only where specifically indicated on Drawings. Perform field welding according to AWS D1.1.

E. Field-bolt and -weld to match shop bolting and welding. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

F. Mechanically fasten joints butted tight, flush, and hairline. Grind welds smooth and flush.

G. Obtain approval of Engineer prior to Site cutting or creating adjustments not scheduled.

3.4 TOLERANCES

A. Section 01 40 00 – Quality Assurance and Quality Control: Requirements for tolerances.

B. Maximum Variation from Plumb: ¼- inch per story, noncumulative.

C. Maximum Offset from Alignment: 1/4-inch.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 – Quality Assurance and Quality Control: Requirements for inspecting and testing.

B. Inspection: Inspect welds according to AWS D1.1.

END OF SECTION

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SECTION 05 52 50
ALUMINUM HANDRAILS AND RAILINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes aluminum balusters, guard and hand railings and fittings.

B. Related Sections:

1. Section 01 20 00 – Measurement and Payment
2. Section 01 33 00 – Submittal Procedures.
3. Section 03 30 00 – Cast-In-Place Concrete.
4. Section 05 50 00 – Metal Fabrications.
5. Section 05 51 00 – Metal Stairs.

1.2 REFERENCES

A. American Architectural Manufacturers Association (AAMA):

1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.

B. ASTM International (ASTM):

1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
2. ASTM B241 - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
3. ASTM B483 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications.
4. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.

C. National Ornamental & Miscellaneous Metals Association (NOMMA):

1. NOMMA Guideline 1 - Joint Finishes.

1.3 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Submittal requirements.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1.4 QUALITY ASSURANCE

A. Finish joints in accordance with NOMMA Guideline 1.

1.5 FIELD MEASUREMENTS

A. Verify field measurements for railing lengths, elevations, and support locations prior to fabrication.

PART 2 PRODUCTS

2.1 ALUMINUM RAILING SYSTEM COMPONENTS

A. Guard Rails and Posts: 2-inch nominal outside diameter, extruded tubing conforming to B211. Hand Rails to be 1-1/2-inch nominal outside diameter, extruded tubing in conformance with current International Building Code profile requirements.

B. Fittings: Fabricated, machined or cast plates, angles and brackets as indicated on the drawings; aluminum.

C. Mounting: Brackets and flanges, with stainless steel anchors either cast in place or drilled in the field and set in place with approved construction adhesive into concrete support surfaces.

D. Splice Connectors: Concealed with locking set stainless steel screws; aluminum.

E. Exposed Fasteners: Flush countersunk stainless steel screws or bolts; consistent with design of railing.

F. Finish coatings to conform to AAMA 611.

G. Exterior Aluminum Surfaces: AAMA A41 anodized, prepared with chemical pre-treatment, anodized to clear color.

H. Apply two coats of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.2 MANUFACTURER

A. Unless otherwise directed all Guard and Handrail shall be fabricated utilizing the Speed-Rail System by Hollaender Manufacturing of Cincinnati, Ohio. (Hollaender.com)

1. Golden Railings Inc. of Broomfield, Colorado is also acceptable (303-279-5807)

B. Railing extend, slopes and elevations shall be as detailed on the Drawings and as directed by the Engineer.

C. All posts and horizontals shall be aluminum pipe per Section 2.1 of this Specification.

D. All fittings and connectors shall be Aluminum-Magnesium Alloy as provided by Hollaender Manufacturing.

E. All components including vertical and horizontal pipe and fittings and connections shall be anodized coated. Color of anodizing shall be as directed and approved by the Owner.

2.3 FABRICATION

A. Fit and shop assemble components in largest practical sizes for delivery to site.

B. Fabricate components with joints tightly fitted and secured. Furnish spigots and sleeves to accommodate site assembly and installation.

C. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

E. Exterior Components: Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations not encouraging water intrusion.

F. Interior Components: Continuously seal joined pieces by continuous welds.

G. 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.

H. Accurately form components to suit stairs and landings, to each other and to adjacent structures and/or equipment.

I. Accommodate for expansion and contraction of members and building movement without damage to connections or members.

J. Extend handrails past last stair step with returns in conformance with current International Building Code requirements.

K. Close all open pipe ends with smooth aluminum plugs as furnished by the approved manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Division 01: Coordination and project conditions.

B. Verify field conditions are acceptable and are ready to receive work.

C. Verify concealed blocking and reinforcement is installed and correctly located to receive wall mounted handrails.

3.2 PREPARATION

A. Clean and strip aluminum where site welding is required.

B. Supply items required to be cast into concrete embedded in masonry with setting templates, to appropriate sections.

3.3 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Anchor railings to structure with anchors as indicated on the drawings.

C. Field weld only where indicated on the drawings or approved by the Engineer. Grind field welds smooth and Touch-up welded areas with a field coating compatible with the railing finish.

D. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

E. Assemble with spigots and sleeves to accommodate tight joints and secure installation.

3.4 ERECTION TOLERANCES

A. Maximum Variation from Plumb: ¼-inch per story, non-cumulative.

B. Maximum Offset from Alignment: ¼-inch.

C. Maximum Out-of-Position: ¼-inch.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.1 WORK INCLUDED

A. Include all labor, materials, equipment, transportation, and services required to complete all rough carpentry as shown on the drawings and herein specified.

1.2 STANDARDS

A. INDUSTRY STANDARDS AND CODES

1. Grading Rules for Western Lumber, 4th Edition, May 15,1977 (WWPA).

2. Product Standard PS 1-74, materials as quality tested by American Plywood Association as revised June 1978 (APA).

3. International Building Code, 2018 Edition.

1.3 PROTECTION

A. Protect lumber from damage by weather or other causes before, during and after installation. All kiln-dried lumber shall be covered and stored off the ground.

PART 2 PRODUCTS

2.1 MATERIALS

A. LUMBER

1. All lumber shall be delivered to job bearing grade stamps (WCLB).

2. All lumber shall be furnished surfaced S4S.

3. All lumber shall be furnished with 19% maximum moisture content unless otherwise specified.

4. Framing lumber shall be furnished of the species and stress grades as noted on the structural drawings. Sizes of members as shown and noted on the drawings.

5. Lumber for stripping and furring shall be furnished kiln dried to 15% maximum moisture content and of the following species and grade:

a. Sized nominal 1 inch thick: Douglas Fir, BOARDS - CONSTRUCTION.

b. Sized nominal 2 inches thick: Douglas Fir, LIGHT FRAMING - CONSTRUCTION.

B. PLYWOOD

1. All plywood shall be delivered to job bearing grade stamps (APA).

2. Plywood thickness as shown on the drawings.

3. Plywood grades as shown on the drawings.

C. MISCELLANEOUS

1. Building Paper: Kraft Sheathing paper, asphalt saturated, equal to American Tar Company #304.

D. ROUGH HARDWARE

1. Frame Anchors, Hangers: Bowman, Silver Metal, Simpson or Teco. Configuration and type shown or to fit conditions. Heavy duty type at least 18 gauge, galvanized, I.B.C. approved furnished with proper nails to fit conditions of supports. Install all connectors per manufacturers recommendations.

2. Bolts, Lag Screws: Size as shown, herein specified or to I.B.C. Furnished galvanized with nuts, washers, and lockwashers (all bolts).

PART 3 EXECUTION

3.1 INSTALLATION – GENERAL

A. TREATED LUMBER

1. All lumber, interior or exterior locations, in contact with concrete or masonry shall be "treated".

2. All lumber for roof curbs, cants shall be “treated”.

3. Treatment specified in Section 06 30 00.

B. JOISTS – CEILING ROOF

1. Set to provide at least 3 inches of bearing.

2. Set with crown up.

3. Install metal hangers, frame anchors where shown or needed for proper connections.

4. Provide headers around openings.

5. Provide bridging: cross-bridging at 8-foot maximum centers on spans exceeding 8 feet. Use 1 x 3 or prefabricated metal.

6. Block at ends at bearing, 2-inch nominal thick by full depth of member.

C. NAILING

1. As herein specified to I.B.C. Chapter 23, Table 2304.9.1 minimum unless noted otherwise on the drawings.

D. PLYWOOD or OSB SHEATHINGS

1. Apply with face grains of sheets across supports, end joints staggered. End joints to occur on framing members.

2. Nails: galvanized, ring or anchor shank.

3. Space panels 1/16 inch at ends and 1/8 inch at edges. Double spacing during installation when wet or humid conditions exist.

4. Nailing: minimum unless noted otherwise on the drawings.

   a. Roof sheathing: 8d to 6-inch centers along panel edges and 12-inch centers at intermediate supports unless noted otherwise.

   b. Blocking panels: 16d at 6-inch centers along panel edges, unless noted otherwise.

E. ROOF BLOCKINGS

1. Roof sheathing: one ply clip between each bearing member each side of each panel if solid blocking is not called for on the drawings.

F. WOOD TRUSSES

1. Receive, store and protect until required for installation.

2. Erect to detail and approved shop drawings.

3. Brace and stabilize until other structural components of assemblies are installed.

G. BEAMS, POSTS, LEDGERS

1. Receive, store and protect until required for installation.

2. Erect to detail and/or approved shop drawings.

H. MISCELLANEOUS (To Drawing Details)

1. Install all work straight, plumb and true.

2. Furnish and install all nails, spikes, bolts, clips, hangers, and miscellaneous fastenings shown, specified or necessary to draw and hold members rigidly and permanently in place.

END OF SECTION

SECTION 06 19 30
PLATE CONNECTED WOOD TRUSSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Shop fabricated wood trusses for roof framing.

B. Bridging, bracing and anchorage.

1.2 REFERENCES

A. ASTM A446 – Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.

B. NFPA: National Forest Products Association.

C. TPI (Truss Plate Institute) BWT-76 – Bracing Wood Trusses.

D. TPI (Truss Plate Institute) HET-80 – Handling and Erecting Wood Trusses.

E. TPI (Truss Plate Institute) TPI-85 – Metal Plate Connected Wood Trusses.

F. TPI (Truss Plate Institute) QST-88 – Metal Plate Connected Wood Trusses.

G. WWPA: Western Wood Products Association.

1.3 SUBMITTALS

A. Shop Drawings: Indicate sizes and spacing of trusses and loads and truss cambers.

B. Product Data: Provide truss configurations, bearing and anchor details, bridging and bracing, and splice connection.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following agencies:

1. Lumber Grading Agency: Certified by ALSC

2. Plywood Grading Agency: Certified by APA

B. Trusses shall be manufactured and erected in accordance with the specifications and the manufacturer's approved drawing. Where there is evidence that any truss or trusses do not meet the specification requirements or are potentially deficient as determined by the Engineer, trusses will be removed and tested. Any truss shall be considered potentially deficient if it fails to comply with any of the requirements which control its deflection capability or load-carrying capacity, including conditions such as poor

workmanship, improperly installed connection plates, improperly fabricated connections, damaged or substandard wood or steel members of connections and non-conformance with the manufacturer's design drawings.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section.

B. Design trusses under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of Utah. See Structural Drawings for additional design requirements.

1.6 REGULATORY REQUIREMENTS

A. Conform to applicable code for loads, seismic zoning, other governing load criteria.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle and erect trusses in accordance with TPI HET-80.

B. Store trusses in vertical position testing on bearing ends.

1.8 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

PART 2 PRODUCTS

2.1 MATERIALS

A. Lumber Grading Rules: WWPA.

B. Steel Connectors: ASTM A446 steel, Grade A and C galvanized.

2.2 FABRICATION

A. Fabricate trusses to achieve structural requirements specified.

B. Brace wood trusses in accordance with TPI BWT-76.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that supports and openings are ready to receive trusses.

3.2 PREPARATION

A. Coordinate placement of support items.

B. Store trusses at the site in a vertical position, off the ground and protected from inclement weather until installation.

3.3 ERECTION

A. Install trusses in accordance with manufacturer's instructions.

B. Set members level and plumb, in correct position.

C. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing. Temporary construction loads which cause member stresses beyond design limits, are not permitted.

D. Do not field cut or alter structural members without approval of Engineer.

E. All joists shall be anchored to support and shall set to accurate alignment, both vertically and horizontally.

3.4 TOLERANCES

A. Framing Members: ¼ inch maximum from true position.

END OF SECTION

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SECTION 06 30 00
WOOD PRESERVATIVE TREATMENT

PART 1 GENERAL

1.1 WORK INCLUDED

A. Includes all labor, materials, equipment, transportation, and services necessary to treat wood members for location as herein specified or shown on the drawings.

1.2 STANDARD SPECIFICATIONS

A. American Wood Preservers Institute.

1.3 SUBMITTALS

A. CERTIFICATE

1. Furnish affidavit from treating plant stating that all treated wood conforms with specifications and that moisture content, after treatment, does not exceed limits specified.

PART 2 PRODUCTS

2.1 MATERIALS

A. Water Borne Preservatives (LP/22), Penta Sol (LP3/33), Solution (LP/44), or Creosote (LP5/55).

2.2 TREATMENT

A. Where possible, pre-cut lumber before treatment.

B. Pressure impregnate wood materials in accordance with standard specifications. Identify each treated number member with brand name and name of procedure.

C. Dry to moisture content not to exceed 19% after treatment.

D. Brush end cuts and drilled holes on job with two coats preservative used in the treatment.

PART 3 EXECUTION

3.1 LOCATIONS

A. All lumber and plywood in contact with concrete or masonry is to be treated wood.

END OF SECTION

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SECTION 07 11 13
BITUMINOUS DAMP PROOFING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes cold-applied, emulsified asphalt damp proofing applied to the following surfaces:

1. Exterior, below-grade surfaces of concrete foundation walls.

2. Back side of concrete retaining walls, below grade.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include recommendations for method of application, primer, number of coats, coverage or thickness, and protection course.

B. Material Certificates: For each product, signed by manufacturers.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain primary damp proofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt damp proofing to be performed according to manufacturers' written instructions.

B. Ventilation: Provide adequate ventilation during application of damp proofing in enclosed spaces. Maintain ventilation until damp proofing has thoroughly cured.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited

to, the following: Retain above for nonproprietary or below for semi proprietary specification. Refer to Section 01 60 00 – Product Requirements.

1. Cold-Applied, Emulsified-Asphalt Damp proofing:

    a. Karnak Corporation.

    b. Koppers Industries, Inc.

    c. Meadows, W. R., Inc.

    d. Sonneborn, Div. of ChemRex, Inc.

    e. Tamms Industries.

2. Protection Course, Asphalt-Board Type:

    a. Grace, W. R. & Co.; Construction Products Div.

    b. Meadows, W. R., Inc.

    c. Sonneborn, Div. of ChemRex, Inc.

2.2 BITUMINOUS DAMPPROOFING

A. Odor Elimination: For interior and concealed-in-wall uses other than exterior face of inner wythe of cavity walls, provide damp proofing material warranted by manufacturer to be substantially odor free after drying for 24 hours under normal conditions.

B. Cold-Applied, Emulsified-Asphalt Damp proofing:

1. Trowel Coats: ASTM International (ASTM) D 1227, Type II, Class 1.

2. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.

3. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

2.3 MISCELLANEOUS MATERIALS

A. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended by manufacturer.

B. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.

C. Protection Course, Asphalt-Board Type: Premolded, 1/8-inch- (3-mm-) thick, multi-ply, semirigid board consisting of a mineral-stabilized asphalt core sandwiched between layers of asphalt-saturated felt and faced on one side with polyethylene film. Paragraph below describes Dow Chemical Company's "Protection Board" and "Protection Board II," Owens Corning's "Fan Fold," and Tenneco Building Products' "Amocor-PB4."

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Applicator present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.

1. Begin damp proofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protection of Other Work: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with damp proofing. Prevent damp proofing materials from entering and clogging weep holes and drains.

B. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.

3.3 APPLICATION, GENERAL

A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of damp proofing.

1. Apply additional coats if recommended by manufacturer or required to achieve coverages indicated.

2. Allow each coat of damp proofing to cure 24 hours before applying subsequent coats.

B. Apply damp proofing to footings and foundation walls whether indicated or not.

1. Apply from finished-grade line to top of footing, extend over top of footing, and down a minimum of six inches (150 mm) over outside face of footing.

2. Extend 12 inches (300 mm) onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.

3. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch- (200-mm-) wide strip of asphalt-coated glass fabric in a heavy coat of damp proofing. Damp proofing coat required for embedding fabric is in addition to other coats required.

3.4 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. On Concrete Foundations: Apply two brush or spray coats at not less than 1.5 gallons/100 square feet (0.6 L/m^2) for first coat and 1 gallon/100 square feet (0.4 L/m^2) for second coat, one fibered brush or spray coat at not less than 3 gallons/100 square feet (1.2 L/m^2), or one trowel coat at not less than 4 gallons/100 square feet (1.6 L/m^2).

B. On Backs of Concrete Retaining Walls: Apply one brush or spray coat at not less than 1.25 gallons/100 square feet (0.5 L/m^2).

3.5 INSTALLATION OF PROTECTION COURSE

A. Where indicated, install protection course over completed-and-cured damp proofing. Comply with damp proofing material manufacturer's written recommendations for attaching protection course. Support protection course with spot application of trowel-grade mastic where not otherwise indicated.

3.6 CLEANING

A. Remove damp proofing materials from surfaces not intended to receive damp proofing.

END OF SECTION

SECTION 07 19 00
WATER REPELLENTS (MASONRY)

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes clear water-repellent coatings for the following vertical and nontraffic horizontal surfaces:

1. Concrete unit masonry (unpainted and unglazed).

B. Related Sections include the following:

1. Division 3 Sections for concrete work including floor sealers and curing agents.
2. Division 4 Sections for concrete unit masonry.
3. Section 07 92 00 – Joint Sealants – Architectural for joint sealants.
4. Section 09 90 00 – Protective Coatings for paints and coatings.

1.3 PERFORMANCE REQUIREMENTS

A. Provide water repellents with the following properties based on testing manufacturer's standard products, according to test methods indicated, applied to substrates simulating Project conditions using same materials and application methods to be used for Project.

1. Absorption: Minimum 98 percent reduction of absorption after 24 hours in comparison of treated and untreated specimens.
    a. Concrete Unit Masonry: ASTM International (ASTM) C 140.
2. Water-Vapor Transmission: Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, per ASTM E 96.
3. Water Penetration and Leakage through Masonry: Maximum 98 percent reduction in leakage rate in comparison of treated and untreated specimens, per ASTM E 514.
4. Durability: Maximum five percent loss of water repellency after 2500 hours of weathering in comparison to specimens before weathering, per ASTM G 53.
5. Permeability: Minimum 80 percent breathable in comparison of treated and untreated specimens, per ASTM D 1653.

1.4 SUBMITTALS

A. Product Data: Include manufacturer's specifications, surface preparation and application instructions, recommendations for water repellents for each surface to be treated, and protection and cleaning instructions. Include data substantiating that materials are recommended by manufacturer for applications indicated and comply with requirements.

B. Samples: Of each substrate indicated to receive water repellent, 12 inches square, with specified repellent treatment applied to half of each sample.

C. Applicator Certificates: Signed by manufacturer certifying that the applicator complies with requirements.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who employs only persons trained and approved by water repellent manufacturer for application of manufacturer's products.

1.6 TEST PANELS

A. Field Samples: Select multiple representative surfaces for each substrate to receive water repellents. Apply water repellent to each substrate, with either partial or full coverage as directed and in accordance with provisions in this Section. Comply with application requirements of this Section.

1. Obtain Architect's approval of field samples before applying water repellents.
2. Maintain field samples during construction in an undisturbed condition as a standard for judging the completed Work.

B. Clean test panel area following substrate manufacture’s guidelines and recommended products for cleaning.

C. After substrate has dried, RILEM tube testing shall be done by manufactures representative, to determine coverage rates.

D. Before full-scale application, review manufacturer's product data sheets to determine the suitability of each product for the specific surfaces. Apply each water repellent to test panels to determine number of applications, coverage rates, compatibility, effectiveness, surface preparation, application procedures, and desired results.

E. Apply water repellents to test panels in accordance with manufacturer's written instructions. Allow 48 hours or until test panels are thoroughly dry before evaluating final appearance and results. A final RILEM tube test shall be done to determine if desired finish has been accomplished. Do not begin full-scale application until test panels are inspected and approved by the Architect and the Manufacturer.

F. Test Panel Requirements:

1. Size: Minimum four feet by four feet each.

2. Locations: As determined by the Architect.

3. Number: As required to completely test each water repellent with each type of substrate to be protected.

1.7 PROJECT CONDITIONS

A. Weather and Substrate Conditions: Do not proceed with application of water repellent under any of the following conditions, except with written instruction of manufacturer:

1. Ambient temperature is less than 40˚F.

2. Concrete surfaces and mortar have cured for less than 28 days.

3. Rain or temperatures below 40˚F are predicted within 24 hours.

4. Application is earlier than 24 hours after surfaces have been wet.

5. Substrate is frozen or surface temperature is less than 40˚F.

6. Windy condition exists that may cause water repellent to be blown onto vegetation or surfaces not intended to be coated.

1.8 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty, executed by the applicator and water repellent manufacturer, covering materials and labor, agreeing to repair or replace materials that fail to provide water repellency within the specified warranty period. Warranty does not include deterioration or failure of coating due to unusual weather phenomena, failure of prepared and treated substrate, formation of new joints and cracks in excess of 1/16 inch (1.5 mm) wide, fire, vandalism, or abuse by maintenance equipment.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

i) Blok-Guard & Graffiti Control VOC 9. Or approved equal by architect.

2.2 WATER REPELLENTS

A. Material Compatibility: Provide primers, undercoats, and finish-coat materials that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's highest grade of the various high-performance coatings specified. Materials not displaying manufacturer's product identification are not acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

2. stitutions.

C. Water and Graffiti- Resistant Treatment:

(1) Use clear-drying, penetrating, solvent-based silicone for weatherproofing masonry materials and protecting them from graffiti.

(2) Physical and Performance Properties:

(a) Total Solids per ASTM D 2369: Nine (9) percent.

(b) Comply with national, state, and district AIM VOC regulations.

(c) Water Absorption Reduction (Brick) per ASTM C 67: Greater than 96 percent.

(d) Water Absorption Reduction per ASTM C 140:

(i) Heavy Weight CMU: Greater than 89 percent.

(ii) Split Face CMU: Greater than 95 percent.

(e) Water Vapor Transmission per ASTM E96:

(i) Limestone: Greater than 86 percent.

(ii) Sandstone: Greater than 95 percent.

(iii) Concrete Block: Greater than 95 percent.

(iv) Mortar: Greater than 95 percent.

(f) Water Vapor Transmission WVT per ASTM D 6490: Minimum 88 percent retention.

(g) Cleanability Level 2 per ASTM D7089.

(3) Approved Products:

(a) "Sure Klean Weather Seal Blok-Guard & Graffiti Control VOC 9"; PROSOCO, Inc. (800-255-4255) (Basis of Design). Or approved equal by architect.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean substrate of substances that might interfere with penetration or performance of water repellents. Test for moisture content, according to repellent manufacturer's written instructions, to ensure surface is sufficiently dry.

B. Test for pH level, according to water repellent manufacturer's written instructions, to ensure chemical bond to silicate minerals.

C. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live plants and grass.

D. Coordination with Sealants: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.

1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.

E. Test Application: Before performing water-repellent work, including bulk purchase and delivery of products, prepare a small application in an unobtrusive location that has been fully cleaned and in a manner approved by Architect to demonstrate the final effect (visual, physical, and chemical) of planned application. Proceed with work only after Architect approves test application or as otherwise directed.

1. Revisions of planned application, if any, as requested by Architect, will be by Change Order if they constitute a departure from requirements of Contract Documents at the time of contracting.

3.2 APPLICATION

A. Application rate shall be in accordance with manufacturer’s written recommendations and in accordance with proper coverage rates for warranty requirements.

B. Apply a heavy-saturation spray coating of water repellent on surfaces indicated for treatment using low-pressure spray equipment. Comply with manufacturer's written instructions for using airless spraying procedure, unless otherwise indicated.

1. Precast Work: At Contractor's option, first application of water repellent on precast concrete units may be completed before installing units. Mask sealant-bond surfaces to prevent water repellent from migrating onto joint surfaces.

C. Apply a second saturation spray coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and

after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Provide services of a factory-authorized technical service representative to inspect and approve the substrate before application and to instruct the applicator on the product and application method to be used.

3.4 CLEANING

A. Protective Coverings: Remove protective coverings from adjacent surfaces and other protected areas.

B. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Repair damage caused by water-repellent application. Comply with manufacturer's written cleaning instructions.

3.5 EXTERIOR SCHEDULE

A. General: Provide the following systems for the various substrates, as indicated.

1. MASONRY SEALER (Concrete Masonry Units)

a. 1st Coat: ProSoCo Sure Klean Weather Seal Blok-Guard and Graffiti Control.

b. Apply one (1) uniform pinhole free, continuous flood coat from the bottom up, with a 6-8-inch run-down, at rate of 75-100 square feet per gallon and in accordance with test application coverage rate. Test application rate shall govern where a discrepancy occurs.

c. Apply 2nd coat within two hours of the first coat or as soon as the first coat is dry to touch.

END OF SECTION

SECTION 07 21 00

INSULATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Foundation wall insulation (supporting backfill).
   2. Concealed building insulation.
   3. Interior rigid insulation
   4. Radiant barriers.
   5. Safing insulation.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 7 Section "Metal Roof Panels" and “PVC Membrane Roofing” for insulation specified as part of roofing construction.
   2. Division 9 Section indicated below for insulation installed as part of metal-framed wall and partition assemblies:
      a. "Gypsum Board Assemblies."

1.03 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of insulation product specified.

C. Product test reports from and based on tests performed by a qualified independent testing agency evidencing compliance of insulation products with specified requirements including those for thermal resistance, fire-test-response characteristics, water-vapor transmission, water absorption, and other properties, based on comprehensive testing of current products.

1.04 QUALITY ASSURANCE

A. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products complying with requirements indicated without delaying the Work.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated on Drawings or specified elsewhere in this

Section as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.
2. Fire-Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect plastic insulation as follows:
   1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
   3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering insulation products that may be incorporated in the work include, but are not limited to, the following:
   1. Extruded-Polystyrene Board Insulation:
      a. Amoco Foam Products Company.
      b. Carlisle Company.
      c. Dow Chemical Co.
      d. UC Industries, Inc.; Owens-Corning Co.
   2. Polyisocyanurate Foil faced Board insulation
      a. Johns Manville
      b. Dow Chemical Co.
      c. Hunter Panels
   3. Glass-Fiber Insulation:
      a. CertainTeed Corporation.
      b. Knauf Fiber Glass GmbH.
      c. Owens-Corning Fiberglas Corporation.
      d. Johns Manville Corporation.

2.02 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.
   1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

B. Extruded-Polystyrene Board Insulation: Rigid, cellular polystyrene thermal insulation formed from polystyrene base resin by an extrusion process to comply with ASTM C 578 for type and with other requirements indicated below:
   1. Type IV, 1.60-lb/cu. ft. (26-kg/cu. m) minimum density, unless otherwise indicated.
   2. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indices of 75 and 450, respectively.
   3. Recycled Content: Not less than 50 percent blend of postconsumer and recovered polystyrene resins.

C. Interior wall insulation: R-13 (2") Hunter Panels XCI 286 with foil facer both sides. Polyisocyanurate Board Insulation, Glass-Fiber-Mat Faced ASTM C1289, glass-fiber-mat faced, Type 1, Class 1.
   1. Where insulation is exposed use the following accessories:
      a. Anchor to wall with "Plasti-Grip" PMF anchors spacing per MFR recommendations
      b. Exposed edges provide J-Channel closure, class-A rated, white, Mfr: Victory Bear. Anchor to wall with power-actuated fasteners per Mfr. recommendations.
      c. Panel edge connector provide Flex-Tite insulation clips, class-A rated, white, Mfr: Victory Bear. Anchor to wall with power-actuated fasteners per Mfr. recommendations.

D. Unfaced Mineral-Fiber Blanket Insulation: Thermal insulation combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665, Type I (blankets without membrane facing).
   1. Mineral-Fiber Type: Fibers manufactured from glass.
   2. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indices of 25 and 50, respectively.

E. Faced Mineral-Fiber Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame spread of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on one face; consisting of fibers manufactured from glass.

F. Sound Attenuation Blankets: ASTM C 665, Type I; semi-rigid mineral fiber blanket without membrane, Class 25 flame-spread. Furnish in 2-3/4", 4" and 6" thicknesses. Provide minimum thickness as required to achieve a minimum 50 STC in all walls.

2.03 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

A. Polyisocyanurate Board Insulation, Foil Faced: ASTM C1289, foil faced, Type I, Class 1 Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

1 Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

2.04 SPRAY POLYURETHANE FOAM INSULATION

A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. BASF Corporation.
   b. Dow Chemical Company (The).
   c. Gaco Western Inc.
   d. Henry Company.
   e. SWD Urethane Company.
2. Minimum density of 1.5 lb/cu. ft. (24 kg/cu. m), thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F (43 K x m/W at 24 deg C).
3. Provide IBC approved Intumescent coating: DC315 Manufactured by International Fireproof Technology, Inc, or Fireshell TB Manufactured by TPR2 Corporation or approved equal by architect.

2.05 SAFING INSULATION AND ACCESSORIES

A. Slag-Wool-Fiber Board Safing Insulation: Semirigid boards designed for use as fire stop at openings between edge of slab and exterior wall panels, produced by combining slag-wool fibers with thermosetting resin binders to comply with ASTM C 612, Type IA and IB; nominal density of 4 lb/cu. ft. (64 kg/cu. m); passing ASTM E 136 for combustion characteristics; thermal resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F (27.7 K x m/W at 24 deg C).

B. Calking Compound: Material approved by manufacturer of safing insulation for sealing joint between foil backing of safing insulation and edge of concrete floor slab against penetration of smoke.

C. Safing Clips: Galvanized steel safing clips approved by manufacturer of safing insulation for holding safing insulation in place.

2.06 VAPOR RETARDERS

A. Reinforced-Polyethylene Vapor Retarders: 2 outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 25 lb/1000 sq. ft. (12 kg/100 sq. m), with maximum permeance rating of 0.0507 perm (2.9 ng/Pa x s x sq. m).

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.

C. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   1. Reinforced-Polyethylene Vapor Retarders:
      a. DURA-SKRIM 6WW; Raven Industries, Inc.
      b. Griffolyn T-65; Reef Industries, Inc., Griffolyn Div.

2.07 EXTERIOR AIR BARRIER

A. NOT USED

2.08 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.09 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation, of thickness indicated, securely in position indicated with self-locking washer in place; and complying with the following requirements:
   1. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
   2. Spindle: Copper-coated low carbon steel, fully annealed, 0.105 inches (2.67 mm) in diameter, length to suit depth of insulation indicated.

B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.
   1. Where spindles will be exposed to human contact after installation, protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap.

C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

D. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   1. Adhesively Attached, Spindle-Type Anchors:
      a. TACTOO Insul-Hangers; AGM Industries, Inc.
      b. Spindle Type Gemco Hangers; Gemco.
   2. Anchor Adhesives:
      a. TACTOO Adhesive; AGM Industries, Inc.
      b. Tuff Bond Hanger Adhesive; Gemco.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or that interfere with insulation attachment.

3.03 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, unsoiled, and has not been exposed at any time to ice and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.04 INSTALLATION OF PERIMETER INSULATION

A. On vertical surfaces, set units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.

B. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection board. Set in adhesive according to written instructions of insulation manufacturer.

3.05 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Seal joints between closed-cell (nonbreathing) insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.
   1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

D. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:
   1. Use blanket widths and lengths that fill cavities formed by framing members. Where more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
   2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

E. Stuff glass-fiber loose-fill insulation into miscellaneous voids and cavity spaces. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

3.06 INSTALLATION OF SAFING INSULATION

A. Install safing insulation to fill gap between edge of concrete floor slab and back of exterior spandrel panels on safing clips spaced as needed to support insulation, but not further apart than 24 inches (610 mm) on center (o.c.). Cut safing insulation wider than gap to be filled to ensure compression fit and seal joint between insulation and edge of slab with calking approved by safing insulation manufacturer for this purpose. Leave no voids in completed installation.

3.07 INSTALLATION OF VAPOR RETARDERS

A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping not less than 2 wall studs. Fasten vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches (406 mm) on center (o.c.).

C. Seal overlapping joints in vapor retarders with adhesives or vapor-retarder tape according to vapor retarder manufacturer's instructions. Seal butt joints and fastener penetrations with vapor-retarder tape. Locate all joints over framing members or other solid substrates.

D. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor retarder manufacturer.

E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.

F. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.08 PROTECTION

A. General: Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07 41 10

METAL ROOF PANELS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Factory-formed and field-assembled, standing-seam metal roof panels.
   2. Metal soffit panels.

B. Related Sections include the following:
   1. Division 7 Section "Sheet Metal Flashing and Trim" for flashings and other sheet metal work not part of metal roof panel assemblies.
   2. Division 7 Section "Joint Sealants" for field-applied sealants not otherwise specified in this Section.

1.03 DEFINITIONS

A. Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight roofing system.

1.04 PERFORMANCE REQUIREMENTS

A. General: Provide metal roof panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

B. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of roof area when tested according to ASTM E 283.

C. Water Penetration: No water penetration when tested according to ASTM E 331.

D. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift resistance class indicated.

E. FMG Listing: Provide metal roof panels and component materials that comply with requirements in FMG 4471 as part of a panel roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
   1. Fire/Windstorm Classification: Class 1A-90.

2. Hail Resistance: SH.

F. Structural Performance: Provide metal roof panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
   1. Wind Loads: Determine loads based on the following minimum design wind pressures:
      a. Uniform pressure as indicated on Structural drawings.

G. Thermal Movements: Provide metal roof panel assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.05 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal roof panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.
   1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:10):
      a. Flashing and trim.
      b. Gutters.
      c. Downspouts.
      d. Roof curbs.
      e. Snow guards.

C. Coordination Drawings: Roof plans drawn to scale and coordinating penetrations and roof-mounted items. Show the following:
   1. Roof panels and attachments.
   2. Roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, snow guards, and items mounted on roof curbs.

D. Samples for Selection: For each type of metal roof panel indicated with factory-applied color finishes.
   1. Include similar Samples of trim and accessories involving color selection.

E. Qualification Data: For Installer.

F. Maintenance Data: For metal roof panels to include in maintenance manuals.

G. Warranties: Special warranties specified in this Section.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
   1. Installer's responsibilities include fabricating and installing metal roof panel assemblies.

B. Source Limitations: Obtain each type of metal roof panels through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal roof panels and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Surface-Burning Characteristics: Provide insulation material with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   1. Flame-Spread Index: 25 or less, unless otherwise indicated.
   2. Smoke-Developed Index: 450 or less, unless otherwise indicated.

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

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.

B. Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.

E. Protect foam-plastic insulation as follows:
   1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
   3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.08 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal roof panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify locations of roof framing and roof opening dimensions by field measurements before metal roof panel fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal roof panels without field measurements, or allow for field-trimming of panels. Coordinate roof construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.09 COORDINATION

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

B. Coordinate metal panel roof assemblies with rain drainage work, flashing, trim, and construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

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

B. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
   1. Weathertight Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
   2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.02 PANEL MATERIALS

A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
   2. Surface: Smooth, flat finish.
   3. Exposed Finishes: Apply the following coil coating, as specified or indicated on Drawings.
      a. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
         1) Fluoropolymer Three-Coat System: Manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil (0.038 mm);

complying with physical properties and coating performance requirements of AAMA 2605, except as modified below:

a) Humidity Resistance: 2000 hours.

b) Water Resistance: 2000 hours.

4. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

B. Panel Sealants:

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.

2.03 THERMAL INSULATION FOR FIELD-ASSEMBLED METAL ROOF PANELS

A. Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type V, oriented-strand-board facing, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed on unfaced core. With cross vent 1.5” air space to provide cold-roof system (“Cool-Vent” Cross vent system or approved equal). Mechanically attached to deck.

2.04 UNDERLAYMENT MATERIALS

A. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felts.

B. Self-Adhering, Polyethylene-Faced Sheet: ASTM D 1970, 40 mils thick minimum, consisting of slip-resisting polyethylene-film reinforcing and top surface laminated to SBS-modified asphalt adhesive, with release-paper backing; cold applied.

1. Available Products:
   a. Carlisle Coatings & Waterproofing, Div. of Carlisle Companies Inc.; Dri-Start "A."
   b. Grace, W. R. & Co.; Grace Ice and Water Shield.
   c. Johns Manville International, Inc.; Roof Defender.
   d. Owens Corning; WeatherLock.
   e. Protecto Wrap Company; Rainproof TM.

C. Slip Sheet: Building paper, minimum 5 lb/100 sq. ft., rosin sized.

D. Vapor barrier (Carlisle CCW705 or approved equal.).

2.05 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating.
   1. Fasteners for Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM or neoprene sealing washer.
   2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
   3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.06 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be field assembled by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
   1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.

B. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels, and mechanically seaming panels together.
   1. Basis-of-Design Product: MBCI , Super-Lock 16” wide Panel or a comparable product of one of the following:
   2. Available Manufacturers:
      a. AEP-Span.
      b. BHP Steel Building Products USA Inc.
      c. CENTRIA Architectural Systems.
      d. MBCI; Div. of NCI Building Systems.
   3. Material: Zinc-coated (galvanized) steel sheet, 0.0269 inch thick.
      a. Exterior Finish: Fluoropolymer.
      b. Color: As selected by Architect from manufacturer's full range.
   4. Batten: Same material, finish, and color as roof panels.
   5. Clips: Floating to accommodate thermal movement.
      a. Material: 0.0528-inch- (1.35-mm-) thick, zinc-coated (galvanized) steel sheet.

6. Joint Type: Single folded.
7. Weatherseal: Provide factory applied extruded vinyl weatherseal.
8. Panel Coverage: 16 inches (406 mm).
9. Panel Height: 2.0 inches (51 mm).
10. Uplift Rating: UL 90.

2.07 METAL SOFFIT PANELS

A. General: Provide factory-formed metal soffit panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.

B. Flush-Profile Metal Soffit Panels: Solid panels formed with vertical panel edges and flat pan between panel edges; with flush joint between panels.
   1. Basis-of-Design Product: MBCI Artisan Series, Flush Seam Panel or a comparable product of one of the following:Available Manufacturers:
      a. AEP-Span.
      b. BHP Steel Building Products USA Inc.
      c. CENTRIA Architectural Systems.
      d. MBCI; Div. of NCI Building Systems.
   3. Material: Zinc-coated (galvanized) steel sheet, 0.0269 inch (0.70 mm) thick.
      a. Exterior Finish: Fluoropolymer.
      b. Color: As selected by Architect from manufacturer's full range.
   4. Panel Coverage: 3-7/8 inches (98.33 mm).
   5. Panel Height: 0.500 inch (13 mm)Sealant: Factory applied within interlocking joint.

2.08 ACCESSORIES

A. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels, unless otherwise indicated.
   1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
   2. Clips: Minimum 0.0625-inch- (1.6-mm-) thick, stainless-steel panel clips designed to withstand negative-load requirements.
   3. Cleats: Mechanically seamed cleats formed from minimum 0.0250-inch- (0.64-mm-) thick, stainless-steel or nylon-coated aluminum sheet.
   4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure

strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Flashing and Trim: Formed from 0.0179-inch thick, zinc-coated (galvanized) steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.

C. Gutters: Formed from 0.0179-inch thick, zinc-coated (galvanized) steel sheet prepainted with coil coating. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch long sections, sized according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced 36 inches (900 mm) o.c., fabricated from same metal as gutters. Provide bronze, copper, or aluminum wire ball strainers at outlets. Finish gutters to match roof fascia and rake trim.

D. Downspouts: Formed from 0.0179-inch thick, zinc-coated (galvanized) steel sheet prepainted with coil coating; in 10-foot long sections, complete with formed elbows and offsets. Finish downspouts to match metal roof panels.

E. Snow Guards: Prefabricated, noncorrosive units designed to be installed without penetrating metal roof panels, and complete with predrilled holes, clamps, or hooks for anchoring.

1. Seam-Mounted, Stop-Type Snow Guards: Cast-aluminum stops designed for attachment to vertical ribs of standing-seam metal roof panels with stainless-steel set screws.
    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    b. TRA Snow & Sun Utah. Clamp to seam snow fence. Or approved equal. Color to match roof.
        1) Berger Bros. Co.
        2) Polar Blox.

F. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

2.09 FABRICATION

A. General: Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Where indicated, fabricate metal roof panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal roof panel manufacturer.
    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal roof panel manufacturer for application but not less than thickness of metal being secured.

2.10 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of work.

1. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

B. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

B. Install flashings and other sheet metal to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

C. Miscellaneous Framing: Install subpurlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written recommendations.

3.03 THERMAL INSULATION INSTALLATION FOR FIELD-ASSEMBLED METAL ROOF PANELS

A. Board Insulation: Extend insulation in thickness indicated to cover entire roof. Comply with installation requirements in Division 7 Section "Building Insulation."

1. Erect insulation horizontally and hold in place with Z-shaped furring members spaced 24 inches (610 mm) o.c. Securely attach narrow flanges of furring members to roof deck with screws spaced 24 inches (600 mm) o.c.

3.04 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment and building-paper slip sheet on roof sheathing under metal roof panels, unless otherwise recommended by metal roof panel manufacturer. Use adhesive for temporary anchorage, where possible, to minimize use of mechanical fasteners under metal roof panels. Apply at locations indicated below, in shingle fashion to shed water, with lapped joints of not less than 2 inches.

1. Apply on roof not covered by self-adhering sheet underlayment. Lap edges of self-adhering sheet underlayment not less than 3 inches (75 mm), in shingle fashion to shed water.

B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof sheathing under metal roof panels. Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply at locations indicated below, in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

1. Roof perimeter for a distance up from eaves of 24 inches (600 mm) beyond interior wall line.
2. Valleys, from lowest point to highest point, for a distance on each side of 18 inches (460 mm). Overlap ends of sheets not less than 6 inches (150 mm).
3. Rake edges for a distance of 18 inches (460 mm).
4. Hips and ridges for a distance on each side of 12 inches (300 mm).
5. Roof to wall intersections for a distance from wall of 18 inches (460 mm).

6. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of 18 inches (460 mm).

C. Install flashings to cover underlayment to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

D. Apply slip sheet over underlayment before installing metal roof panels.

3.05 METAL ROOF PANEL INSTALLATION, GENERAL

A. General: Provide metal roof panels of full length from eave to ridge, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Field cutting of metal roof panels by torch is not permitted.
   2. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels.
   3. Provide metal closures at peaks, rake edges, each side of ridge and hip caps.
   4. Flash and seal metal roof panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
   5. Locate and space fastenings in uniform vertical and horizontal alignment.
   6. Install ridge and hip caps as metal roof panel work proceeds.
   7. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
   8. Lap metal flashing over metal roof panels to allow moisture to run over and off the material.

B. Fasteners:
   1. Steel Roof Panels: Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.
   1. Seal metal roof panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.
   2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

3.06 FIELD-ASSEMBLED METAL ROOF PANEL INSTALLATION

A. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.
   1. Install clips to supports with self-tapping fasteners.
   2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
   3. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.

3.07 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
   1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
   2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 4 feet o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
   1. Provide elbows at base of downspouts to direct water away from building.

E. Snow Guards: Attach bar supports to vertical ribs of standing-seam metal roof panels with clamps or set screws. Do not use fasteners that will penetrate metal roof panels.

1. Install snow guards above entrances, adjacent to walking surfaces, at other areas where falling snow may be hazardous and at locations as recommended by the manufacturer and where directed by the Architect. Install in accordance with manufacturer=s printed instructions and recommendations.

F. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.08 ERECTION TOLERANCES

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

3.09 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 62 10
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following sheet metal flashing and trim:

1. Manufactured reglets.
2. Formed roof drainage system.
3. Formed low-slope roof flashing and trim.
4. Formed wall flashing and trim.
5. Formed equipment support flashing.

B. Related Sections include the following:

1. Section 04 30 00 – Unit Masonry for installing through-wall flashing, reglets, and other sheet metal flashing and trim.
2. Section 07 54 19 – PVC Membrane Roofing for flashing and trim not part of sheet metal flashing and trim.
3. Section 07 92 00 – Joint Sealants – Architectural for field-applied sheet metal flashing and trim sealants.

1.3 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Fabricate and install roof edge flashing and copings capable of resisting the following forces according to recommendations in FM Global (FMG) Loss Prevention Data Sheet 1-49:

1. Wind Zone 1: For velocity pressures of 21- to 30-pound force per square foot (1.00 to 1.44 kPa): 60-pound force per square foot (2.87-kPa) perimeter uplift force, 90-pound force per square foot (4.31-kPa) corner uplift force, and 30-pound force per square foot (1.44-kPa) outward force.

C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and

surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120°F (67°C), ambient; 180°F (100°C), material surfaces.

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

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
4. Details of expansion-joint covers, including showing direction of expansion and contraction.

C. Samples for Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

1.5 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with Sheet Metal and Air Conditioning Contractors' National Association's (SMACNA's) "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

B. Mockups: Prior to installing sheet metal flashing and trim, construct mockups indicated to verify selections made under Sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.

1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Architect.

2. Notify Architect one week in advance of the dates and times when mockups will be constructed.

3. Demonstrate the proposed range of aesthetic effects and workmanship.

4. Construct mockups for the following type of sheet metal flashing and trim:

   a. Exposed trim, gravel stops, and fasciae.

   b. Copings.

5. Obtain Architect's approval of mockups before start of final unit of Work.

6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

   a. When directed, demolish and remove mockups from Project site.

   b. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

C. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Engineer, Architect, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.

2. Review methods and procedures related to sheet metal flashing and trim.

3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.

4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

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

1.8 FM GLOBAL REQUIREMENTS (NOT USED)

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 SHEET METALS

A. Aluminum Sheet: ASTM International (ASTM) B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.

1. Alclad Finish: Metallurgically bonded surfacing to both sides, forming a composite aluminum sheet with reflective luster.

2. Surface: Smooth, flat.

3. Factory Prime Coating: Where painting after installation is indicated, pretreat with white or light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of 0.2 mil (0.005 mm).

4. Clear Anodic Finish, Coil Coated: American Architectural Manufacturers Association (AAMA) 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

5. Color Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

a. Color: Clear Anodized

b. Color Range: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

6. Exposed Coil-Coated Finishes:

a. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

7. Color: As selected by Architect from manufacturer's full range.

8. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2.3 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.

B. Slip Sheet: Rosin-sized paper, minimum three pounds per 100 squre feet (0.16 kg/m^2).

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
4. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

C. Solder for Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

D. Solder for Zinc: ASTM B 32, 60 percent lead and 40 percent tin with low antimony, as recommended by manufacturer.

E. Burning Rod for Lead: Same composition as lead sheet.

F. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

G. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

H. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

I. Bituminous Coating: Cold-applied asphalt mastic, The Society for Protective Coatings (SSPC)-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory- mitered and -welded corners and junctions.

1. Available Manufacturers:

a. Fry Reglet Corporation.

2. Material: Aluminum, 0.024 inch (0.61 mm) thick.

3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

4. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.

a. Available Manufacturers:

i. Cheney Flashing Company, Inc., Type B Snap Lock.

5. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.

6. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

2.6 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Seams: Comply with SMACNA Architectural Sheet Metal Manual, (Sixth Edition, September 2003) Figure no. 3-2 and 3-3 as applicable to specific installations.

1. Standing Seams: Provide double lock standing seams (detail no. 25, figure no. 3-3), with finish not less than 1-1/4-inch high.

F. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than one inch (25 mm) deep, filled with elastomeric sealant concealed within joints.

G. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

H. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.7 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- (2400-mm-) long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.

1. Gutter Style: D and as detailed.

2. Expansion Joints: Built in.

3. Accessories: Continuous removable leaf screen with sheet metal frame and hardware cloth screen.

4. Gutters with Girth up to 15 Inches (380 mm): Fabricate from the following material:

a. Pre-finished Aluminum: 0.032 inch (0.81 mm).

B. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Fabricate downspouts from the following material:

a. Pre-finished Aluminum: 0.040 inch (1.02 mm).

2.8 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot (3-m) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.

1. Joint Style: Standing seams.

2. Fabricate copings from the following material:

a. Pre-finished Aluminum: 0.050 inch (1.27 mm).

B. Roof and Roof to Wall Transition Expansion-Joint Cover: Fabricate from the following material:

1. Pre-finished Aluminum: 0.050 inch (1.27 mm).

C. Base Flashing: Fabricate from the following material:

1. Pre-finished Aluminum: 0.040 inch (1.02 mm).

D. Counterflashing: Fabricate from the following material:

1. Aluminum: 0.032 inch (0.81 mm).

E. Flashing Receivers: Fabricate from the following material:

1. Aluminum: 0.032 inch (0.81 mm).

F. Roof-Penetration Flashing: Fabricate from the following material:

1. Stainless Steel: 0.019 inch (0.48 mm).

2.9 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch (2400-mm) long, but not exceeding 12 foot (3.6 m) long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend six inches (150 mm) beyond each side of wall openings. Form with 2-inch (50-mm) high end dams. Fabricate from the following material:

1. Stainless Steel: 0.016 inch (0.40 mm).

B. Openings Flashing in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend four inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch (50-mm) high end dams. Fabricate from the following material:

1. Pre-finished Aluminum: 0.032 inch (0.81 mm).

C. Wall Expansion-Joint Cover: Fabricate from the following material:

1. Pre-finished Aluminum: 0.040 inch (1.02 mm).

2.10 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following material:

1. Stainless Steel: 0.019 inch (0.48 mm).

2.11 FINISHES

A. Comply with National Association of Architectural Metal Manufacturer's (NAAMM's) "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Coat side of sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.

2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.

3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than one inch (25 mm) deep, filled with elastomeric sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

1. Use stainless-steel fasteners.

H. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than one inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40° and 70°F (4° and 21°C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40°F (4°C).

2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 – Joint Sealants – Architectural.

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm) except where pretinned surface would show in finished Work.

1. Do not solder prepainted, metallic-coated steel sheet.

2. Pretinning is not required for lead.

3. Where surfaces to be soldered are lead coated, do not tin edges, but wire brush lead coating before soldering.

4. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

3.3 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with elastomeric sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets spaced not more than 36 inches (900 mm) apart. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Fasten gutter spacers to front and back of gutter.

2. Loosely lock straps to front gutter bead and anchor to roof deck.

3. Anchor and loosely lock back edge of gutter to continuous eave or apron flashing.

4. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches (600 mm) apart.

5. Anchor gutter with spikes and ferrules spaced not more than 24 inches (600 mm) apart.

6. Install gutter with expansion joints at locations indicated but not exceeding 50 feet (15.24 m) apart. Install expansion joint caps.

7. Install continuous gutter screens on gutters with noncorrosive fasteners, hinged to swing open for cleaning gutters.

C. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely one inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.

1. Provide elbows at base of downspout to direct water away from building or connect downspouts to underground drainage system indicated.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 16-inch (400-mm) centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 16-inch (400-mm) centers.

2. Anchor interior leg of coping with screw fasteners and washers at 18-inch (450-mm) centers.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of four inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing four inches (100 mm) over base flashing. Lap counterflashing joints a minimum of four inches (100 mm) and bed with elastomeric sealant.

1. Secure in a waterproof manner by means of snap-in installation and sealant.

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:

1. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing: Installation of formed through-wall flashing is specified in Section 04 30 00 – Reinforced Unit Masonry.

C. Reglets: Installation of reglets is specified in Section 03 30 00 – Cast-in-Place Concrete and in Section 04 30 00 – Reinforced Unit Masonry.

D. Openings Flashing in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend four inches (100 mm) beyond wall openings.

3.6 MISCELLANEOUS FLASHING INSTALLATION

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

3.7 CLEANING AND PROTECTION

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

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 07 92 00

JOINT SEALANTS - ARCHITECTURAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
   1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
      a. Construction joints in cast-in-place concrete.
      b. Control and expansion joints in unit masonry and cast stone units.
      c. Joints between metal panels.
      d. Joints between different materials listed above.
      e. Perimeter joints between materials listed above and frames of doors and windows.
      f. Control and expansion joints in ceilings and other overhead surfaces.
      g. Other joints as indicated.
   2. Exterior joints in the following horizontal traffic surfaces:
      a. Isolation and contraction joints in cast-in-place concrete slabs.
      b. Tile control and expansion joints.
      c. Joints between different materials listed above.
      d. Other joints as indicated.
   3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints of exterior openings where indicated.
      c. Tile control and expansion joints.
      d. Vertical joints on exposed surfaces of walls and partitions.
      e. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
      f. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      g. Other joints as indicated.
   4. Interior joints in the following horizontal traffic surfaces:
      a. Isolation joints in cast-in-place concrete slabs.
      b. Control and expansion joints in tile flooring.
      c. Other joints as indicated.

B. Related Sections include the following:

1. Division 4 Section “Unit Masonry" for masonry control and expansion joint fillers and gaskets.
2. Division 8 Section "Glazing" for glazing sealants.
3. Division 9 Section "Gypsum Board" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
4. Division 9 Section "Ceramic Tile" for sealing tile joints.
5. Division 9 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.

1.03 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.04 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

D. Qualification Data: For Installer.

E. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.

F. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
   1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

G. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

H. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
   1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
   2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
   3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
   5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:
   1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
   2. Conduct field tests for each application indicated below:
      a. Each type of elastomeric sealant and joint substrate indicated.
      b. Each type of nonelastomeric sealant and joint substrate indicated.
   3. Notify Architect seven days in advance of dates and times when test joints will be erected.
   4. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193.
      a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
   5. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
   6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

E. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
   1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

1.06 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.07 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Three years from date of Substantial Completion.

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.02 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and

application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.03 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Immersion in Liquids. Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.

D. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

E. Single-Component Neutral-Curing Silicone Sealant:
   1. Available Products:
      a. Pecora Corporation; 895.
   2. Type and Grade: S (single component) and NS (nonsag).
   3. Class: 50.
   4. Use Related to Exposure: NT (nontraffic).
   5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
      a. Use O Joint Substrates: Aluminum coated with a high-performance coating.
   6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.

F. Single-Component Acid-Curing Silicone Sealant:
   1. Available Products:
      a. Dow Corning Corporation; 999-A.
      b. GE Silicones; Construction
      c. Pecora Corporation; 860.
      d. Tremco; Proglaze.
   2. Type and Grade: S (single component) and NS (nonsag).
   3. Class: 25.

4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.
    a. Use O Joint Substrates: Aluminum coated with a high-performance coating.

G. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant:
1. Available Products:
    a. Pecora Corporation; 898.
    b. Tremco; Tremsil 600 White.
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.
    a. Use O Joint Substrates: Ceramic tile.

H. Multicomponent Nonsag Urethane Sealant:
1. Available Products:
    a. Pecora Corporation; Dynatrol II.
    b. Tremco; Dymeric 511.
2. Type and Grade: M (multicomponent) and NS (nonsag).
3. Class: 50.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.
    a. Use O Joint Substrates: Aluminum coated with a high-performance coating.

I. Multicomponent Pourable Urethane Sealant:
1. Available Products:
    a. Pecora Corporation; Dynatrol II-SG.
    b. Sika Corporation, Inc.; Sikaflex - 2c SL.
    c. Sonneborn, Division of ChemRex Inc.; SL 2.
2. Type and Grade: M (multicomponent) and P (pourable).
3. Class: 25.
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

J. Single-Component Nonsag Urethane Sealant:
1. Available Products:
    a. Pecora Corporation; Dynatrol I-XL.
    b. Sika Corporation, Inc.; Sikaflex - 15LM.

c. Tremco; DyMonic.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

2.04 SOLVENT-RELEASE JOINT SEALANTS

A. Acrylic-Based Solvent-Release Joint Sealant: Comply with ASTM C 1311 or FS TT-S-00230.
   1. Available Products:
      a. Tremco; Mono 555.

B. Butyl-Rubber-Based Solvent-Release Joint Sealant: Comply with ASTM C 1085.
   1. Available Products:
      a. Sonneborn, Division of ChemRex Inc.; Sonneborn Multi-Purpose Sealant.
      b. Tremco; Tremco Butyl Sealant.

2.05 LATEX JOINT SEALANTS

A. Latex Sealant: Comply with ASTM C 834, Type P, Grade NF.

B. Available Products:
   1. Pecora Corporation; AC-20+.
   2. Sonneborn, Division of ChemRex Inc.; Sonolac.
   3. Tremco; Tremflex 834.

2.06 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:
   1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   2. Available Products:
      a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
      b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

2.07 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.08 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

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

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
    1. Do not leave gaps between ends of sealant backings.
    2. Do not stretch, twist, puncture, or tear sealant backings.
    3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.04 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.06 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior vertical construction joints in cast-in-place concrete.
   1. Joint Sealant: Multicomponent nonsag urethane sealant.
   2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

B. Joint-Sealant Application: Exterior horizontal nontraffic and traffic isolation and contraction joints in cast-in-place concrete slabs.
   1. Joint Sealant: Multicomponent pourable urethane sealant.
   2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

C. Joint-Sealant Application: Exterior vertical control and expansion joints in unit masonry.

1. Joint Sealant: Multicomponent nonsag urethane sealant or Single-component nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

D. Joint-Sealant Application: Exterior butt joints between metal panels.
1. Joint Sealant: Single-component nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

E. Joint-Sealant Application: Exterior vertical joints between different materials listed above.
1. Joint Sealant: Multicomponent nonsag urethane sealant or Single-component nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

F. Joint-Sealant Application: Exterior perimeter joints between unit masonry and frames of doors and windows.
1. Joint Sealant: Multicomponent nonsag urethane sealant or Single-component nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

G. Joint-Sealant Application: Exterior control and expansion joints in ceilings and other overhead surfaces.
1. Joint Sealant: Multicomponent nonsag urethane sealant or Single-component nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

H. Joint-Sealant Application: Vertical control and expansion joints on exposed interior surfaces of exterior walls.
1. Joint Sealant: Multicomponent nonsag urethane sealant or Single-component nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

I. Joint-Sealant Application: Interior perimeter joints of exterior openings.
1. Joint Sealant: Multicomponent nonsag urethane sealant or Single-component nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

J. Joint-Sealant Application: Interior ceramic tile expansion, control, contraction, and isolation joints in horizontal traffic surfaces.
1. Joint Sealant: Multicomponent nonsag urethane sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

K. Joint-Sealant Application: Interior joints between plumbing fixtures and adjoining walls, floors, and counters.
1. Joint Sealant: Single-component mildew-resistant neutral-curing silicone sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

L. Joint-Sealant Application: Vertical joints on exposed surfaces of interior unit masonry walls and partitions.
   1. Joint Sealant: Single-component nonsag urethane sealant.
   2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

M. Joint-Sealant Application: Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
   1. Joint Sealant: Latex sealant.
   2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION

SECTION 07 92 13
SEALANTS AND CAULKING

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. The Contractor shall furnish and install all caulking, sealing, moisture protection and appurtenant work, complete, all in accordance with the requirements of the Contract Documents. This section specifies sealants for general Construction and sealants that shall be in contact with waste material and water.

1.2 SUBMITTALS

A. Submittals shall conform to the provisions of Section 01 33 00 of the Specifications and shall include the following:

1. Manufacturer's product data showing conformance to the specified requirements.

2. Manufacturer's recommendations for storage, handling and application of sealants and primers.

3. Provide certified test reports from the sealant manufacturer indicating compliance with the requirements in Paragraph 2.2 below if required by the Engineer.

1.3 WARRANTY

A. The Contractor shall provide a 3-year written guarantee of the entire sealant installation against defects in materials and workmanship, together with a statement that he agrees to repair or replace, to the satisfaction of the Owner, at no additional cost to the Owner, any such defective areas which become evident within said 3-year guarantee period.

PART 2 PRODUCTS

2.1 GENERAL SEALANT

A. Sealant for all exterior arid interior building joint filling and sealing requirements shall be with General Electric Silicone 1300 Construction Sealant or approved equal.

2.2 ELASTOMERIC SEALANT

A. The sealant shall be an elastomeric polyurethane designed for bonding to concrete which is continuously submerged in wastewater. No material will be acceptable which has an unsatisfactory history as to bond or durability when used in the joints of

hydraulic structures. Prior to ordering the sealant material, the Contractor shall submit to the Engineer for the Engineer's review sufficient data to show general compliance with the specification requirements. The material shall meet the following requirements:

1. Work Life 45 - 90 minutes

2. Time to reach 20 Shore "A" Hardness (@ 77°F, 200 gr. quantity) 24 hours, maximum

3. Ultimate Hardness 30 - 40 Shore "A"

4. Tensile Strength 100 psi, minimum

5. Ultimate Elongation 400 percent, minimum

6. Tear Resistance Die C ASTM D624) 75 pounds per inch of thickness, min.

7. Color Light Gray

B. Non-sag sealant shall be used on vertical exposed joints. Self-leveling sealant shall be used on horizontal exposed joints. Elastomeric polyurethane sealant shall be Sonolastic Polyurethane Sealant by Sonneborn or approved equal.

2.3 FILLER MATERIAL FOR SEALANT

A. Filler material shall be a non-gassing, resilient, closed-cell polyethylene foam and/or bond breaker of proper size for joint widths. It shall be compatible with sealant manufacturer's product.

2.4 PRIMERS

A. Primers shall be as recommended in the manufacturer's printed instructions for caulking and sealants.

2.5 SOLVENT WASH

A. Solvent wash for surface preparation and cleanup shall be as recommended in the manufacturer's printed instruction for caulking and sealants.

PART 3 EXECUTION

3.1 PREPARATION OF JOINTS

A. Concrete shall have been cured 28 days. Thoroughly clean all joints, removing all concrete fins, dust, oil, grease, water, surface dirt and frost. Previously applied paint or primer must adhere permanently or be entirely removed.

B. Porous surfaces such as concrete shall be cleaned where necessary by grinding, sand or water blasting, abrading, acid washing, or combinations of these methods as required to provide a clean, sound base for sealant adhesion.

C. Non-porous surfaces such as metal shall be cleaned either mechanically or chemically. Protective coatings on metallic surfaces shall be removed by solvents such as xylene or toluene as specified herein. Solvent shall be used with clean, white cloths or lint-free paper towels. Do not allow solvent to air dry without wiping.

3.2 APPLICATION

A. Apply in accordance with manufacturer's printed instructions as to appropriate use. Sealants and caulking shall be applied with gun using nozzle of correct size for joint and shall be forced into grooves with sufficient pressure to expel air and completely fill the groove.

3.3 CLEANING

A. Clean all adjoining surfaces of excess sealants and caulking, smears or markings due to application and leave joint with neat, uniformly filled surface.

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SECTION 08 33 22

CORROSION RESISTANT INSULATED ALUMINUM ROLLING SERVICE DOOR

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: electric operated overhead insulated rolling doors.

1.02 RELATED SECTIONS

1. Section 05 50 00 - Metal Fabrications.
2. Section 08 31 00 - Access Doors and Panels.
3. Section 08 70 00 - Hardware.
4. Section 09 91 00 - Painting.
5. Division 26.

B. Products that may be supplied, but are not installed under this section:
   1. Control station.

1.03 SYSTEM DESCRIPTION

A. Design requirements:
   1. Air Infiltration to comply with:
      a. ASHRAE® (American Society of Heating, Refrigeration, and AirConditioning Engineers) standard 90.1-2007, 2010 and 2013 requirements of less than .3 cubic foot per meter per square foot.
      b. IECC® (International Energy Conservation Code) 2012 requirements of less than 1.0 cubic foot per meter per square foot.
   2. Wind loading:
      a. Supply doors to withstand up to 38.5 pounds per square foot design wind load.
   3. Cycle life:
      a. Design doors of standard construction for normal use of up to 20 cycles per day maximum, and an overall maximum of 50,000 operating cycles for the life of the door.
   4. Seismic performance:
      a. Provide manufacturer's seismic calculations confirming ASCE7-10.
   5. Insulated door slat material requirements:
      a. Flame spread index of 0 and a smoke developed index of 10 as tested per ASTM E84.
      b. Sound transmission class (STC) rating up to 30 for the curtain and up to 22 for the entire assembly. If an STC of 32 is desired, additional options are required.
         1) All configurations are evaluated per ASTM E90 and based on testing a complete, operable assembly.

c. Minimum R-value of 8.0 (U-value of 0.125) as calculated using the ASHRAE Handbook of Fundamentals.
d. Insulation to be chlorofluorocarbon (CFC)-free with an ozone depletion potential (ODP) rating of zero.

6. Safety:
   a. Chain operated doors shall be designed so that the door immediately stops upward or downward travel and is maintained in a stationary position when the hand chain is released by user.

1.04 SUBMITTALS

A. Submit the following items as specified in Section 01_33_00 - Submittal Procedures:
   1. Product Data.
   2. Shop Drawings: Include special conditions not detailed in Product Data.
      a. Show interface with adjacent work.
   3. Quality Assurance/Control Submittals:
      a. Provide manufacturer ISO 9001:2015 registration.
      b. Provide manufacturer and installer qualifications as specified in this Section.
      c. Provide manufacturer's installation instruction.
      d. Manufacturer must provide independent testing lab results proving .3 cubic feet per meter per square foot or less air infiltration.
   4. Closeout Submittals:
      a. Operation and maintenance manual.
      b. Certificate stating that installed materials comply with this specification.

1.05 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer qualifications: ISO 9001:2015 registered and a minimum of 5 years of experience in producing doors of the type specified.
   2. Installer qualifications: Manufacturer's approval.

1.06 DELIVERY STORAGE AND HANDLING

A. As specified in Section 01_60_00 - Product Requirements.

B. Follow manufacturer's instructions.

1.07 WARRANTY

A. Standard Warranty: 2 years from date of shipment against defects in material and workmanship.

B. Maintenance: Submit for owner’s consideration and acceptance of a maintenance service agreement for installed products.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Manufacturer:
   1. Cookson: 1901 South Litchfield, Goodyear, AZ 85338. Telephone: (800) 294-4358.
      a. Or approved manufacturer by Engineer prior to bid.

2.02 PRODUCT INFORMATON

A. Model: ESD20CR.

2.03 MATERIALS

A. Curtain: Air infiltration rate of less than .3 cubic feet per meter per square foot, as tested per ASTM E283 validated by an independent testing agency. Test report required.
   1. Fabrication:
      a. Slat Material: No. 6F.
         1) Listed exterior/interior:
            a) Aluminum/aluminum: 18 gauge aluminum.
      b. Insulation: 7/8 inch foamed-in-place, closed cell urethane.
      c. Total slat thickness: 15/16 inch.
      d. Flame spread index of 0 and a smoke developed index of 10 as tested per ASTM E84.
      e. R-value: 8.0.
      f. STC rating: Up to 30 for the curtain and up to 22 for the entire assembly.
         1) If an STC of 32 is desired, additional options are required.
            a) All configurations are evaluated per ASTM E90 and based on testing a complete, operable assembly.
   2. Exterior slat finish:
      a. Aluminum.
      b. Aluminum, polyester powder coating, color verify powder.
   3. Interior slat finish:
      a. Aluminum.
      b. Aluminum, polyester powder coating, color verify powder.

B. Endlocks: Fabricate interlocking sections with high strength nylon endlocks on alternate slats each secured with two 1/4-inch rivets.
   1. Provide windlocks as required to meet specified wind load.
      a. Nylon: Required up to 21-foot 5-inch width distance between guides (DBG).

C. Bottom bar:
   1. Configuration:
      a. Insulated bottom bar: Reinforced extruded aluminum interior face with full depth insulation and exterior skin slat to match curtain material and gauge.
         1) Minimum 4-inches tall by 1-1/16-inch thickness.
   2. Finish:
      a. Exterior: Match slats.

b. Interior: Powder coat to match slats.

3. Air infiltration certification label: Must be affixed to bottom bar.

D. Guides:
1. Fabrication:
a. Thermal break required.
1) Minimum 3/16-inch structural steel angles.
2) Provide windlock bars of same material when windlocks are required to meet specified wind load.
3) Top of inner and outer guide angles to be flared outwards to form bellmouth for smooth entry of curtain into guides.
4) Provide removable guide stoppers to prevent over travel of curtain and bottom bar.
b. Top 16-1/2 inches of coil side guide angles to be removable for ease of curtain installation and as needed for future curtain service.
2. Finish:
a. Powder coat (color selected by Engineer):
1) Zirconium pre-treatment followed by baked-on polyester powder coat.
2) Minimum 2.5 mils cured film thickness.
3) ASTM D-3363 pencil hardness: H or better.

E. Counterbalance shaft assembly:
1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inch per foot of width.
2. Spring balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 pounds.
3. Provide wheel for applying and adjusting spring torque.

F. Brackets: Fabricate from minimum 3/16-inch steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.
1. Finish:
a. Powder coat (color selected by Engineer):
1) Zirconium pre-treatment followed by baked-on polyester powder coat.
2) Minimum 2.5 mils cured film thickness.
3) ASTM D-3363 pencil hardness: H or better.
4) Polyester powder coating, color verify powder.

G. Hood: Minimum 18 gauge aluminum with reinforced top and bottom edges. Minimum 1/4-inch aluminum intermediate support brackets.
1. Finish:
a. Powder coat (color selected by Engineer):
1) Zirconium pre-treatment followed by baked-on polyester powder coat.
2) Minimum 2.5 mils (0.065 mm) cured film thickness.
3) ASTM D-3363 pencil hardness: H or better.

H. Weatherstripping:

1. Bottom bar:
    a. Weather edge with neoprene astragal extending full width of door bottom bar.
2. Guides: Replaceable vinyl strip on guides sealing against fascia side of curtain.
3. Lintel seal: Double brush seal with EPDM sandwiched between the 2 brush seals at door header to impede air flow.
4. Hood: Neoprene/rayon baffle to impede air flow above coil.

2.04 OPERATION

A. Manual ControlGard Chain Hoist:
    1. Provide chain hoist operator with endless steel chain, chain pocket wheel and guard, geared reduction unit, and chain keeper secured to guide.
    2. Chain hoist to include integral brake mechanism that will immediately stop upward or downward travel and maintain the door in a stationary position when the hand chain is released by the user.

B. Continuous use motor:
    1. Model SGHNX (super duty gear head NEMA 4X) Operator:
        a. The operator must not extend above or below the door coil when mounted front-of-coil.
        b. Rated for a maximum of 20 cycles per hour (not to be used for consecutive hours) cULus listed.
            1) To comply with UL requirements in the United States and Canada.
            2) Totally enclosed fan cooled gear head operator(s) rated 1/3, 1/2, or 3/4 horsepower as recommended by door manufacture for size and type of door.
            3) 115 volts, 1 phase.
            4) Provide complete with electric motor and factory pre-wired motor control terminals, maintenance free solenoid actuated brake, emergency manual chain hoist and control station(s).
                a) Motor shall be high starting torque, industrial type, protected against overload with an auto-reset thermal sensing device.
                b) Primary speed reduction shall be super-duty, lubricated gears with mechanical braking to hold the door in any position.
                c) Operator shall be equipped with an emergency manual chain hoist assembly that safely cuts operator power when engaged.
                d) A disconnect chain shall not be required to engage or release the manual chain hoist.
                e) Operator drive and door driven sprockets shall be provided with #50 roller chain.
                    (1) Provide an integral motor mounted Interlock system to prevent damage to door and operator when mechanical door locking devices are provided.
                    (2) Operator shall be capable of driving the door at a speed of 8 to 9 inches per second.
                        (a) Fully adjustable, driven linear screw type cam limit switch mechanism shall synchronize the operator with the door.

(b) The electrical contractor shall mount the control station(s) and supply the appropriate disconnect switch, all conduit and wiring per the overhead door wiring instructions.
(c) Class 1 Division 2 modification on motor and controls NEMA 7/4X as specified in Division 26.

C. Control station:
1. Interior side: Surface mounted:
a. "Open/Close/Stop" push buttons.
b. NEMA 7/4X as specified in Division 26.

D. Control operation:
1. Constant pressure to close.

2.05 ACCESSORIES

A. Locking:
1. Padlockable slide bolt on coil side of bottom bar at each jamb extending into slots in guides. Provide interlock switches on motor operated units.

B. Operator and bracket mechanism cover:
1. Minimum 18 gauge aluminum sheet cover to enclose exposed moving operating components at coil area of unit.
2. Finish to match door hood.

C. Trim Package: Minimum 16 gauge powder coated aluminum to match guides.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings.

B. Coordinate with responsible entity to perform.

C. Corrective work on unsatisfactory substrates.

D. Commencement of work by installer is acceptance of substrate.

3.02 INSTALLATION

A. General: Install door and operating equipment with necessary hardware, anchors, inserts, hangers and supports.

B. Follow manufacturer's installation instructions.

3.03 ADJUSTING

A. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion.

3.04 CLEANING

A. Clean surfaces soiled by work as recommended by manufacturer.

B. Remove surplus materials and debris from the site.

3.05 DEMONSTRATION

A. Demonstrate proper operation to Owner's Representative.

B. Instruct Owner's Representative in maintenance procedures.

END OF SECTION

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SECTION 08 41 11

ALUMINUM-FRAMED WINDOWS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Exterior and interior aluminum-framed windows
      a. Glazing is retained mechanically with gaskets on four sides.

B. Related Sections include the following:
   1. Division 7 Section "Joint Sealants" for installation of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.
   2. Division 8 Section "Glazing" for glazing requirements to the extent not specified in this Section.

1.03 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:
   1. Structural loads.
   2. Thermal movements.
   3. Movements of supporting structure indicated on Drawings including, but not limited to, deflection from uniformly distributed and concentrated live loads.
   4. Dimensional tolerances of building frame and other adjacent construction.
   5. Failure includes the following:
      a. Deflection exceeding specified limits.
      b. Thermal stresses transferred to building structure.
      c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
      d. Glazing-to-glazing contact.
      e. Noise or vibration created by wind and thermal and structural movements.
      f. Loosening or weakening of fasteners, attachments, and other components.
      g. Sealant failure.
      h. Failure of operating units to function properly.

B. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Seismic Loads: As indicated on Drawings.

C. Deflection of Framing Members:
   1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
   2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components directly below to less than 1/8 inch (3.2 mm) and clearance between members and operable units directly below to less than 1/16 inch (1.5 mm).

D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
   1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
   2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test Durations: As required by design wind velocity but not less than 10 seconds.

E. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
   2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
      a. Test High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F (82 deg C).
      b. Test Low Exterior Ambient-Air Temperature: 0 deg F (minus 18 deg C) .
      c. Test Interior Ambient-Air Temperature: 75 deg F (24 deg C).

F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).

G. Water Penetration Under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

H. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 53 when tested according to AAMA 1503.

I. Average Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having average U-factor of not more than 0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K) when tested according to AAMA 1503.

1.04 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
   1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   2. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.

C. Samples for Selection: For units with factory-applied color finishes.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of systems, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:
   1. Joinery.
   2. Anchorage.
   3. Expansion provisions.
   4. Glazing.
   5. Flashing and drainage.

E. Welding certificates.

F. Qualification Data: For Installer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems.

H. Maintenance Data: For aluminum-framed systems to include in maintenance manual.

I. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
   1. Engineering Responsibility: Preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard

units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.

B. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

C. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code--Aluminum."

D. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical wall area as shown on Drawings.
   2. Field testing shall be performed on mockups according to requirements in Part 3 "Field Quality Control" Article.
   3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating aluminum-framed systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.07 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration caused by thermal movements.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Water leakage through fixed glazing and framing areas.
      e. Failure of operating components to function properly.

2. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
   1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. EFCO Corporation.
   2. Kawneer.
   3. United States Aluminum.
   4. Vistawall Architectural Products.
   5. Wausau Window and Wall Systems.

2.02 MATERIALS

A. Basis of Design: Equal to: Kawneer VG 451UT (Exterior) and VG 451 (Interior).

B. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
   3. Extruded Structural Pipe and Tubes: ASTM B 429.
   4. Structural Profiles: ASTM B 308/B 308M.
   5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

C. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
   1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.03 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Framing members are composite assemblies of two separate extruded-aluminum components permanently bonded by an elastomeric material of low thermal conductance.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
   2. Reinforce members as required to receive fastener threads.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.

E. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

2.04 GLAZING SYSTEMS

A. Glazing: As specified in Division 8 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

2.05 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."

B. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.06 FABRICATION

A. Form aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
   4. Physical and thermal isolation of glazing from framing members.
   5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   6. Provisions for field replacement of glazing from exterior.
   7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

2.07 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing:

C. Kawneer Permanodic™ AA-M10C21A44, AAMA 611, Architectural Class I Color Anodic Coating (Color: Refer to drawings).

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General:
   1. Comply with manufacturer's written instructions.
   2. Do not install damaged components.
   3. Fit joints to produce hairline joints free of burrs and distortion.
   4. Rigidly secure nonmovement joints.
   5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
   6. Seal joints watertight, unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, without warp or rack.

F. Install glazing as specified in Division 8 Section “Glazing.”

G. Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

H. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:
1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
2. Alignment:
   a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
   b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).
3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
1. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing under Part 1 "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).
2. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure difference of 0.67 times the static-air-pressure difference specified for laboratory testing under Part 1 "Performance Requirements"

Article, but not less than 4.18 lbf/sq. ft. (200 Pa), and shall not evidence water penetration.

C. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

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SECTION 08 62 50

TUBULAR SKYLIGHTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Unit skylights mounted on site-built curbs.

B. Related Sections:
   1. Division 7 Section "Sheet Metal Flashing and Trim" for flashing at unit skylights.
   2. Division 26 Sections for electrical service and connections for motor operators, controls, limit switches, and other powered devices.

1.03 PERFORMANCE REQUIREMENTS

A. Test Performance Criteria: Provide tubular skylights capable of complying with performance requirements indicated, based on testing manufacturer's tubular skylights that are representative of those specified.
   1. Structural Performance: Provide tubular skylights, including glazing and anchorage, capable of withstanding the effects of the following design loads:
      a. Positive Pressure or Inward Load: As indicated.
      b. Negative Pressure or Uplift Load: As indicated.
   2. Air Infiltration: Provide unit skylights with maximum air leakage through assembly of 0.3 cfm/sq. ft. (1.5 L/s per sq. m) when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).
   3. Water Penetration: Provide unit skylights that do not evidence water penetration through assembly when tested according to ASTM E 331 at a zero static-air-pressure difference across unit.

1.04 SUBMITTALS

A. Product Data: For each type of tubular skylight indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for tubular skylights.

B. Shop Drawings: For tubular skylight work. Include plans, elevations, sections, details, and connections to supporting structure and other adjoining work.

1. Tubular Skylight Operating System: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, mounting, and grounding provisions.
2. Wiring Diagrams: For power, signal, and control wiring for electric motors of operable tubular skylights.

C. Samples for Selection: For tubular skylights with factory-applied color finishes.

D. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency for each type, performance class, performance grade, and size of tubular skylight. Test results based on use of downsized test units will not be accepted.

E. Maintenance Data: For tubular skylights to include in maintenance manuals.

F. Warranty: Sample of special warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating tubular skylights that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

B. Installer Qualifications: An installer acceptable to tubular skylight manufacturer for installation of units required for this Project.

C. Source Limitations: Obtain tubular skylights from single source from single manufacturer.

D. Surface-Burning Characteristics of Plastic Glazing: Provide plastic glazing sheets identical to those tested for fire-exposure behavior per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
1. Self-Ignition Temperature: 650 deg F (343 deg C) or more for plastic sheets in thickness indicated when tested per ASTM D 1929.
2. Smoke-Production Characteristics: Comply with either requirement below:
    a. Smoke-Developed Index: 450 or less when tested per ASTM E 84 on plastic sheets in manner indicated for use.
    b. Smoke Density: 75 or less when tested per ASTM D 2843 on plastic sheets in thickness indicated for use.
3. Burning Characteristics: Tested per ASTM D 635.
    a. Acrylic Glazing: Class CC2, burning rate of 2-1/2 inches (64 mm) per minute or less for nominal thickness of 0.060 inch (1.5 mm) or thickness indicated for use.

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.

F. Preinstallation Conference: Conduct conference at Project site.

1.06 COORDINATION

A. Coordinate tubular skylight flashing requirements with roofing system.

B. Coordinate sizes and locations of site-built curbs with actual tubular skylights provided.

C. Provide anchors and inserts to be placed in adjacent construction in proper sequence so as not to delay the Work.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of tubular skylights that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Uncontrolled water leakage.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      c. Yellowing of acrylic glazing.
   2. Warranty Period: Ten years from date of Substantial Completion.

1.08 FM GLOBAL REQUIREMENTS (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Solatube International, Inc.

2.02 MATERIALS

A. Aluminum Components:
   1. Sheets: ASTM B 209 (ASTM B 209M), alloy and temper to suit forming operations and finish requirements but with not less than the strength and durability of alclad Alloy 3005-H25.
   2. Extruded Shapes: ASTM B 221 (ASTM B 221M), alloy and temper to suit structural and finish requirements but with not less than the strength and durability of Alloy 6063-T52.

B. Fasteners: Same metal as metal being fastened, nonmagnetic stainless steel, or other noncorrosive metal as recommended by manufacturer. Finish exposed fasteners to match material being fastened.
   1. Where removal of exterior exposed fasteners might allow access to building, provide nonremovable fastener heads.

2.03 GLAZING

A. Acrylic Glazing: ASTM D 4802, thermoformable, monolithic sheet, category as standard with manufacturer, Finish 1 (smooth or polished), Type UVF (formulated with UV absorber).
   1. Single-Glazing Profile: Dome, 25 percent rise.
      a. Thickness: Not less than thickness required to exceed performance requirements.
      b. Color: Colorless, transparent.

B. Glazing Gaskets: Manufacturer's standard.

2.04 INSTALLATION MATERIALS

A. Joint Sealants: As specified inDivision 7 Section "Joint Sealants."

B. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

2.05 TUBULAR SKYLIGHTS

A. Tubular Skylights General : Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICBO/ICC AC-16. All components made and assembled by one manufacturer.

B. Solatube Brighten Up Series 290 DS, 14-inch, diameter tubes: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.
   1) Complete system Assembly.
   2) With grid ceiling diffusers.
   3) Dimmer Switch: Type SW, Manufacturer-specific low voltage DC DP/DT switch (white) required to operate Daylight Dimmer. Note: A maximum of 10 units can be connected to one switch. For use with Daylight Dimmer, Type D, only.
   4) Dimmer Cable: Type CA, Two conductor, 22 gauge, low voltage cable (500 ft.) for multiple unit DC connections. For use with Daylight Dimmer, Type D, only when aggregate circuit runs do not exceed 200 feet (60.96 m).
   2. Accessories:
      a. Flashing Turret Extensions: Provide manufacturer's standard extensions for applications requiring:
         1) Additional lengths of 12 inches (305 mm) extension
   3. Catalog Number: S21C-DD-FCM-EXX-L2-D-I.

2.06 ACCESSORIES

A. Daylight Dimmer: (Where indicated on drawings): Electro-mechanically actuated daylight valve; for universal input voltages ranging between 90 and 277 V at 50 or 60 Hz; actuator rated at 0.1 amp per unit; controlled by low voltage, series circuited, 4 conductor, size 22 cable, and low voltage DC DP/DT switch; providing daylight output between 2 and 100 percent.

2.07 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.08 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with tubular skylight installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Coordinate installation of tubular skylight with installation of substrates, roof insulation, roofing membrane, and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.

B. Install tubular skylights level, plumb, and true to line, without distortion.

C. Anchor tubular skylights securely to supporting substrates.

D. Where metal surfaces of tubular skylights will contact incompatible metal or corrosive substrates, including preservative-treated wood, apply bituminous coating on concealed metal surfaces, or provide other permanent separation recommended in writing by tubular skylight manufacturer.

E. Set tubular skylight flanges in thick bed of roofing cement to form a seal unless otherwise indicated.

F. Where cap flashing is indicated, install to produce waterproof overlap with roofing or roof flashing. Seal with thick bead of mastic sealant except where overlap is indicated to be left open for ventilation.

3.03 CLEANING

A. Clean exposed tubular skylight surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes.

B. Remove excess sealants, glazing materials, dirt, and other substances.

C. Remove and replace glazing that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect tubular skylight surfaces from contact with contaminating substances resulting from construction operations.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components
3. Field verification, preparation and modification of existing doors and frames to receive new door hardware.

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 07 Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
2. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.
3. Division 26 “Electrical” sections for connections to electrical power system and for low-voltage wiring.

1.02 REFERENCES

A. UL - Underwriters Laboratories

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 **SUBMITTALS**

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:

   a. Comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein.
   b. Review drawings and Sections from related trades to verify compatibility with specified hardware.
   c. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:

   a. Wiring Diagrams: For power, signal, and control wiring and including:
      1) Details of interface of electrified door hardware and building safety and security systems.
      2) Schematic diagram of systems that interface with electrified door hardware.
      3) Point-to-point wiring.
      4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.

    a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule:

    a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
    b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
    c. Indicate complete designations of each item required for each opening, include:
        1) Door Index: door number, heading number, and Architect's hardware set number.
        2) Quantity, type, style, function, size, and finish of each hardware item.
        3) Name and manufacturer of each item.
        4) Fastenings and other pertinent information.
        5) Location of each hardware set cross-referenced to indications on Drawings.
        6) Explanation of all abbreviations, symbols, and codes contained in schedule.
        7) Mounting locations for hardware.
        8) Door and frame sizes and materials.
        9) Degree of door swing and handing.
        10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

5. Key Schedule:

    a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
    b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
    c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
    d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
    e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
    f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

C. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:

    a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
    b. Include warranties for specified door hardware.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:

    a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
    b. Catalog pages for each product.
    c. Final approved hardware schedule edited to reflect conditions as installed.
    d. Final keying schedule
    e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
    f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:

1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:

    a. fire door assemblies, in compliance with NFPA 80.
    b. required egress door assemblies, in compliance with NFPA 101.

1.04 **QUALITY ASSURANCE**

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

a. For door hardware: DHI certified AHC or DHC.
b. Can provide installation and technical data to Architect and other related subcontractors.
c. Can inspect and verify components are in working order upon completion of installation.
d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.

4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

1. Fire-Rated Door Openings:

a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
b. Provide only items of door hardware that are listed products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

2. Smoke and Draft Control Door Assemblies:

a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

3. Electrified Door Hardware

a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

4. Accessibility Requirements:

a. Comply with governing accessibility regulations cited in “REFERENCES” article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference

a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.

2) Preliminary key system schematic diagram.
3) Requirements for key control system.
4) Requirements for access control.
5) Address for delivery of keys.

2. Pre-installation Conference

a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
b. Inspect and discuss preparatory work performed by other trades.
c. Inspect and discuss electrical roughing-in for electrified door hardware.
d. Review sequence of operation for each type of electrified door hardware.
e. Review required testing, inspecting, and certifying procedures.
f. Review questions or concerns related to proper installation and adjustment of door hardware.

3. Electrified Hardware Coordination Conference:

a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer’s original packaging.

C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 **COORDINATION**

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where existing doors, frames and/or hardware are to remain, field verify existing functions, conditions and preparations and coordinate to suit opening conditions and to provide proper door operation.

1.07 **WARRANTY**

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.

1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer’s published listings.

    a. Mechanical Warranty
        1) Locks
            a) Falcon: 10 year
        2) Exit Devices
            a) Falcon: 10 year
        3) Closers
            a) LCN 4050 Series: 25 year

1.08 **MAINTENANCE**

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approval of manufacturers and/or products other than those listed as “Scheduled Manufacturer” or “Acceptable Manufacturers” in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.

B. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fabrication

1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer’s recognized installation standards for application intended.
2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with “Metal Doors and Frames”, “Flush Wood Doors”, “Stile and Rail Wood Doors” to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.

B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.

1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
2. Use materials which match materials of adjacent modified areas.
3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.

C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

D. Cable and Connectors:

1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 **HINGES**

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

   a. Ives 5BB series

2. Acceptable Manufacturers and Products:

   a. Hager BB1191/1279 series
   b. McKinney TB series
   c. Stanley FBB series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:

   a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
   b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:

   a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
   b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. 2 inches or thicker doors:

   a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
   b. Interior: Heavy weight, steel, 5 inches (127 mm) high

6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
9. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

a. Steel Hinges: Steel pins
b. Non-Ferrous Hinges: Stainless steel pins
c. Out-Swinging Exterior Doors: Non-removable pins
d. Out-Swinging Interior Lockable Doors: Non-removable pins
e. Interior Non-lockable Doors: Non-rising pins

10. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 **CONTINUOUS HINGES**

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Select
b. Stanley
c. Roton
d. ABH
e. Hager

B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 **FLUSH BOLTS**

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Burns
b. Rockwood
c. DCI
d. Trimco
e. Don-Jo
f. Hager

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.06 **MORTISE LOCKS**

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Falcon MA series

2. Acceptable Manufacturers and Products:

a. Corbin-Russwin ML2000 series
b. Sargent 8200 series
c. Yale 8800 series

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
2. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
3. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to “KEYING” article, herein.

4. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
5. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
6. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide a request to exit (RX) switch that is actuated with rotation of inside lever.
7. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

    a. Lever Design: DANE

2.07 **EXIT DEVICES**

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. Falcon 24/25 series

2. Acceptable Manufacturers and Products:

    a. Sargent 19-43-GL-80 series
    b. Precision Apex series

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide flush end caps for exit devices.
7. Provide exit devices with manufacturer’s approved strikes.
8. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
9. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
10. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
11. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
12. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.

13. Provide electrified options as scheduled.
14. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.
    1) .

2.08 **KEYING**

A. Requirements:

1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.

    a. Master Keying system as directed by the Owner.

2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
3. Provide keys with the following features:

    a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
    b. Patent Protection: Keys and blanks protected by one or more utility patent(s).
    c. Geographically Exclusive: Where High Security or Security cylinders/cores are indicated, provide nationwide, geographically exclusive key system complying with the following restrictions.

4. Identification:

    a. Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
    b. Identification stamping provisions must be approved by the Architect and Owner.
    c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
    d. Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
    e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

5. Quantity: Furnish in the following quantities.

    a. Change (Day) Keys: 3 per cylinder/core.
    b. Permanent Control Keys: 3.
    c. Master Keys: 6.

2.09 **KEY CONTROL SYSTEM**

A. Manufacturers:

1. Scheduled Manufacturer:

    a. Telkee

2. Acceptable Manufacturers:

    a. HPC
    b. Lund

B. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.

    a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
    b. Provide hinged-panel type cabinet for wall mounting.

2.10 **DOOR CLOSERS**

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. LCN 4050A series

2. Acceptable Manufacturers and Products:

    a. Falcon SC70A series
    b. Norton 7500 series
    c. Sargent 351 series
    d. Yale 4400 series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with cast aluminum cylinder.
3. Closer Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter heat-treated pinion journal and full complement bearings.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and all weather requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.

6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and back check.
7. Pressure Relief Valve (PRV) Technology: Not permitted.
8. Provide stick on templates, special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.11 **DOOR TRIM**

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives.

2. Acceptable Manufacturers:

a. Elmes
b. Trimco
c. Burns
d. Rockwood

B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.12 **PROTECTION PLATES**

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Burns
b. Trimco
c. Rockwood

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.13 **OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS**

A. Manufacturers:

1. Scheduled Manufacturers:

    a. Glynn-Johnson

2. Acceptable Manufacturers:

    a. Rixson
    b. Sargent
    c. ABH

B. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.
2. Provide friction type at doors without closer and positive type at doors with closer.

2.14 **DOOR STOPS AND HOLDERS**

A. Manufacturers:

1. Scheduled Manufacturer:

    a. Ives

2. Acceptable Manufacturers:

    a. Trimco
    b. Burns
    c. Rockwood

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.15 **THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING**

A. Manufacturers:

1. Scheduled Manufacturer:

    a. Zero International

2. Acceptable Manufacturers:

    a. National Guard
    b. Reese
    c. Legacy
    d. Pemko

B. Requirements:

1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.16 **SILENCERS**

A. Manufacturers:

1. Scheduled Manufacturer:

    a. Ives

2. Acceptable Manufacturers:

    a. Burns
    b. Rockwood
    c. Trimco

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.17 **DOOR POSITION SWITCHES**

A. Manufacturers:

1. Scheduled Manufacturer:

    a. Schlage

2. Acceptable Manufacturers:

a. GE-Interlogix
b. Sargent

B. Requirements:

1. Provide recessed or surface mounted type door position switches as specified.
2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used with magnetic locking device, provide minimum of 4 inches (102 mm) between switch and magnetic locking device.

2.18 **COAT HOOKS**

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

2. Acceptable Manufacturers:

a. Burns
b. Rockwood

B. Provide coat hooks as specified.

2.19 **FINISHES**

A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)
8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum
10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 **EXAMINATION**

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly

construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.

B. Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

D. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 **PREPARATION**

A. Where on-site modification of doors and frames is required:

1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
2. Field modify and prepare existing doors and frames for new hardware being installed.
3. When modifications are exposed to view, use concealed fasteners, when possible.
4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:

    a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
    b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
    c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.03 **INSTALLATION**

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
4. Installation Guide for Doors and Hardware: DHI TDH-007-20

B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.

C. Install each hardware item in compliance with manufacturer’s instructions and recommendations, using only fasteners provided by manufacturer.

D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.

I. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to fire/smoke alarm system and smoke evacuation system.
4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
5. Connections to panel interface modules, controllers, and gateways.
6. Testing and labeling wires with Architect's opening number.

J. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

K. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

L. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

M. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.

N. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

O. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

P. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

Q. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

R. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.04 **ADJUSTING**

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.05 **CLEANING AND PROTECTION**

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items per manufacturer's instructions to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.06 **DOOR HARDWARE SCHEDULE**

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.

C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

D. Hardware Sets: Refer to drawings Door Schedule.

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Windows.
   2. Doors.
   3. Glazed entrances.
   4. Interior borrowed lites.
   5. Storefront framing.

1.03 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

F. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions.

Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.04 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
    a. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings. Design wind load shall be minimum 50 mph.
    b. Specified Design Snow Loads: As indicated, but not less than snow loads applicable to Project as required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 7.0, "Snow Loads."
    c. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
        1) Load Duration: 60 seconds or less.
    d. Probability of Breakage for Sloped Glazing: 1 lite per 1000 for lites set more than 15 degrees off vertical and under wind and snow action.
        1) Load Duration: 30 days.
    e. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch (25 mm), whichever is less.
        1) For monolithic-glass lites heat treated to resist wind loads.
        2) For insulating glass.
        3) For laminated-glass lites.
    f. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
    g. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass

framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
   2. For laminated-glass lites, properties are based on products of construction indicated.
   3. For insulating-glass units, properties are based on units with lites 6.0 mm thick and a nominal 1/2-inch- (12.7-mm-) wide interspace.
   4. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
      a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F (W/sq. m x K).
      b. Solar Heat Gain Coefficient: NFRC 200.
      c. Solar Optical Properties: NFRC 300.

1.05 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass.
   1. Each color of tinted float glass.
   2. Each type of patterned glass.
   3. Coated vision glass.
   4. Ceramic-coated spandrel glass.
   5. Each pattern and color of ceramic-coated vision glass.
   6. Fire-resistive glazing products.
   7. Each type of laminated glass with colored interlayer.
   8. Insulating glass for each designation indicated.
   9. For each color (except black) of exposed glazing sealant indicated.

C. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

D. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
   1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

E. Qualification Data: For installers.

F. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

G. Product Test Reports: For each of the following types of glazing products:
   1. Tinted float glass.
   2. Coated float glass.
   3. Insulating glass.
   4. Glazing sealants.
   5. Glazing gaskets.

H. Warranties: Special warranties specified in this Section.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear float glass, coated float glass, laminated glass, and insulating glass.

C. Source Limitations for Glass Sputter-Coated with Solar-Control Low-E Coatings: Where solar-control low-e coatings of a primary glass manufacturer that has established a certified fabricator program is specified, obtain sputter-coated solar-control low-e-coated glass in fabricated units from a manufacturer that is certified by coated-glass manufacturer.

D. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

E. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.
   1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

F. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
   1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
   2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

G. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:
   1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
   2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
   3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   4. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
   5. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.

H. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

I. Glazing for Fire-Rated Window Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

J. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.
   1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
   2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. (0.84 sq. m) in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. (0.84 sq. m) or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

K. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA Publications: GANA Laminated Division's "Laminated Glass Design Guide" and GANA's "Glazing Manual."
   2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
   3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Sloped Glazing Guidelines."

4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

L. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
   1. Insulating Glass Certification Council.

M. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
   2. Build glass mockups by installing the following kinds of glass in mockups specified in Division 8 Section "Aluminum-Framed Entrances and Storefronts and Glazed Aluminum Curtain Walls" to match glazing systems required for Project, including glazing methods:
      a. Heat-strengthened coated glass.
      b. Fully tempered glass.
      c. Spandrel glass.
      d. Laminated glass.
      e. Coated insulating glass.
   3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

N. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F (4.4 deg C).

1.09 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
   1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to Owner and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
   1. Warranty Period: Five years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
   2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.02 GLASS PRODUCTS

A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
   2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
   3. For uncoated glass, comply with requirements for Condition A.

4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
5. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.

C. Ceramic-Coated Vision Glass: Float glass with ceramic enamel applied by silk-screened process and complying with ASTM C 1048, Condition C (other coated glass), Type I (transparent flat glass), Quality-Q3, Specification No. 95-1-31 in GANA Tempering Division's "Engineering Standards Manual," and other requirements specified.

D. Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum deposition process after manufacture and heat treatment (if any), and complying with other requirements specified.

E. Coated Spandrel Float Glass: Float glass complying with other requirements specified and with the following:
1. Fallout Resistance: Provide spandrel units identical to those passing the fallout-resistance test for spandrel glass specified in ASTM C 1048.
2. Factory apply manufacturer's standard opacifier of the following material to coated second surface of lites, with resulting products complying with Specification No. 89-1-6 in GANA Tempering Division's "Engineering Standards Manual."
    a. Manufacturer's standard opacifier material.

F. Laminated Glass: ASTM C 1172, and complying with other requirements specified and with the following:
1. Interlayer: Polyvinyl butyral of thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.
    a. For polyvinyl butyral interlayers, laminate lites in autoclave with heat plus pressure.
2. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets.

G. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.
3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
4. Sealing System: Dual seal, with primary and secondary sealants as follows:
    a. Polyisobutylene and hot-melt butyl.

5. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
    a. Spacer Material: Aluminum with mill or clear anodic finish.
    b. Desiccant: Molecular sieve or silica gel, or blend of both.
    c. Corner Construction: Manufacturer's standard corner construction.

2.03 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
    1. EPDM, ASTM C 864.
    2. Silicone, ASTM C 1115.
    3. Thermoplastic polyolefin rubber, ASTM C 1115.
    4. Any material indicated above.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
    1. EPDM.
    2. Silicone.
    3. Thermoplastic polyolefin rubber.
    4. Any material indicated above.

C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.04 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:
    1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
    2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
    3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
    1. Single-Component Neutral- and Basic-Curing Silicone Glazing Sealants:

a. Available Products:
    1) Dow Corning Corporation; 790.
    2) GE Silicones; SilPruf LM SCS2700.
    3) Tremco; Spectrem 1 (Basic).
b. Type and Grade: S (single component) and NS (nonsag).
c. Class: 100/50.
d. Use Related to Exposure: NT (nontraffic).
e. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.
    1) Use O Glazing Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, and wood.

2. Neutral-Curing Silicone Glazing Sealants:
    a. Available Products:
        1) Dow Corning Corporation; 795.
        2) GE Silicones; UltraPruf II SCS2900.
        3) Pecora Corporation; 865.
    b. Type and Grade: S (single component) and NS (nonsag).
    c. Class: 50.
    d. Use Related to Exposure: NT (nontraffic).
    e. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.
        1) Use O Glazing Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, and wood.
3. Class 25 Neutral-Curing Silicone Glazing Sealant:
    a. Available Products:
        1) Dow Corning Corporation; 799.
        2) GE Silicones; UltraGlaze SSG4000.
        3) Tremco; Tremsil 600.
    b. Type and Grade: S (single component) and NS (nonsag).
    c. Class: 25.
    d. Use Related to Exposure: NT (nontraffic).
    e. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.
        1) Use O Glazing Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, and wood.
4. Acid-Curing Silicone Glazing Sealants:
    a. Available Products:
        1) Dow Corning Corporation; 999-A.
        2) GE Silicones; Contractors SCS1000.
        3) Pecora Corporation; 860.

4) Tremco; Tremsil 200.

b. Type and Grade: S (single component) and NS (nonsag).

c. Class: 25.

d. Use Related to Exposure: NT (nontraffic).

e. Uses Related to Glazing Substrates: G, A, and, as applicable to glazing substrates indicated, O.

1) Use O Glazing Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel and wood.

2.05 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:

1. Type 1, for glazing applications in which tape acts as the primary sealant.
2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.06 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.07 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.

C. Grind smooth and polish exposed glass edges and corners.

2.08 MONOLITHIC FLOAT-GLASS UNITS

A. Uncoated Clear Float-Glass Units: Class 1 (clear) annealed or Kind HS (heat-strengthened) float glass where heat strengthening is required to resist thermal stresses induced by differential shading of individual glass lites and to comply with system performance requirements and Kind FT (fully tempered) float glass.
   1. Thickness: Not less than 6.0 mm.
   2. Uncoated Clear Fully Tempered Float Glass: Kind FT (fully tempered).

2.09 LAMINATED-GLASS UNITS

A. Heat-Treated Laminated-Glass Units:
   1. Kind LHS, consisting of two lites of heat-strengthened float glass.
   2. Outer Lite: Class 1 clear float glass.
      a. Kind HS (heat strengthened).
      b. Thickness: 5.0 mm.
   3. Inner Lite: Class 1 (clear) float glass.
      a. Kind HS (heat strengthened).
      b. Thickness: 5.0 mm.
   4. Plastic Interlayer:
      a. Thickness: 0.030 inch, but not less than that required to comply as a Type II safety glass material.
      b. Interlayer Color: Clear.

2.10 INSULATING-GLASS UNITS

A. Solar Control Low-E Insulating Glass: Where glass of this designation is indicated, provide low-emissivity insulating-glass units complying with the following:
   1. Products: Available products include the following:
      a. PPG SOLARBAN 60 (2) SOLARGRAY.
   2. Overall Unit Thickness and Thickness of Each Lite: 25 and 6 mm.
   3. Interspace Content: Air.
   4. Indoor Lite: Type I (transparent glass, flat), Class 1 (clear) float glass.

a. Kind HS (heat strengthened), Condition C (other coated glass).

5. Outdoor Lite: Type I (transparent glass, flat) float glass.
   a. Class 2 (tinted) float glass.
   b. Tint Color: SOLARGRAY
   c. Kind HS (heat strengthened), Condition A (uncoated surfaces) or Kind FT (fully tempered), Condition A (uncoated surfaces).
6. Low-Emissivity Coating: Sputter on second surface.
7. Visible Light Transmittance: 35%
8. Winter Nighttime U-Value: 0.29
9. Summer Daytime U-Value: 0.27
10. Solar Heat Gain Coefficient: 0.25
11. Outdoor Visible Reflectance: 12%
12. Shading Coefficient: 0.29

B. Ceramic-Coated Spandrel Insulating Glass: Where glass of this designation is indicated, provide insulating-glass units complying with the following:
   1. Products: Available products include the following:
      a. Match adjacent glazing panels.
   2. Construction: Provide units that comply with requirements specified for insulating-glass units except for indoor lite.
   3. Indoor Lite: Ceramic-coated spandrel glass.
      a. Kind HS (heat strengthened) or Kind FT (fully tempered).
      b. Ceramic Coating Location: Fourth surface.
      c. Color: As selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep system.
   3. Minimum required face or edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.03 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm) as follows:

   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.04 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant where indicated.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.05 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.06 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.07 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.08 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION

SECTION 09 25 00

GYPSUM BOARD

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Interior gypsum board.
   2. Exterior gypsum sheating.
   3. Tile backing panels.

B. Related Sections include the following:
   1. Division 5 Section "Cold-Formed Metal Framing" for load-bearing steel framing that supports gypsum board.
   2. Division 7 Section "Building Insulation" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.
   3. Division 7 Section "Joint Sealants" for acoustical sealants installed in assemblies that incorporate gypsum board.
   4. Division 9 Section "Non-Load-Bearing Steel Framing" for non-structural framing and suspension systems that support gypsum board.
   5. Division 9 Section "Ceramic Tile" for cementitious backer units installed as substrates for ceramic tile.
   6. Division 9 painting Sections for primers applied to gypsum board surfaces.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For the following products:
   1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim `

1.04 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.05 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 PRODUCTS

2.01 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.02 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. American Gypsum Co.
      b. BPB America Inc.
      c. G-P Gypsum.
      d. National Gypsum Company.
      e. PABCO Gypsum.
      f. USG Corporation.

B. Type X:
   1. Thickness: 5/8 inch (15.9 mm).

2. Long Edges: Tapered.

C. Special Type X: Having improved fire resistance over standard Type X, and complying with requirements of fire-resistance-rated assemblies indicated on Drawings.
   1. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
   2. Long Edges: Tapered.
   3. Abuse Resistant Type X: Where indicated on drawings
   4. Thickness: 5/8 inch (15.9 mm).
   5. Long Edges: Tapered.

2.03 EXTERIOR GYPSUM SHEATHING

A. General: Complying with ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. American Gypsum Co.
      b. BPB America Inc.
      c. G-P Gypsum.
      d. National Gypsum Company.
      e. PABCO Gypsum.
      f. USG Corporation.

B. Type X:
   1. Thickness: 5/8 inch (15.9 mm).
   2. Long Edges: Tapered.

2.04 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board:
   1. Complying with ASTM C 1178/C 1178M.
      a. Product: Subject to compliance with requirements, provide "DensShield Tile Guard" by G-P Gypsum.
   2. Core: 5/8 inch (15.9 mm), Type X.

2.05 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
   2. Shapes:
      a. Cornerbead.
      b. Bullnose bead.
      c. LC-Bead: J-shaped; exposed long flange receives joint compound.

d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Expansion (control) joint.
g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Fry Reglet Corp.
b. Gordon, Inc.
c. Pittcon Industries.
2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.06 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
1. Interior Gypsum Wallboard: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:
1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.07 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
   2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Acoustical Sealant: As specified in Division 7 Section "Joint Sealants."

E. Thermal Insulation: As specified in Division 7 Section "Building Insulation."

F. Vapor Retarder: As specified in Division 7 Section "Building Insulation."

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.

2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.03 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
1. Type X: Vertical surfaces, unless otherwise indicated.
2. Special Type X: Where required for specific fire-resistance-rated assembly indicated.

B. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:
1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with

vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

4. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.04 APPLYING TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.05 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Bullnose Bead: Use at outside corners, unless otherwise indicated
2. Cornerbead: Use where indicated.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where indicated.
5. U-Bead: Use at exposed panel edges.
6. Curved-Edge Cornerbead: Use at curved openings.

D. Aluminum Trim: Install in locations indicated on Drawings.

E. Install corner beads at external corners. Provide metal trim to protect edge of gypsum board wherever gypsum board intersects a dissimilar material. Hold channel and >L= trim back from metal window and door frames 1/8 inch to allow for caulking.

3.06 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below:
   1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
   2. Level 2: Panels that are substrate for tile.
   3. Level 3: Panels that are substrates for wall coverings and wall panels.
   4. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
      a. Primer and its application to surfaces are specified in other Division 9 Sections.

E. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

3.07 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

3.08 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Architect will conduct an above-ceiling observation before installing gypsum board ceilings and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
   1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
   2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
      a. Installation of 80 percent of lighting fixtures, powered for operation.
      b. Installation, insulation, and leak and pressure testing of water piping systems.
      c. Installation of air-duct systems.
      d. Installation of air devices.
      e. Installation of mechanical system control-air tubing.
      f. Installation of ceiling support framing.

END OF SECTION

SECTION 09 90 00
HIGH PERFORMANCE COATINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnishing and applying protective coatings of paint to all surfaces indicated on the Drawings or specified herein, including all surface preparation and related work.

B. Not all coating systems in this specification will be used on this project.

1.2 EXCLUSIONS

A. Painting is not required for the following surfaces or items unless otherwise shown on the Drawings, specified in other sections, or specified herein:

1. Stainless steel, aluminum (except where in contact with concrete), chrome, fiberglass, copper instruments, pressure gauge tubing, and structural FRP. (unless noted on plans or finish schedules.)

2. Electrical panels, motor control centers, pumps, and motors having a factory finish. The factory finish shall be approved by the Engineer. Non-approved factory finishes shall be painted as specified hereinafter.

3. Surfaces hidden from view such as piping, ducts, structural wood, and insulation.

1.3 ABBREVIATIONS

A. CSM - Coating System Manufacturer.

B. CSA - Coating System Applicator. Specialty subcontractor retained by the Contractor to install the coating systems specified in this Section.

C. CTR - Coating System Manufacturer's Technical Representative.

1.4 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. American National Standards Institute (ANSI)

a. Standard Colors for Color Identification and Coding

b. A13.1, Scheme for the Identification of Piping Systems

2. American Water Works Association (AWWA)

a. C203, Coal-Tar Protective Coatings and Linings for Steel Water Pipelines-Enamel and Tape-Hot-Applied

b. C210, Liquid Epoxy Coating System for the Interior and Exterior of Steel Water Pipelines

c. C214, Tape Coating Systems for the Exterior of Steel Water Pipelines

3. NSF International (NSF): 61 Drinking Water System Components-Health Effects

4. National Association of Corrosion Engineers (NACE): Manual for Painter Safety

5. Occupational Safety and Health Act (OSHA)

6. Steel Structures Painting Council (SSPC)

a. QP1, Standard Procedure for Evaluating Qualifications of Painting Contractors

b. QP2, Standard Procedure for Evaluating the Qualifications of Painting Contractors to Remove Hazardous Paint

c. SP 1, Surface Preparation Specification No. 1, Solvent Cleaning

d. SP 2, Hand Tool Cleaning

e. SP 3, Power Tool Cleaning

f. SP 5, White Metal Blast Cleaning

g. SP 6, Commercial Blast Cleaning

h. SP 7, Brush-Off Blast Cleaning

i. SP 8, Pickling

j. SP 10, Near-White Blast Cleaning

k. SP 11, Power Tool Cleaning to Bare Metal

l. SP 12, High Pressure Water Jetting

m. SP 13, Surface Preparation of Concrete

n. SP 16, Brush off Blast Cleaning of Non-Ferrous Metals.

o. PA1, Best Practices for Paints and Coatings Application

p. PA2, Measurement of Dry Coating Thickness with Magnetic Gauges

q. PA17, Determining Conformance to Steel Profile/Surface Roughness

r. Guide No. 3, PA, Guide to Safety in Paint Applications

7. National Association of Pipe Fabricators (NAPF)

   a. 500-03-01, Solvent Cleaning

   b. 500-03-02, Hand Tool Cleaning

   c. 500-03-03, Power Tool Cleaning

   d. 500-03-04, Abrasive Blast Cleaning for Ductile Iron Pipe

   e. 500-03-05, Abrasive Blast Cleaning for Ductile Iron Fittings

8. International Concrete Repair Institute (ICRI)

   a. 310.2, Surface Preparation of Concrete

   b. CSP, Concrete Surface Profile

9. NACE International (NACE)

   a. SP-0178, Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service.

   b. SP-0188-06, Discontinuity (Holiday) Testing of Protective Coatings

10. ASTM International (ASTM)

    a. ASTM D 16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.

    b. ASTM D 3359 Standard Test Methods for Rating Adhesion by Tape Test

    c. ASTM D 3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

    d. ASTM D 4258, Standard Practice for Surface Cleaning Concrete for Coating.

    e. ASTM D 4259, Standard Practice for Abrading Concrete.

    f. ASTM D 4261, Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating.

    g. ASTM D 4262, Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces.

    h. ASTM D 4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

i. ASTM D 4418, Standard Practice for Measurement of Wet Film Thickness by Notch Gages.

j. ASTM D 4417, Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel.

k. ASTM D 4541, Standard Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers.

l. ASTM D 4787, Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates.

m. ASTM D 7091, Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals.

n. ASTM D 7234 Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.

o. ASTM E 337, Standard Test Method for Measuring Humidity with a Psychrometer (the Measurement of Wet- and Dry-Bulb Temperatures).

p. ASTM F 1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

q. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-situ Probes.

1.5 SUBMITTALS

A. Shop Drawings

1. Data Sheets, including catalog cuts and color charts.

a. Material Safety Data Sheets (MSDS), the manufacturer’s Technical Data Sheets, and paint colors available (where applicable) for each product used in the paint system.

b. Submit required information on a system-by-system basis.

i. Schedule of proposed coating materials.

ii. Schedule of surfaces to be coated with each coating material.

c. Furnish copies of paint system submittals to the coating applicator.

d. Indiscriminate submittal of manufacturer’s literature only is not acceptable.

e. Thick film coating systems (greater than 25 mils):

i. CSM's detailed written instructions for coating system treatment and graphic

details for coating system terminations in coated structures, including pipe penetrations, metal embedments, gate frames, and other terminations encountered.

ii. Include detail treatment for coating system at concrete joints.

iii. Manufacturer's Representative's (CTR) Field Reports.

2. Detailed chemical and gradation analysis for each proposed abrasive material.

3. System Application Process (for each coating system):

a. Contractor shall indicate surface preparation, primer, stripe coat, finish coat, and quality control parameters as indicated in Section 3.7.

b. Submittal shall include a detailed pre-installation packet with on-site photographs of each edge and transition termination around pipes, gates, frames, edge of coating etc. Drawings on the photographs shall indicate the termination method to be used, in conformance with the coating system manufacturer's recommendations.

c. Submittals shall be approved by the coating manufacturer, the applicator and the General Contractor that is specific to each application system.

B. Quality Control Submittals

1. Applicator's Qualification: List of references substantiating experience.

2. Factory-Applied Coatings: Manufacturer's certification stating factory-applied coating system meets or exceeds requirements specified.

3. If the manufacturer of finish coating differs from that of shop primer, provide both manufacturers' written confirmations that materials are compatible.

4. Manufacturer's written instructions and special details for applying each type of paint.

5. Manufacturer's written verification that submitted material is suitable for the intended use.

6. Qualifications of CSA, including:

a. List of Similar Projects.

b. Name and address of project.

c. Year of installation.

d. Year placed in operation.

e. Point of contact: Name and phone number.

f. Provide a minimum of 5 project references, each including contact name, address, and telephone number where similar coating work has been performed by their company in the past 5 years.

7. CSA Reports:

a. Written daily quality control inspection reports.

8. CTR Reports:

a. Reports on visits to project site to view and approve surface preparation of structures to be coated.

b. Reports on visits to project site to observe and approve coating application procedures.

C. Extended Warranty Certificates

D. Contract Closeout Submittals: Extended Warranty Certificate

1.6 QUALITY CONTROL

A. Qualifications of Applicator: Minimum 5 years' experience in application of specified products.

B. Contractor's Responsibilities

1. The Contractor shall perform first-line, in-process QC inspections and testing in accordance with the level of quality control specified for each coating system.

2. The Contractor shall use the "Daily Coating Inspection Report" found at the end of this specification to record the results of quality control inspections and tests. The completed reports shall be turned in to the Engineer before work resumes the following day.

3. The Contractor shall supply all necessary equipment to perform the QC tests. The instruments shall be calibrated by the Contractor's personnel according to the equipment manufacturer's recommendations and the Contractor's QC Program. All inspection equipment shall be made available to the Engineer for QA observations on an as-needed basis.

4. Equipment shall include the following at a minimum:

a. Recording thermometer.

b. Hygrometer.

c. Recording or comparable equipment for the recording of dew point and continuous recording of relative humidity.

d. Surface temperature thermometer.

e. Hypodermic Needle Pressure Gage for determining blasting pressure at the nozzle.

f. Visual Standard for abrasive blast cleaning.

g. Testex Press-O-Film Replica Tape and Spring Micrometer.

h. Wet Film Thickness Gage.

i. Blotter paper and plate glass for compressed air cleanliness checks.

j. Magnetic Dry Film Thickness Gage with calibration standards.

k. Holiday Detector: Non-destructive wet sponge-type detector. Operating test voltage shall be per NACE RO-02-74 or as recommended by the Coating Manufacturer's representative.

l. A non-sudsing-type wetting agent such as Kodak Photo-Flo, or equal, shall be added to the water prior to wetting the detector sponge.

C. CSA qualifications:

1. Minimum of 5 years of experience applying specified type or types of coatings under conditions similar to those of the Work:

a. Provide qualifications of applicator and references listing 5 similar projects completed in the past 5 years.

2. SSPC QP 1 certified.

3. Manufacturer-approved applicator when manufacturer has approved applicator program or when required in these specifications.

D. CTR qualifications:

1. Certification, one of the following:

a. NACE Level 2 or 3 Certified Coating Inspector.

b. SSPC Level 3 Protective Coatings Inspector.

2. Minimum of 5 years of experience applying manufacturer's coatings under conditions similar to those of the Work:

a. Provide qualifications of applicator and references listing 5 similar projects completed in the past 5 years.

E. Pre-installation conference: Contractor to conduct coatings conference..

1. Coordinate Hold Point schedule

F. CSM services:

1. CSA shall arrange for CTR to attend pre-installation conference.

2. Visit the project site periodically to consult on and inspect specified surface preparation and application Hold Points.

3. CTR shall provide written inspection reports.

G. Conduct and continually inspect work so the coating system is installed as specified. The CSM shall provide written directions to correct coating work not conforming to the specifications or is otherwise unacceptable.

H. Provide written daily reports summarizing test data, work progress, surfaces covered, ambient conditions, quality control inspection test findings, and other information pertinent to the coating system application.

1. Confirm that compressed air used for surface preparation or blow-down cleaning is free of oil and moisture.

2. Monitor surface preparation daily at shift's beginning and end and at intervals not to exceed 4 hours during the shift.

3. Do not apply coatings when environmental conditions are outside of the CSM's published limits.

I. Quality Assurance (QA) Observations by Engineer

1. The Engineer will conduct QA observations of any or all phases of the work. The presence or activity of Engineer observations in no way relieves the Contractor of the responsibility to provide all necessary daily QC inspections of his/her own and to comply with all requirements of this Specification.

2. Hold Points: Work that requires a specific inspection upon completion is designated as a Hold Point. The Contractor shall provide the Engineer with a minimum one-day notification before a Hold Point inspection will be reached. Permission to proceed beyond a Hold Point without a QA inspection will be granted solely at the discretion of the Engineer, and only on a case-by-case basis.

3. The Engineer has the right to reject any work that was performed without adequate provision for QA observations.

4. The Engineer will issue a Non-Conformance Report when work is found to be in violation of the specification requirements and is not corrected to bring it into compliance before proceeding with the next phase of work.

5. Inspection Access and Lighting

a. The Contractor shall facilitate the Engineer's observations as required, including allowing ample time to view the work. The Contractor shall furnish, erect, and move scaffolding or other mechanical equipment to permit close observation of all surfaces to be cleaned and painted. This equipment shall be provided during all phases of the work.

b. When the surface to be inspected is more than 1.8 m (6 ft) above the ground or water surface, the Contractor shall provide the Engineer with a safety harness and a lifeline according to OSHA regulations.

c. The Contractor shall provide artificial lighting in areas where natural light is inadequate, as determined by the Engineer, to allow proper cleaning, inspection, and painting. Illumination for inspection shall be at least 325 LUX (30-foot candles). Illumination for cleaning and painting, including the working platforms, access, and entryways shall be at least 215 LUX (20-foot candles).

J. Inspection at Hold Points:

1. Conduct inspections at Hold Points during the coating system application and record the results.

2. Coordinate Hold Points with the Engineer so the Engineer can observe Contractor's inspections on a scheduled basis.

3. Provide the Engineer a minimum of [24] hours of notice before conducting Hold Point Inspections.

4. Hold Points shall be as follows:

a. Conditions before surface preparation: Before starting surface preparation, observe, record, and confirm that oil, grease, and/or soluble salts are gone from the surface.

b. Post surface preparation: After completing surface preparation, measure and inspect for cleanliness and proper surface profile as specified in this Section and in the CSM's written instructions.

c. Coatings application: At the beginning of any coating system application, measure, record, and confirm acceptability of surface and ambient air temperature and humidity. Inspect applicator's equipment for serviceability and suitability for coatings application.

d. Post application inspection: Identify defects in application work on all surfaces, including pinholes, holidays, excessive runs or sags, inadequate or excessive film thickness, and other problems.

e. Follow-up corrective actions and final inspection: Measure and re-inspect corrective coating work performed to repair defects at prior Hold Points, and repeat until the surface condition is acceptable. Conduct final visual inspection with follow-up tests, such as holiday detection, adhesion tests, and DFT surveys.

1.7 SUBSTITUTIONS

A. Products of manufacturers other than those specified, and equal in type and quality to those specified, may be considered acceptable if said products are offered by the Contractor with satisfactory data on past performance, composition and directions for use. No request for substitution will be approved which decreases the film thickness specified and/or number of coats to be applied, or which offers a change from the generic type of paint and coating system specified.

1.8 DELIVERY, STORAGE AND HANDLING

A. All paint shall be delivered to the job site in the manufacturer's original, sealed and labeled containers and shall be subject to inspection and approval by the Engineer prior to use.

B. Shipping

1. Where pre-coated items are to be shipped to the site, protect coating from damage. Batten coated items to prevent abrasion.

2. Use non-metallic or padded slings and straps in handling.

C. Storage

1. Store products in a protected area that is heated or cooled to maintain temperatures within the range recommended by paint manufacturer.

2. Primed surfaces shall not be exposed to weather for more than two months before being topcoated, or less time if recommended by coating manufacturer.

1.9 SERVICES OF MANUFACTURER

A. For submerged and severe service coating systems, the Contractor shall require the paint manufacturer to furnish the following services:

1. The manufacturer's representative shall provide technical support to resolve field problems associated with the surface preparation requirements and application and curing of the manufacturer's products.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Provide tenting, dehumidification, heating, and other environmental controls necessary to meet the preparation, application, and curing requirements of the coatings used.

1.11 EXTENDED WARRANTIES

A. When specified, provide manufacturer's and contractor's extended warranty for materials and workmanship with Owner named as beneficiary, and shall commence at the time of Substantial Completion.

1.12 PROTECTION OF EXISTING PAINTED STRUCTURES

A. The painting on existing structures and equipment shall be protected. Any damage caused by the Contractor's operation shall be repaired or restored to a condition equal to or better than before it was damaged.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer used as the basis of design: Product names used herein refer to materials manufactured and/or supplied by Tnemec Co. and are used as the basis of quality for design and bidding.

1. Approved Manufacturers – Paint

    a. Tnemec

    b. Sherwin Williams

    c. Pre-approved equal.

B. All paint materials selected for each system for each type of surface shall be the product of a single manufacturer. The type of paint material to be used and the number of coats to be applied are listed in the coating systems specified below.

C. All paint materials and equipment shall be compatible in use. Finish coats shall be compatible with prime coats. Prime coats shall be compatible with the surface to be coated. All tools and equipment shall be compatible with the coating to be applied.

D. Coal tar epoxy and products containing coal tar pitch will not be allowed.

E. Special systems as specified for surface conditions by the manufacturer specified; substitution only upon affidavit of alternate manufacturer that product will meet conditions and label for surface use.

2.2 COLORS

A. Alternating coats shall be contrasting but complimentary to finish coating.

B. All colors and glosses shall be as selected by the Owner.

C. Colors and painting schemes shall match existing colors at project for similar surfaces.

2.3 ABRASIVE MATERIALS

A. Select abrasive type and size to produce a surface profile that meets coating manufacturer’s recommendations.

B. Abrasive blast cleaning shall be performed using either expendable abrasives (other than silica sand) or recyclable steel grit abrasives. Expendable abrasive shall be used one time and disposed of. Abrasive suppliers shall certify that the expendable abrasives meet the requirements of SSPC-AB1 and that recyclable steel grit abrasives meet AB3. The Contractor shall verify that recycled abrasives meet the requirements of SSPC-AB2 during use. All surfaces prepared with abrasives not meeting the SSPC-AB1, AB2, or AB3 requirements, as applicable, shall be solvent cleaned or low pressure water cleaned as directed by the Engineer, and re-blast cleaned at the Contractor's expense.

2.4 THINNERS, CLEANERS, DRIERS, AND OTHER ADDITIVES

A. As recommended by manufacturer of the particular coating.

2.5 VISUAL STANDARD

A. When specified and to facilitate inspection, Contractor shall, on the first day of sandblasting operations, sandblast metal plates to the surface preparation standards specified. Plates shall measure 8½ inches by 6 inches. Plates shall be approved by the Engineer. Plates shall be coated with a clear, non-yellowing finish. One of these plates shall be prepared for each type of sandblasting and shall be used as the comparison standard throughout the project.

PART 3 EXECUTION

3.1 SURFACE PREPARATION, GENERAL

A. Prior to all surface preparation and painting operations, completely mask, remove or otherwise adequately protect all hardware, accessories, machined surfaces, plates, lighting fixtures, equipment, and similar items in contact with painted surfaces but not scheduled to receive paint.

B. All surfaces to be painted shall be in the proper condition to receive the specified paint before said paint is applied. Surface preparation shall be done in a workmanlike manner with the objective of obtaining a clean and dry surface. No more surface preparation than can be coated in a normal working day shall be permitted. No coating shall be applied before the prepared surfaces are approved by the Engineer.

C. Schedule all cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly-painted surfaces.

D. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.

E. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process. For process piping, mask bolt threads to allow nuts to be removed for maintenance.

F. Mask openings in motors to prevent paint and other materials from entering the motors.

G. Protect all surfaces adjacent to or downward of work area from overspray. Contractor shall be responsible for any damage resulting from overspray.

3.2 SURFACE PREPARATION DESIGNATIONS

A. General:

1. The following designations for surface preparation shall be utilized in the coating systems specified. In no case shall the surface preparation be less than that specified by the Paint Manufacturer. In case of conflict, the more restrictive requirement shall apply.

2. Inspect and provide substrate surfaces prepared in accordance with these Specifications and the printed directions and recommendations of paint manufacturer whose product is to be applied. The more stringent requirements shall apply.

3. Position diesel- or gasoline-powered equipment in a manner to prevent deposition of combustion contaminants on any part of the structure.

4. Do not perform abrasive blast cleaning whenever relative humidity exceeds 85 percent or whenever surface temperature is less than 5° F above dew point of ambient air.

5. Schedule all cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly-painted surfaces.

6. No more surface preparation than can be coated in a normal working day shall be permitted.

7. No coating shall be applied before the prepared surfaces are approved by the Engineer.

B. Concrete and Masonry*:* All surfaces shall be cleaned of all dust, mortar splatter, curing compounds, grease and other foreign matter. Prepare concrete surfaces per SSPC-SP13, ICRI 310.2 with the appropriate concrete surface profile (CSP) as suggested by the coatings manufacturer. Surface preparation shall conform to the following table:

CONCRETE AND MASONRY SURFACE PREPARATION	
Designation	**Description**
CM-1	**Solvent Cleaning**: Solvent cleaning is a method for removing all visible oil, grease, soil, and other soluble contaminants. Low pressure (1500 – 4000 psi) high volume (3-5 gal/min) water washing with appropriate cleaning chemicals.
CM-2	**Acid Etch**: Clean and etch with 10% muriatic acid solution, scrub thoroughly, neutralize acid, rinse thoroughly, and allow to dry. If curing compound has been used on concrete, clean curing compound off with solenoid prior to acid etching.
CM-3	**Abrasive Blasting**

C. Metal: All surfaces shall be cleaned of all rust, scale, dust and other foreign matter. Sharp edges, burrs and weld spatter shall be removed. Surface preparation shall conform to the

following table and shall be in accordance with the Steel Structures Painting Council (SSPC). Ductile Iron Pipe surface preparation requirements are detailed elsewhere.

METAL SURFACE PREPARATION	
Designation	**Description**
SSPC-SP1	**Solvent Cleaning**: Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds and other soluble contaminants. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Low-pressure (1500 - 4000 psi) high volume (3 - 5 gal/min.) water washing with appropriate cleaning chemicals is a recognized "solvent cleaning" method. All surfaces should be cleaned per this specification prior to using hand tools or blast equipment.
SSPC-SP2	**Hand Tool Cleaning**: Hand Tool Cleaning removes all loose mill scale, loose rust and other detrimental foreign matter. It is not intended that this process remove adherent mill scale, rust and paint. Mil scale, rust and paint are considered adherent if they cannot be removed by lifting with a dull putty knife. Before hand-tool cleaning, remove visible oil, grease, soluble welding residues and salts by the methods outlined in SSPC-SP1.
SSPC-SP3	**Power Tool Cleaning**: Power Tool Cleaning removes all loose mill scale, loose rust and other detrimental foreign matter. It is not intended that this process remove adherent mill scale, rust and paint. Mil scale, rust and paint are considered adherent if they cannot be removed by lifting with a dull putty knife. Before power tool cleaning, remove visible oil, grease, soluble welding residues and salts by the methods outlined in SSPC-SP1.
SSPC-SP5	**White Metal Blast Cleaning**: A White Metal Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products and other foreign matter. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
SSPC-SP6	**Commercial Blast Cleaning**: A Commercial Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products and other foreign matter, except for staining. Staining shall be limited to no more than 33% of each square inch of surface area and may consist of light shadows, slight streaks or minor discoloration caused by stains of rust, stains of mill scale or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
SSPC-SP7	**Brush-Off Blast Cleaning**: A Brush-Off Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust and loose paint. Tightly adherent mill scale, rust and paint may remain on the surface. Mil scale, rust and coating are considered adherent if they cannot be removed by lifting with a dull putty knife after abrasive blast cleaning has been performed. Before blast cleaning, visible

METAL SURFACE PREPARATION	
Designation	**Description**
	deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
SSPC-SP10	**Near-White Blast Cleaning**: A Near-White Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products and other foreign matter, except for staining. Staining shall be limited to no more than 5 percent of each square inch of surface area and may consist of light shadows, slight streaks or minor discoloration caused by stains of rust, stains of mill scale or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods.
SSPC-SP11	**Power Tool Cleaning to Bare Metal**: Metallic surfaces that are prepared according to this specification, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxide corrosion products and other foreign matter. Slight residues of rust and paint may be left in the lower portions of pits if the original surface is pitted. Prior to power tool surface preparation, remove visible deposits of oil or grease by any of the methods specified in SSPC-SP1, Solvent Cleaning, or other agreed upon methods.
SSPC-SP13	Surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems. An acceptable prepared concrete surface should be free of contaminants, laitance, loosely adhering concrete, and dust, and should provide a sound, uniform substrate suitable for the application of protective coating or lining systems.
SSPC-SP16	**Brush-Off Blast Cleaning of Non-Ferrous Metals** SP 16 is intended for brush-off blast cleaning of coated or uncoated metal surfaces other than carbon steel prior to the application of a protective coating system. Surface preparation using this standard is intended to roughen and clean coated and uncoated non-ferrous metal substrates, including, but not limited to, galvanized surfaces, stainless steel, copper, aluminum, and brass. SP 16 requires the cleaned surface to be free of loose contaminants and loose coating as determined by visual inspection. A minimum surface profile of 19 micrometers (0.75 mil) on the bare metal surface is required. Intact coatings are required to be roughened to the degree specified in the project specification.

D. Wood: Wood surfaces shall be thoroughly cleaned and free of all foreign matter. Surface preparation shall conform to the following table:

WOOD SURFACE PREPARATION	
Designation	**Description**
W-1	Clean with mineral spirits, scraping or wire-brushing. Properly fill cracks, nail holes and other defects. Wipe clean of dust.

E. PVC Pipe: PVC pipe shall be clean and dry. Surface preparation shall conform to the following table:

PVC PIPE SURFACE PREPARATION	
Designation	**Description**
P-1	Sand lightly and wipe clean with xylol or toluol solvent. Allow to dry completely.

F. Ductile Iron Pipe and Fittings: Prepare per NAPF 500-03.

1. Per 500-03-01:

    a. Solvent cleansing is a method which shall result in the surface being free of all oil, small deposits of asphalt paint, grease, soil, drawing and cutting compounds and other soluble contaminants from iron surfaces. It is intended that solvent cleaning, when necessary, be used prior to the application of special coating/lining and in conjunction with surface preparation methods specified for the removal of rust, annealing oxide, or mold coating.

2. Per 500-03-02:

    a. Hand tool cleaning is a method of preparing iron surfaces by the use of non-power hand tools which shall result in the surface being free of all loose annealing oxide, loose rust, loose mold coating and other loose detrimental foreign matter. It is not intended that adherent annealing oxide, mold coating and rust be removed by this process. Annealing oxide, mold coating, and rust are considered adherent if they cannot be removed by lifting with a dull putty knife. All asphalt paint must be removed prior to hand tool cleaning.

3. Per 500-03-03:

    a. Power tool cleaning is a method of preparing iron surfaces by the use of power assisted hand tools which shall result in the surface being free of all loose annealing oxide, loose rust, loose mold coating and other loose detrimental foreign matter. It is not intended that adherent annealing oxide, mold coating and rust be removed by this process. Annealing oxide, mold coating, and rust are considered adherent if they cannot be removed by lifting with a dull putty knife. All asphalt paint must be removed prior to power tool cleaning.

4. Per 500-03-04:

    a. Abrasive Blast Cleaning – **External** Pipe Surfaces is a method of preparing the exterior of ductile iron pipe surfaces which, when viewed without magnification, shall result in the surface being free of all visible dirt, dust, loose annealing oxide, loose rust, loose mold coating and other foreign matter. All oils, small deposits of

asphalt paint and grease shall have been removed by solvent cleaning (see NAPF 500-03-01). After the entire surface to be coated is struck by the blast media, tightly adherent annealing oxide, mold coating and rust staining may remain on the surface provided they cannot be removed by lifting with a dull putty knife.

b. Abrasive Blast Cleaning - **Internal** Pipe Surfaces is a method of preparing the interior of ductile iron pipe surfaces which, when viewed without magnification, shall result in the surface being free of all visible dirt, dust, loose annealing oxide, loose rust, loose mold coating and other foreign matter. Internal pipe surface preparation requirements shall be specified by the pipe manufacturer or pipe fabricator as well as the lining manufacturer and shall be based upon testing of a specific lining applied to ductile iron pipe exposed to a specific environment.

5. Per 500-03-05:

a. Abrasive Blast Cleaning - Cast Ductile Iron Fittings. Internal and External Surfaces is a method of repairing the interior and exterior of cast ductile iron fittings surfaces which, when viewed without magnification, shall result in the surface being free of all visible dirt, dust, loose annealing oxide, loose rust, loose mold coating and other foreign matter. All oils, small deposits of asphalt paint and grease shall have been removed by solvent cleaning (see NAPF 500-03-01). Four degrees of abrasive blast cleaning for fittings are available, depending on the type of service for which the fitting is intended and upon the type of coating/lining specified.

3.3 APPLICATION

A. General

1. The application of all coatings shall be in strict accordance with the Manufacturer's Instructions and shall be performed in a manner satisfactory to the Engineer. Painting shall be done at such times as the Contractor and Engineer may agree upon in order that dust-free and neat work be obtained.

2. On metal surfaces, each coat shall be applied at the rate specified by the Manufacturer to achieve the dry mil thickness specified herein. If material has thickened or must be diluted for application by spray gun, the coating shall be built up to the same film thickness achieved with undiluted material. Deficiencies in film thickness shall be corrected by the application of additional coats of paint.

3. On masonry or wood, application rates will vary according to surface texture; however, in no case shall the Manufacturer's stated coverage rate be exceeded. On porous surfaces, it shall be the Contractor's responsibility to achieve a protective and decorative finish, either by decreasing the coverage rate or by applying additional coats of paint.

4. Additional coats of paint shall not be applied until the preceding coat has dried as evidenced by tests with a moisture meter. Drying time shall be construed to mean an interval under normal conditions and shall be increased to allow for adverse weather or

drying conditions.

5. Thinning, when required, shall be done in strict accordance with the Manufacturer's recommendations using the Manufacturer's thinner, or that recommended by the Manufacturer, with knowledge and approval of the Engineer.

6. Use skilled craftsmen and experienced supervision.

7. Apply coating to produce an even film of uniform thickness. Give special attention to edges, corners, crevices, and joints. Ensure thorough cleaning and an adequate thickness of coating material. Apply coatings to produce finished surfaces free from runs, drips, ridges, waves, laps, brush marks, and variations in color, texture, and finish. Effect complete hiding so that the addition of another coat would not increase the hiding. Give special attention to ensure that edges, corners, crevices, welds, and similar areas receive a film thickness equivalent to adjacent areas. Apply a brushed stripe coat to all edges and welds after priming submerged or severe service areas.

8. Coordinate cleaning and coating so that dust and other contaminants from the cleaning process will not fall on wet, newly-coated surfaces.

9. Prime surfaces within 12 hours after they are blasted. Re-blast surfaces that have started to rust before they are painted.

10. No paint shall be applied in fog, snow, rain, or to wet or damp surfaces or when air temperatures are below 40° F.

11. Surface temperature shall be at least 5° F above the dew point during final surface preparation and painting.

12. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.

13. Coat units or surfaces to be bolted together or joined closely to structures or to one another prior to assembly or installation.

14. On pipelines, terminate coatings along pipe runs to 1 inch inside pipe penetrations.

15. Keep paint materials sealed when not in use.

16. Where more than one coat of a material is applied within a given system, alternate color to provide a visual reference that the required number of coats have been applied.

17. The Contractor shall be responsible for ensuring that the shop prime coating is compatible with the finish coating. Materials and application as specified herein shall govern regardless of whether coatings are factory-applied or field-applied. After installation, any damaged areas in prime or finish coatings shall be repaired as directed by the Engineer.

B. Stripe Coating

1. Stripe coat all field welds, edges, angles, fasteners, and other irregular surfaces.

2. Stripe coat shall consist of one coat, brush applied, to the coating thickness specified.

3. Apply stripe coat between primer and intermediate coats.

4. Stripe coat color shall contract with prime coat to allow visual verification of application.

3.4 FACTORY-APPLIED COATINGS AND TOUCH-UP

A. Except where factory or shop application of finish coatings is permitted elsewhere in these Specifications, or by the Engineer in writing, all items shall be finish-painted after installation with the color selected or approved by the Engineer. Shop priming shall be permitted in all cases. The Contractor shall be responsible for insuring that the shop prime coating is compatible with the finish coating. Materials and application as specified herein shall govern regardless of whether coatings are factory-applied or field-applied. After installation, any damaged areas in prime or finish coatings shall be repaired as directed by the Engineer.

3.5 INSPECTION

A. Do not apply additional coats until completed coat has been inspected and approved by the Engineer. Only inspected and approved coats of paint shall be considered in determining the number of coats applied.

3.6 CLEANUP

A. Prevent accidental spilling of paint materials and, in the event of such a spill, immediately remove all spilled material and the waste or other equipment used to clean up the spill, and wash the surfaces to their original, undamaged condition.

B. Upon completion of painting, visually inspect all surfaces and remove all paint and traces of paint from surfaces not specified to be painted.

3.7 QUALITY CONTROL TESTING

A. Owner-provided inspection or inspection by others does not limit the Contractor's or CSA's responsibilities for quality workmanship or quality control as specified or as required by the CSM's instructions. Owner inspection is in addition to any inspection required of the Contractor.

B. Contractor shall perform and document quality control testing as specified for each coating system.

1. Level 1 – Minimum required QC test requirements for all painting and coating:

a. Weather conditions – every 4 hours

b. Ambient temperatures – every 4 hours

c. Surface temperature – every 4 hours

d. Wet film thickness – every ½ hour

e. Verify DFT of each coat and total DFT of each coating system are as specified using wet film and dry film gauges. DFT's shall be measured in accordance with SSPC-PA2.

2. Level 2 – Testing requirements in addition to Level 1 requirements:

a. Continuous ambient temperature (recording thermometer)

b. Relative humidity – every 4 hours

c. Dew point – every 4 hours

d. Compressed air cleanliness – prior to using compressed air for abrasive blast cleaning, blowing down the surfaces, and painting with conventional spray, the Contractor shall verify that the compressed air is free of moisture and oil contamination according to the requirements of ASTM D4285. The tests shall be conducted at least one time each shirt for each compressor system in operation. If air contamination is evident, the Contractor shall change filters, clean traps, add moisture separators or filters, or make other adjustments as necessary to achieve clean, dry air. The Contractor shall also examine the work performed since the last acceptable test for evidence of defects or contamination caused by the compressed air. Affected work shall be repaired at the Contractor's expense.

e. Blast pressure at nozzle – every 4 hours

f. Visual standard for abrasive blast cleaning

g. Surface profile – every 4 hours

h. Surface pH of concrete surfaces

i. Dry film thickness with magnetic dry film thickness gauge

j. Contractor shall perform holiday testing in accordance with NACE SP0188 to identify holidays or pinholes needing repair for coating over 100 percent of surfaces:

i. Coated steel that will be immersed or exposed to aggressively corrosive conditions.

ii. Coated concrete.

iii. Perform holiday tests after proper application and coating system cure.

iv. Where specifically noted, Contractor shall perform adhesion testing per ASTM D4541 – 17. Pass/fail test pressure, curing conditions required prior to testing, and test location(s) shall be per the coating system manufacturer.

C. Where specifically noted, contractor to perform adhesion testing per ASTM D 3359-17. Curing conditions required prior to testing hall be per coating system manufacturer. Engineer shall witness adhesion testing and contractor shall submit testing report. For Test Method A-X – cut Tape Test of ASTM D 3359-17, only tests resulting in a SA rating are acceptable, and considered as passing. For Test Method B – Cross-cut Tape Test of ASTM D 3359-17, only tests resulting in a 5B rating are acceptable, and considered as passing.

3.8 FINAL INSPECTION

A. Conduct final inspection of coating system work to determine whether it meets specifications requirements.

B. Conduct subsequent final inspection with Engineer to ensure work conforms to contract documents requirements.

C. Mark any rework required.

1. Re-clean and repair, as specified, at no additional cost to the Owner.

3.9 PIPING COLOR CODE AND IDENTIFICATION

A. General:

1. Unless required otherwise by the Engineer, all exposed process and building piping and accessories shall be identified and painted as specified herein and in conformance with this specification.

2. The following piping materials need not be painted with the basic identification color except for colored bands.

   a. Stainless steel

   b. chrome-plated piping

   c. Interior PE/HDPE Piping

   d. Interior PVC/CPVC Piping

3. Where piping is to be identified with colored bands, a three-band system shall be used. The background color, as identified on the pipe schedule, shall appear in the left and right-most bands, with the secondary color located in the center.

4. PVC Piping that extends to the exterior of buildings/structures (i.e., exposed to UV/sunlight) shall be painted completely. Submit to coordinate color with process identification and architectural elements.

5. The entire exposed surface of all other piping and accessories shall be painted according to the color codes indicated in the pipe schedule.

B. Identification Labels:

1. Identify all exposed piping and all piping on each side of each valve; on each side of a branch; on both sides and adjacent to each wall and floor penetrations and not more than 15 feet on center.

2. All chemical piping shall be identified a minimum of two (2) times in each interior room.

3. Identification Tag Requirements:

   a. Name of service as shown on Plans

   b. Flow direction arrows

   c. Position identification so that it is readily visible from eye level.

   d. Block letters on adhesive labels on the finished insulation or pipe with flat black or white enamel contrasting the background pipe color. Label/Text size shall be as noted below. In some instances, as an alternative to painting of identification, an adhesive decal pipe identification system may be approved upon review by the Engineer. Contractor shall submit product information for review by Owner and Engineer as an alternative to painted identification.

SIZE OF LETTERS / ARROWS	
Outside Diameter of Pipe or Covering	**Height of Adhesive Letter**
¾" to 1¼"	½"
1½" to 2"	¾"
2½" to 6"	1¼"
8" to 10"	2½"
Over 10"	3½"

3.10 COATING SYSTEMS

A. Architectural Finishes Including:

1. Gypsum Wall Board

2. Siding and Trim (interior and exterior)

3. Concrete Masonry Units - CMU (interior and exterior)

4. Exterior and Interior Metal Doors, Frames and Vision Lite Frames

5. Exterior Overhead Entry Canopies and Sun Shades

6. For other architectural finishes, reference Section 09 91 00 Architectural Painting.

    a. Where conflicts occur, contractor to adhere to more stringent specifications.

B. **General:** Surface preparation, prime coatings and finish coatings for the various surfaces and items to be painted are specified below. Prime coatings shall be contrasting but complimentary to finish coat.

C. Table 1: Coating System Application Area Descriptions

1. Description: Coating System Application Area Descriptions, includes general descriptions of a systems and a corresponding letter (for example: “A”) to be the designator throughout the rest of the document. Table 2: Applicable Manufacturer Products, includes approved manufacturers and materials for each system. The following pages each correspond to a single system (for example: “A”) and include some details that are necessary for installation. There is also a section labelled Notes at the bottom of each page. These notes can include requirements and reviews of how the systems have performed.

Table 1: Coating System Application Area Descriptions

COATING SYSTEM APPLICATION AREA DESCRIPTIONS	
System A-1	**Exterior Metal and Piping, Non-Submerged (unless specified elsewhere)** Includes, but not limited to, machinery, structural steel beams, columns, bracing, open web steel bar joists, and ancillary structural elements, pumps, pipe hangers, ductile iron pipe, cast iron pipe, galvanized steel pipe, copper pipe, fabrications, PVC pipe, and electrical conduit; *excludes others specifically noted or specified elsewhere.* "Non-submerged" is defined as those items located one (1) foot or more above the maximum water level.
System B-1	**Interior Metal and Piping (unless specified elsewhere)** Includes, but not limited to, machinery, pumps, pipe hangers, ductile iron pipe, cast iron pipe, galvanized steel pipe, steel pipe, copper pipe, fabrications, PVC pipe, and electrical conduit; *excludes others specifically noted or specified elsewhere.*
System B-2	**Interior Structural Components (unless specified elsewhere)** Includes, but not limited to, structural steel beams, columns, bracing, open web steel bar joists, and ancillary structural elements; *excludes others specifically noted or specified elsewhere. SEE NOTES 1, 2 and 3 in System B-2*
System C-1	**Submerged and Intermittently Submerged Metal (unless specified elsewhere)** "Submerged" is defined as all items below one (1) foot above the maximum water level, including submerged elements. Also includes all metal surfaces, structural steel, and metal fabrications in proximity noted above.
System D-1	**Metal, Concrete Encased (unless specified elsewhere)** All metal surfaces, encased in concrete, such as pipes, wall pipes, thimbles, pipe sleeves, gate guides. Excludes reinforcing steel, stainless steel, and galvanized metals.
System D-2	**Aluminum in Contact with Concrete (unless specified elsewhere)**
System E-1	**Epoxy coated floors, walls and sumps (as called-out on the drawings)**
System E-2	**Reinforced Epoxy coated floors, interior walls and ceilings of process tanks and secondary containment (as called-out on the drawings)** **Provide sand-grit floors in secondary chemical containment areas and equipment/pump areas**
System E-3	**Epoxy coated floors, interior walls and secondary containment (as called-out on the drawings)** **Provide sand-grit floors in secondary chemical containment areas and equipment/pump areas**
System F-1	**Concrete process tank interior floor and walls and sumps (unless specified elsewhere)**
System G-1	**Dry fall for interior ceilings**

D. Table 2: Applicable Manufacturer Products

Table 2: Applicable Manufacturer Products

System Designation	Manufacturer	Filler	Primer Coat(s)	Stripe Coat(s)	Intermediate Coat(s)	Finish Coat(s)
A-1	Sherwin-Williams	N/A	Corothane I Mio-Zinc	Macropoxy 5500LT	Macropoxy 5500LT	Acrolon Ultra
	Tnemec	N/A	Series 1 Omnithane	Series 66	N/A	Series 73
B-1	Sherwin-Williams	N/A	Corothane I Mio-Zinc	Macropoxy 5500LT	Macropoxy 5500LT	Macropoxy 5500LT
	Tnemec	N/A	Series 1 Omnithane	Series 66	N/A	Series 66
B-2	Sherwin-Williams	N/A	Shercryl 1300	Shercryl HPA	N/A	Shercryl HPA
	Tnemec	N/A	115 Unibond	Series 1029	N/A	Series 1029
C-1	Sherwin-Williams	N/A	N/A	Macropoxy 5500LT	Sher-Glass FF	Sher-Glass FF
	Tnemec	N/A	Series 1 Omnithane	Series 66	N/A	Series 69
D-1	Sherwin-Williams	N/A	Macropoxy 5500LT	N/A	N/A	Macropoxy 5500LT
	Tnemec	N/A	N/A	N/A	N/A	Series 69
D-2	Sherwin-Williams	N/A	Macropoxy 5500LT	N/A	N/A	Macropoxy 5500LT
	Tnemec	N/A	Series 66	N/A	N/A	Series N69
E-1	Sherwin-Williams	Dura-Plate 2300	Macropoxy 5500LT	N/A	Macropoxy 5500LT	Macropoxy 5500LT
	Tnemec	Series 218	Series 1	N/A	N/A	Series N69
				Series 206 SubFlex EP		
E-2	Sherwin-Williams	N/A	Corobond 100	N/A	Dura-Plate UHS Clear Laminate	Dura-Plate UHS
	Tnemec	Series 218	Thinned	N/A	Intermediate	Series 22

System Designation	Manufacturer	Filler	Primer Coat(s)	Stripe Coat(s)	Intermediate Coat(s)	Finish Coat(s)
			Series N140F		Base Coat: Series 215 with Series 211-15 Mesh Saturant Coat: Thinned Series 22 Epoxoline	Epoxoline
E-3	Sherwin-Williams	Dura-Plate 2300	Corobond 100	N/A	Int. Coat: Dura-Plate 8200 (includes sand grit for horizontal surfaces) Grout Coat: Dura-Plate 8200	General Polymers 4638
	Tnemec	Series 218	Series 201 Epoxoprime	N/A	Int. Coat: Series 280 Tneme-Glaze (includes sand grit for horizontal surfaces) Grout Coat: 280 Tneme-Glaze	Series 290 CRU-Urethane
F-1	Sherwin-Williams	Dura-Plate 2300	Macropoxy 5500LT 2-3	N/A	N/A	Macropoxy 5500LT
	Tnemec	Series 218	N/A	N/A	N/A	Series 141
G-1	Sherwin-Williams	N/A	Spraylastic Waterborne		N/A	Spraylastic Waterborne
	Tnemec	N/A	115 Unibond	Series 1029	N/A	Series 1029

The following pages include the System Application Data Sheets and their corresponding details.

1. System: A-1

	TNEMEC	SHERWIN-WILLIAMS
Surface Preparation:	1. Bare Metal (Steel). SSPC-SP6 or as approved by the Engineer 2. Primed Metal (Ductile or Cast Iron). SSPC-SP1 and SSPC-SP7 (or SP3) 3. PVC per this specification	• Same as Tnemec
Generic Type Primer:	• Modified Aromatic Polyurethane	• Same as Tnemec
Generic Type Intermediate Coat:	• N/A	• N/A
Generic Type Finish:	• Acrylic Polyurethane	• Same as Tnemec
Generic Type Stripe Coat:	• Per Manufacturer recommendations	• Same as Tnemec
Generic Type Surface/Filler:	• N/A	• N/A
Primer Thickness:	• 3.0 to 4.0 MDFT	• N/A
Intermediate Coat Thickness:	• N/A	• 4.0 to 6.0 MDFT
Finish Coat Thickness:	• 2.0 to 5.0 MDFT	• 2.0 to 3.0 MDFT
Stripe Coat Thickness:	• Stripe coat shall be used as necessary to insure proper dry film thickness and a pin-hole free surface.	• Same as Tnemec
Surface/Filler Thickness:	• N/A	• N/A
Quality Control:	• Level 1 and 2	• Same as Tnemec
Extended Warranty:	• Three (3) Years. At the completion of the work, stencil the date on the structure/machine in 2-inch-high capital letters containing the following wording: “PAINTED (insert month and year in which painting was completed)”.	• Same as Tnemec

2. System: B-1

	TNEMEC	SHERWIN-WILLIAMS
Surface Preparation:	1. Bare Metal (Steel). SSPC-SP6 2. Primed Metal (Ductile or Cast Iron). SSPC-SP1 and SSPC-SP7 (or SP3) 3. Galvanized Metal. SSPC-SP1 and SSPC-SP3 4. PVC. P-1	• Same as Tnemec
Generic Type Primer:	• Modified Aromatic Polyurethane	• Same as Tnemec
Generic Type Intermediate Coat:	• N/A	• N/A
Generic Type Finish Coat:	• Polyamide epoxy	• Polyamidoamine
Generic Type Stripe Coat:	• Polyamide epoxy	• Polyamidoamine
Generic Type Surface/Filler:	• N/A	• N/A
Primer Thickness: **Intermediate Coat Thickness:**	• 3.0 to 4.0 MDFT • N/A	• • 3.0 to 4.0 MDFT
Finish Coat Thickness:	• 3.0 to 4.0 MDFT	• Same as Tnemec
Stripe Coat Thickness:	• 3.0 to 4.0 MDFT. Stripe coat shall be used as necessary to insure proper dry film thickness and a pin-hole free surface as necessary.	• Same as Tnemec
Surface/Filler Thickness:	• N/A	• N/A
Quality Control:	• Level 1 and 2	• Same as Tnemec
Extended Warranty:	• Three (3) Years. At the completion of the work, stencil the date on the structure/machine in 2-inch-high capital letters containing the following wording: “PAINTED (insert month and year in which painting was completed)”.	• Same as Tnemec

Notes:

1. All bituminous coated metals shall be sealed prior to the application of the prime coat to prevent bleeding. Sealer shall be compatible with other coatings.
2. Fabrications and elements that are not Factory Shop-Coated in conformance with this specification with Primer, Stripe and Finish Coats shall be prepared and field coated (or shop coated) per this specification prior to erection on-site. Following erection of structural steel elements, coatings shall be touched-up in the field to repair damaged areas per this specification.

3. System: B-2

	TNEMEC	SHERWIN-WILLIAMS
Surface Preparation:	1. Bare Metal: SSPC-SP6 2. Primed Metal SSPC-SP7	• Same as Tnemec
Generic Type Primer:	• Self-crosslinking Hydrophobic Acrylic	• Same as Tnemec
Generic Type Finish Coat:	• HDP Acrylic Polymer	• Same as Tnemec
Generic Type Stripe Coat:	• HDP Acrylic Polymer	• Same as Tnemec
Primer Thickness:	• 2 to 4 MDFT	• Same as Tnemec
Finish Coat Thickness:	• 2 to 4 MDFT	• Same as Tnemec
Stripe Coat Thickness:	• 2 to 4 MDFT Stripe coat shall be used to ensure proper coverage on all edges.	• Same as Tnemec
Quality Control:	• Level 1 and Level 2	• Same as Tnemec
Extended Warranty:	• Three (3) Years. At the completion of the work, stencil the date on the structure/machine in 2-inch-high capital letters containing the following wording: “PAINTED (insert month and year in which painting was completed)”.	• Same as Tnemec

Notes:

1. All bituminous coated metals shall be sealed prior to the application of the prime coat to prevent bleeding. Sealer shall be compatible with other coatings.
2. STRUCTURAL STEEL fabrications and elements that are not Factory Shop-Coated in conformance with this specification with Primer, Stripe and Finish Coats shall be prepared and field coated (or shop coated) per this specification prior to erection on-site. Following erection of structural steel elements, coatings shall be touched-up in the field to repair damaged areas per this specification.
3. Bar joist factory hold priming and dip priming shall not be considered in conformance with this specification and shall be removed and re-coated per these specifications on-site or at Contractors facility.

4. System: C-1

	TNEMEC	SHERWIN-WILLIAMS
Surface Preparation:	1. Bare Metal. SSPC-SP10 2. Primed Metal. SSPC-SP1 and SSPC-SP3, scarify the surface	• Same as Tnemec
Generic Type Primer:	• Modified Aromatic Polyurethane	• Same as Tnemec
Generic Type Finish Coat:	• Polyamidoamine Epoxy	• Polyamidoamine
Generic Type Stripe Coat:	• Polyamide Epoxy	• Same as Tnemec
Generic Type Surface/Filler:	• N/A	• N/A
Primer Thickness:	• 3.0 to 5.0 MDFT	• Same as Tnemec
Finish Coat Thickness:	• Two (2) coats, 8.0 to 10.0 MDFT/coat	• Same as Tnemec
Stripe Coat Thickness:	• Stripe coat shall be used as necessary to insure proper dry film thickness and a pin-hole free surface.	• Same as Tnemec
Surface/Filler Thickness:	• N/A	• N/A
Quality Control:	• Level 1 and 2	• Same as Tnemec
Extended Warranty:	• Three (3) Years. At the completion of the work, stencil the date on the structure/machine in 2-inch-high capital letters containing the following wording: “PAINTED (insert month and year in which painting was completed)”.	• Same as Tnemec

5. System: D-1

	TNEMEC	SHERWIN-WILLIAMS
Surface Preparation:	• Bare Metal (Steel). SSPC-SP6	• Same as Tnemec
Generic Type Primer:	• N/A	• N/A
Generic Type Intermediate Coat:	• N/A	• N/A
Generic Type Finish Coat:	• Polyamidoamine Epoxy	• Same as Tnemec
Generic Type Stripe Coat:	• Polyamidoamine Epoxy	• Same as Tnemec
Generic Type Surface/Filler:	• N/A	• N/A
Primer Thickness:	• N/A	• N/A
Intermediate Coat Thickness:	• N/A	• N/A
Finish Coat Thickness:	• Two (2) coats, 8.0 to 10.0 MDFT/coat	• Same as Tnemec
Stripe Coat Thickness:	• Stripe coat shall be used as necessary to insure proper dry film thickness and a pin-hole free surface.	• Same as Tnemec
Surface/Filler Thickness:	• N/A	• N/A
Quality Control:	• Level 1 and 2	• Same as Tnemec
Extended Warranty:	• None	• Same as Tnemec

6. System: D-2

	TNEMEC	SHERWIN-WILLIAMS
Surface Preparation:	• SSPC-SP1 and SSPC-SP16 (Scarify, degloss and provide 1 mil profile)	• Same as Tnemec
Generic Type Primer:	• Polyamide Epoxy	• Polyamidoamine
Generic Type Intermediate Coat:	• N/A	• N/A
Generic Type Finish Coat:	• Polyamidoamine Epoxy	• Same as Tnemec
Generic Type Stripe Coat:	• Polyamide Epoxy	• Polyamidoamine
Generic Type Surface/Filler:	• N/A	• N/A
Primer Thickness:	• 3-5 MDFT	• Same as Tnemec
Intermediate Coat Thickness:	• N/A	• N/A
Finish Coat Thickness:	• 6 to 8 MDFT	• Same as Tnemec
Stripe Coat Thickness:	• Stripe coat shall be used to insure proper coverage on all sharp edges.	• Same as Tnemec
Surface/Filler Thickness:	• N/A	• N/A
Quality Control:	• Level 1	• Same as Tnemec
Extended Warranty:	• None	• Same as Tnemec

7. System: E-1

	TNEMEC	SHERWIN-WILLIAMS
Surface Preparation:	• CM-1, and additional prep as recommended by manufacturer	• Same as Tnemec
Generic Type Surface/Filler:	• Epoxy Modified Cementitious Mortar	• Same as Tnemec
Generic Type Primer:	• Modified Aromatic Polyurethane Primer	• Same as Tnemec
Generic Type Stripe Coat:	• Polyamidoamine epoxy	• Same as Tnemec
Generic Type Finish Coat:	• Polyamidoamine Epoxy	• Same as Tnemec
Primer Thickness:	• 2.5 to 3.5 MDFT	• Same as Tnemec
Intermediate Coat Thickness:	• N/A	• N/A
Surface/Filler Thickness:	• Fill bug holes, rock pockets, and pinholes, 1/16" to ¼" thickness per lift, maximum ½" thickness	• Same as Tnemec
Stripe Coat Thickness:	• A stripe coat shall be used as necessary to insure proper dry film thickness and a pin-hole free surface.	• Same as Tnemec
Finish Coat Thickness:	• Two (2) coats, 4.0 to 6.0 MDFT/coat	• Same as Tnemec
Quality Control:	• Level 1 and 2	• Same as Tnemec
Extended Warranty:	• None	• Same as Tnemec

Notes:

1. Apply to all concrete sump surfaces; walls, floor. Apply after completion of all grouting and proper concrete cure.
2. Reference manufacturer's application guide for termination details (edge of coating terminations). Upon full cure, the installed lining system shall be checked by high voltage spark detection in accordance with NACE RP0188-90 to verify a pinhole-free surface.

8. System: E-2

	TNEMEC	SHERWIN-WILLIAMS
Surface Preparation:	• Surface Preparation: Prepare in accordance with SSPC-13/NACE 6 and ICRI Technical Guidelines. Abrasive Blast, shot-blast or mechanically abrade concrete surfaces to provide a minimum ICRI-CSP 3 or greater surface profile.	• Same as Tnemec
Generic Type Surface/Filler:	• Epoxy Modified Cementitious Mortar	• Same as Tnemec
Generic Type Primer Coat:	• Polyamidoamine Epoxy	• Same as Tnemec
Generic Type Intermediate Basecoat:	• Modified Polyamine Epoxy	• Same as Tnemec
Saturant Coat:	• Modified Polyamine Epoxy	• Same as Tnemec
Generic Type Finish (top) Coat:	• Modified Polyamine Epoxy	• Same as Tnemec
Surface/Filler:	• Fill flush to plane all bug holes and surface voids as a result of the abrasive blasting process.	• Same as Tnemec
Primer Coat Thickness:	• To all horizontal and vertical surfaces, roller-apply a prime coat of Series N140F at a thickness of 3.0–4.0 mils DFT, thinned up to 10% with Tnemec No. 4 Thinner.	• To all horizontal and vertical surfaces, roller-apply a primer coat of Corobond 100 at a thickness of 3.0-4.0 mils DFT.
Intermediate Basecoat Thickness:	• To all horizontal (floors and ceilings) and vertical surfaces, trowel-apply, or spray transfer and trowel-finish full parge coat of Series 215 Surfacing Epoxy at a thickness of 60.0–80.0 mils DFT. • Embed Series 211-215, ¾ ounce fiberglass mat into basecoat while still wet, overlap edges 2 inches and smooth with ribbed roller to remove any voids or wrinkles.	• Apply Dura-plate UHS Clear Laminate to all surfaces at 40-50 mils DFT. For vertical surfaces, add ½ to 1 ½ lbs of fumed silica. 2.5-3.2 gallons of mixed material with 10.5 lbs of glass mat will cover approximately 100 sqft at 40-50 mils DFT.
Saturant Coat Thickness:	• Saturate top of fiberglass mat completely with Series 22 Epoxoline at 8.0–12.0 mils, thinned up to 5% with Tnemec No. 2	• Same as Tnemec

	Thinner, until glass attains a uniform, wet-out appearance. Do not over-saturate. Once cured, sand to remove any imperfections or raised fibers that protrude through film. Grind if necessary.	
Finish (top) Coat and Thickness:	• To all horizontal and vertical surfaces, roller-apply topcoat of Series 22 Epoxoline at 20.0–30.0 mils DFT.	• Apply a finish coat of Dura-Plate UHS at 18.0-22.0 mils DFT.
Quality Control:	• Level 1 and 2	• Same as Tnemec
Extended Warranty:	• None	• Same as Tnemec

Notes:

1. Reference manufacturer's application guide for termination details (edge of coating terminations).
2. Reference manufacturer's application guide for termination details (edge of coating terminations). Upon full cure, the installed lining system shall be checked by high voltage spark detection in accordance with NACE RP0188-90 to verify a pinhole-free surface.

9. System: E-3

	TNEMEC	SHERWIN-WILLIAMS
Surface Preparation:	• Surface Preparation: Prepare in accordance with SSPC-13/NACE 6 and ICRI Technical Guidelines. Abrasive Blast, shot- blast or mechanically abrade concrete surfaces to provide a minimum ICRI-CSP 3 or greater surface profile.	• Same as Tnemec
Generic Type Surface/Filler:	• Epoxy Modified Cementitious Mortar	• Same as Tnemec
Generic Type Primer Coat:	• Moisture tolerant epoxy primer	• Same as Tnemec
Generic Type Intermediate Coat:	• Modified Polyamine Epoxy	• Novolac Epoxy
Grout Coat:	• Modified Polyamine Epoxy	• Novolac Epoxy
Generic Type Finish (top) Coat:	• Aliphatic Polyester Polyurethane	• Same as Tnemec
Surface/Filter Thickness:	• Fill flush to plane all bug holes and surface voids as a result of the abrasive blasting process.	• Same as Tnemec
Primer Coat Thickness:	• 6 to 12 mils DFT; Coverage at 160 - 200 square feet per gallon	• Apply Corobond 100 at 3.0-4.0 mils DFT
Intermediate Coat Thickness:	• 6 to 10 mils DFT; Coverage at 160-200 square feet per gallon • For texture/tread on horizontal walking surfaces - randomly broadcast 30/50 mesh aggregate into the wet Intermediate Coat to refusal	• Apply Dura-Plate 8200 at 15-20 mils DFT. For texture, broadcast to refusal with 20-40 mesh dry washed silica
Grout Coat Thickness:	• 8 to 10 mils DFT	• Apply Dura-Plate 8200 at 15-20 mils DFT.
Finish (top) Coat and Thickness:	• 2 to 3 mils DFT; Coverage at 390-425 square feet per gallon • The finished appearance and texture will depend on the film thickness and number of coats applied. 4'x 4' Mock-ups shall be applied to determine the desired finish appearance and texture.	• Apply finish coat of General Polymers 4638 at 3.0-4.0 mils.

Quality Control:	• Level 1 and 2	• Same as Tnemec
Extended Warranty:	• None	• Same as Tnemec

Notes:

1. Reference manufacturer's application guide for termination details (edge of coating terminations).
2. Reference manufacturer's application guide for termination details (edge of coating terminations). Upon full cure, the installed lining system shall be checked by high voltage spark detection in accordance with NACE RP0188-90 to verify a pinhole-free surface.

10. System: F-1

	TNEMEC	SHERWIN WILLIAMS
Surface Preparation:	• SSPC SP 13 to meet ICRI CSP5 surface profile all surfaces to be coated. Surface shall be clean, dry, and free of contaminants. CM-3 minimum.	• SSPC SP 13 to meet ICRI CSP2-3 surface profile all surfaces to be coated. Surface shall be clean, dry, and free of contaminants. CM-3 minimum.
Generic Type Primer:	• Modified Polyamine Epoxy	• Polyamidoamine
Generic Type Intermediate Coat:	• N/A	• N/A
Generic Type Finish Coat:	• Modified Polyamine Epoxy	• Polyamidoamine
Generic Type Stripe Coat:	• Modified Polyamine Epoxy	• Same as Tnemec
Generic Type Surface/Filler:	• Epoxy Modified Cementitious Mortar	• Same as Tnemec
Primer Thickness:	• N/A	• 2.0 to 3.0 mils DFT
Intermediate Coat Thickness:	• N/A	• N/A
Finish Coat Thickness:	• 14 to 16 MDFT in one-coat application	• 12 to 14 mils DFT
Stripe Coat Thickness:	• Per Manufacturer Recommendations.	• Same as Tnemec
Surface/Filler Thickness:	• 1/32" minimum thickness. Fill surface voids flush to plane to ensure finish is monolithic and pinhole free.	• Same as Tnemec
Quality Control:	• Level 1 and 2 and as specified below	• Same as Tnemec
Extended Warranty:	• Three (3) Years. At the completion of the work, stencil the date on the structure/machine in 2-inch-high capital letters containing the following wording: “PAINTED (insert month and year in which painting was completed)”.	• Same as Tnemec

Notes:

1. Coating system shall be applied only by coating-system certified contractor. Applicator must be trained and certified as an installer by the manufacturer of the product which they are applying.
2. Alternative coating systems submitted for substitution approval for this system shall be reviewed for approval by the Engineer.
3. Reference manufacturer's application guide for termination details (edge of coating terminations). Upon full cure, the installed lining system shall be checked by high voltage spark detection in accordance with NACE RP0188-90 to verify a pinhole-free surface.

11. System: G-1

	TNEMEC	SHERWIN-WILLIAMS
Surface Preparation:	1. Bare Metal: SSPC-SP6 2. Primed Metal SSPC-SP7 3. Galvanized Metal Composite Deck: SSPC-SP1 and SSPC-SP3. Clean galvanized metal deck with Clean n' Etch (Mfr. Great Lakes Laboratories) per manufacturers recommendations for passivated galvanized surfaces.	• Same as Tnemec
Generic Type Primer:	• Self-crosslinking Hydrophobic Acrylic	• Same as Tnemec
Generic Type Finish Coat:	• HDP Acrylic Polymer	• Same as Tnemec
Generic Type Stripe Coat:	• HDP Acrylic Polymer	• Same as Tnemec
Primer Thickness:	• 2 to 4 MDFT	• Same as Tnemec
Finish Coat Thickness:	• 2 to 4 MDFT	• Same as Tnemec
Stripe Coat Thickness:	• As required.	• Same as Tnemec
Quality Control:	• Level 1 and Level 2	• Same as Tnemec
Extended Warranty:	• Three (3) Years. At the completion of the work, stencil the date on the structure/machine in 2-inch-high capital letters containing the following wording: "PAINTED (insert month and year in which painting was completed)".	• Same as Tnemec

Notes:

1. Specifications for Open Web Steel Bar-Joists and structural steel are specified elsewhere.

END OF SECTION

Paint Inspection:

Daily Coating Inspection Report

Project/Client:
Location:
Description:
Requirements:
Contractor:

Date: / / M T W Th F S Su
Project #:
Inspector:
Spec #

Pg. Of
COPY To:
☐ QC Mgr ☐ Owner
☐ Contr ☐ _____
Attachments:
☐ DFT Sheet ☐ NCR/CAR
☐ _____
Revision #

Description of Areas & Work Performed

Hold Point Inspections Performed

- ☐ 1 Pre Surface Pep/Condition & Cleanliness
- ☐ 2 Surface Preparation Monitoring
- ☐ 3 Post Surface Preparation/Cleanliness & Profile
- ☐ 4 Pre Application Prep/Surface Cleanliness
- ☐ 5 Application Monitoring/Wet Film Thickness (WFT)
- ☐ 6 Post Application/Application Defects
- ☐ 7 Post Cure/Dry Film Thickness (DFT)
- ☐ 8 Nonconformance/Corrective Actions Follow-up
- ☐ 9 Final Inspection

Approved By: _____

Surface Conditions

☐ New ☐ Maint ☐ Primer/Paint ☐ Age/Dry/Cure_____
☐ Steel ☐ Galvanize ☐ Concrete ☐ Other_____
☐ Hazard _____ ☐ Sample Report # _____
☐ Degree of contamination: _____
Test: ☐ Cl_____ µg/cm² / ppm ☐ Fe ____ppm ☐ pH _____
☐ Degree of Corrosion: _____
☐ Scale ☐ Pitting/Holes ☐ Crevices ☐ Sharp Edges
☐ Weld _____ ☐ Moisture ☐ Oils ☐ Other_____
☐ Painted Surface Condition: _____
Dry to: ☐ Touch ☐ Handle ☐ Recoat
☐ Dry/Over Spray ☐ Runs/Sags ☐ Pinholes ☐ Holidays
☐ Abrasion ☐ Fall Out ☐ Other _____

Surface Preparation

Start Time: Finish Time: Est Sq/ft:
☐ Solvent Clean ☐ Hand Tool ☐ Power Tool
☐ HP Wash PSI_____ ☐ Other _____
☐ Abrasive Blast ☐ Abrasive Type _____ ☐ Sample
☐ Blast Hose Size _____ ☐ Nozzle Size / PSI _____
☐ Air Supply CFM _____ ☐ Air Supply Cleanliness
☐ Water/Oil Trap Check ☐ Equipment Condition Check

Surface Cleanliness & Profile Measurement

☐ Job Specification ☐ SSPC/NACE - SP- _____
☐ SSPC/NACE Spec / Visual Stds ☐ _____
Profile Check: _____ ☐ Disc ☐ Tape ☐ Gauge
☐ Specified_____mils avg. / Achieved _____mils
☐ Surface effect on DFT Gauge/BMR_____mils

Dry Film Thickness

Gage Type / Model	Gage Serial #	Gage Calib. Verified	Spec Avg. DFT	Total Avg DFT	DFT Last Coat	DFT This Coat

Ambient Conditions

Time (Indicate AM or PM)	:	:	:	:
Dry Bulb Temp° (C/F)	°	°	°	°
Wet Bulb Temp° (C/F)	°	°	°	°
% Relative Humidity	%	%	%	%
Surface Temp° (C/F) Min/Max	/ °	/ °	/ °	/ °
Dew Point Temp° (C/F)	°	°	°	°
Wind Direction/Speed				
Weather Conditions:				

Application

Start Time : Finish Time : Est. Sq/ft.
☐ Primer ☐ Intermediate ☐ Topcoat ☐ Touch-up

Generic Type:	Qty Mixed:
Manuf.:	Mix Ratio:
Prod Name:	Mix Method:
Prod #:	Strain/Screen:
Color:	Material Temp: °F
Kit Sz/Cond.:	Sweat-in Time: Min/Hrs
Shelf Life:	Pot Life: Min/Hrs

Batch #'s

(A)	Qty Added: Pt/Qt/Gal
(B)	% by Vol: %
(C)	Specified WFT Avg: Mils
Reducer:	Achieved WFT Avg: Mils

☐ Airless/Conv. Spray ☐ Brush ☐ Roller ☐ Other _____

Pump Pot	Hose Dia.	Air Check
Ratio/Size	Hose Lng.	SEP/Trap
GPM/CFM	Spray Gun	Filter
PSI	Tip Sz.	Agitator

Inspector's Signature Date

SSPC the society for protective coatings Created03/03 by

SECTION 09 91 00

ARCHITECTURAL PAINTING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes surface preparation and field painting of exposed exterior and interior architectural items and surfaces.
   1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. The WORK of this Section requires painting surfaces as described in the Finish Schedules on the Architectural Drawings. In case of conflict between the provisions of this Section and Section 09 96 00, the provisions of Section 09 96 00 shall take precedence.

C. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.
   1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.
   2. Walls behind scheduled coverings shall receive prime coat.
   3. If it can be seen, paint it.

D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
   1. Prefinished items include the following factory-finished components:
      a. Architectural woodwork.
      b. Acoustical wall panels.
      c. Finished mechanical and electrical equipment.
      d. Light fixtures.
      e. Anodized aluminum door and window frames
   2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
      a. Foundation spaces.
      b. Furred areas.
      c. Ceiling plenums.
      d. Utility tunnels.
      e. Pipe spaces.
      f. Duct shafts.

3. Finished metal surfaces include the following:
    a. Anodized aluminum.
    b. Stainless steel.
    c. Chromium plate.
    d. Copper and copper alloys.
    e. Bronze and brass.
4. Operating parts include moving parts of operating equipment and the following:
    a. Valve and damper operators.
    b. Linkages.
    c. Sensing devices.
    d. Motor and fan shafts.
5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

E. Related Sections include the following:
1. Division 2 Section "Cement Concrete Pavement" for traffic-marking paint.
2. Division 5 Section "Structural Steel" for shop priming structural steel.
3. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
4. Division 6 Section "Interior Architectural Woodwork" for shop priming interior architectural woodwork.
5. Division 8 Section "Steel Door Frames" for factory priming steel doors and frames.
6. Division 9 Section "Gypsum Board" for surface preparation of gypsum board.

1.02 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.03 SUBMITTALS

A. Product Data: For each paint system indicated. Include block fillers and primers.
1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

B. Samples for Initial Selection: For each type of finish-coat material indicated.
   1. After color selection, Architect will furnish color chips for surfaces to be coated.

C. Qualification Data: For Applicator.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's stock number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.
   8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.
   1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.06 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C).

B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).

C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.07 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
   1. Quantity: Furnish Owner with an additional 3 percent, but not less than 1 gal. (3.8 L) or 1 case, as appropriate, of each material and color applied.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
   1. Sherwin-Williams Co. (Sherwin-Williams).
   2. Benjamin Moore & Co. (Benjamin Moore).
   3. ICI Dulux Paint Centers (ICI Dulux Paints).
   4. PPG Industries, Inc. (Pittsburgh Paints).

2.02 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
   1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: Match Architect's samples and as selected by Architect from manufacturer's full range.

2.03 CONCRETE UNIT MASONRY BLOCK FILLERS

A. Concrete Unit Masonry Block Filler: Factory-formulated high-performance latex block fillers.
   1. Sherwin-Williams; Heavy Duty Block Filler B42W46: Applied at a dry film thickness of not less than 10.0 mils (0.254 mm).

2.04 EXTERIOR PRIMERS

A. Exterior Ferrous-Metal Primer: Factory-formulated rust-inhibitive metal primer for exterior application.
   1. Sherwin-Williams; ProCryl Universal Primer B66-310 Series (<50 g/L): Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).

B. Exterior Galvanized Metal Primer: Factory-formulated galvanized metal primer for exterior application.
   1. Sherwin-Williams; DTM Wash Primer B71 Series: Applied at a dry film thickness of more less than 1.4 milsdry film thickness. .

C. Exterior Aluminum Primer under Acrylic Finishes: Factory-formulated acrylic-based metal primer for exterior application.
   1. Sherwin-Williams; DTM Acrylic Primer/Finish B66W1: Applied at a dry film thickness of not less than 3.0 mils.

2.05 INTERIOR PRIMERS

A. Interior Concrete and Masonry Primer for Walls: Factory-formulated alkali-resistant acrylic-latex interior primer for interior application.
   1. Sherwin-Williams; Heavy Duty Block filler B42W46: Applied at a dry film thickness of not less than 10.0 mils (0.254 mm).

B. Interior Concrete Floor Primer: Factory-formulated 2 component, water based epoxy primer for interior application.
   1. Sherwin-Williams; : Resuprime 3477 Epoxy Sealer. Applied at a dry film thickness of not less than 2.0 mils (0.152 mm) (3.0 mils wet).

C. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.
   1. All areas except as scheduled for Wet Areas: Sherwin-Williams; ProMar 200 Zero Primer B28 Series (<50 VOC): Applied at a dry film thickness of not less than 1.0 mils (0.033 mm).
   2. Wet Areas (Scheduled for Epoxy Finish Coat): Sherwin-Williams; S-W PrepRite ProBlock Latex Primer, B28. Applied at a dry film thickness of not less than 1.2 mils (0.030 mm) (4 mils wet).

D. Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive metal primer.
   1. Sherwin-Williams; ProCryl Universal Primer B66-310 Series (<50g/L): Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).

E. Interior Zinc-Coated Metal Primer: Factory-formulated galvanized metal primer.
   1. Sherwin-Williams; Zinc Clad 4100: Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).

2.06 EXTERIOR FINISH COATS

A. Exterior Full-Gloss Acrylic Enamel for Ferrous and Other Metals: Factory-formulated full-gloss waterborne acrylic-latex enamel for exterior application.
   1. Sherwin-Williams; Sher-Cryl High Performance Acrylic, B66-300 Series (192 g/L): Applied at a dry film thickness of not less than 4.0 mils (0.101 mm).

B. Exterior Full-Gloss Alkyd Enamel: Factory-formulated full-gloss alkyd enamel for exterior application.
   1. Sherwin-Williams; Pro Industrial WB Urethane Alkyd Enameleries (<250 g/L): Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).

C. Exterior Full-Gloss Urethane: Factory-formulated full-gloss urethane for exterior application.
   1. Sherwin-Williams; High Solids Polyurethane 250 B65 Series (<250 g/L): Applied at a dry film thickness of not less than 3.0 mils (0.076 mm).

2.07 INTERIOR FINISH COATS

A. Interior Flat Acrylic Paint: Factory-formulated flat acrylic-emulsion latex paint for interior application.
   1. Sherwin-Williams; ProMar 200 Zero Interior Latex Flat B30 Series (0 VOC): Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).

B. Interior Low-Luster Acrylic Enamel: Factory-formulated eggshell acrylic-latex interior enamel.
   1. Sherwin-Williams; Scuff Tuff Interior WB Enamel S24 Series (0 VOC): Applied at a dry film thickness of not less than 1.2 mils (0.041 mm).

C. Interior Semigloss Acrylic: Factory-formulated semigloss acrylic-latex enamel for interior application.
   1. Sherwin-Williams; ProMar 200 Zero Interior Latex Semi-Gloss B31 Series (0 VOC): Applied at a dry film thickness of not less than 1.6 mils (0.041 mm).

D. Interior Semi-Gloss Acrylic Coating: Factory-formulated semigloss water based acrylic dryfall coating.
   1. Sherwin-Williams; Pro Industrial Multi Surface Acrylic B66 Series. Applied at a dry film thickness of not less than 1.5 mils dry

E. Interior Full Gloss 100% Solids Epoxy for Concrete Floors: Factory-formulated 2 component, high performance, recoatable epoxy:
   1. Sherwin-Williams; Resuflor 3746 High Performance Epoxy. Applied at a wet film thickness of not less than 12.0 mils (0.309 mm) (12.0 mils wet).

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.
   1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
   2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
   1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.02 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
   1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
   1. Provide barrier coats over incompatible primers or remove and reprime.
   2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
      a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
      b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.

c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
   a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
   b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
   c. If transparent finish is required, backprime with spar varnish.
   d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
   e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
   a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.
   b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
   c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.
5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
   1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
   2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
   3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.03 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
9. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer over metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.

3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical items to be painted include, but are not limited to, the following:
   1. Uninsulated metal piping.
   2. Uninsulated plastic piping.
   3. Pipe hangers and supports.
   4. Tanks that do not have factory-applied final finishes.
   5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
   6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
   7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

F. Electrical items to be painted include, but are not limited to, the following:
   1. Switchgear.
   2. Panelboards.
   3. Electrical equipment that is indicated to have a factory-primed finish for field painting.

G. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

H. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

I. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

J. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
   1. Provide satin finish for final coats.

K. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.04 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:
   1. Owner may engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
   2. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.05 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
   1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.06 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
   1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces.

3.07 EXTERIOR PAINT SCHEDULE

A. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.
   1. Full-Gloss Acrylic-Enamel Finish: Two finish coats over a rust-inhibitive primer.
      a. Primer: Exterior ferrous-metal primer.
      b. Finish Coats: Exterior full-gloss acrylic enamel for ferrous and other metals.
   2. Full-Gloss Alkyd-Enamel Finish: Two finish coats over a rust-inhibitive primer.
      a. Primer: Exterior ferrous-metal primer.

b. Finish Coats: Exterior full-gloss alkyd enamel.

3. Full-Gloss Urethane Finish: Two finish coats over a rust-inhibitive primer.
   a. Primer: Exterior ferrous-metal primer.
   b. Finish Coats: Exterior full-gloss urethane.

B. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated metal surfaces:
   1. Full-Gloss Acrylic-Enamel Finish: Two finish coats over a galvanized metal primer.
      a. Primer: Exterior galvanized metal primer.
      b. Finish Coats: Exterior full-gloss acrylic enamel for ferrous and other metals.

C. Aluminum: Provide the following finish systems over exterior aluminum surfaces:
   1. Full-Gloss Acrylic-Enamel Finish: Two finish coats over a primer.
      a. Primer: Exterior aluminum primer under acrylic finishes.
      b. Finish Coats: Exterior full-gloss acrylic enamel for ferrous and other metals.

3.08 INTERIOR PAINT SCHEDULE

A. Concrete and Masonry (Other Than Concrete Unit Masonry): Provide the following paint systems over interior concrete and brick masonry substrates:
   1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.
      a. Primer: Interior concrete and masonry primer.
      b. Finish Coats: Interior semigloss acrylic enamel.

B. Concrete Unit Masonry: Provide the following finish systems over interior concrete masonry:
   1. Semigloss Acrylic-Enamel Finish: Two finish coats over a block filler.
      a. Block Filler: Concrete unit masonry block filler.
      b. Finish Coats: Interior semigloss acrylic enamel.

C. Concrete Unit Masonry for Epoxy Finish: Provide the following finish systems over interior concrete masonry:
   1. Gloss Epoxy Finish: Two finish coats over a block filler.
      a. Block Filler: Concrete unit masonry block filler.
      b. Finish Coats: Interior gloss epoxy.

D. Concrete Floor Sealer (Rain Guard Floor-Loc with Micro-Loc): Provide the following finish systems over interior concrete floors:
   1. Clear silane / silozane ASTM C-309
   2. Remove all oil, grease and loose particles.
   3. 2 coats: 400 SFPGPC

E. Concrete Wall Sealer (MasterProtect H 107): Provide the following finish systems over interior concrete and cement base fire proofing at walls & Ceilings:

1. Clear silane / silozane ASTM C-309
2. Remove all oil, grease and loose particles.
3. 2 coats: 400 SFPGPC

F. Concrete Floors Non Skid Epoxy: Provide the following finish systems over interior concrete floors:
   1. Full Gloss Epoxy Finish: Two finish coats (15 mils) over a primer.
      a. Primer: Interior concrete floor primer; S-W Resuprime 3579
      b. Finish Coats: Interior full gloss 100% solids self-leveling epoxy; S-W Resuflor 3746

G. Metal (Structural Steel)
   1. Ferrous and Non-Ferrous- (Galvanized Ductwork, Piping, Conduit, Door Frames)
      a. Acrylic Coating
      b. Semi-Gloss Finish
      c. 1st Coat: S-W Pro Industrial Multi Surface Acrylic, B66 Series. (1.5 -3 mils dry)
      d. 2nd Coat: S-W Pro Industrial Multi Surface Acrylic, B66 Series. (1.5 -3 mils dry)

H. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:
   1. Flat Acrylic Finish: Two finish coats over a primer.
      a. Primer: Interior gypsum board primer.
      b. Finish Coats: Interior flat acrylic paint.
   2. Low-Luster Acrylic-Enamel Finish: Two finish coats over a primer.
      a. Primer: Interior gypsum board primer.
      b. Finish Coats: Interior low-luster acrylic enamel.
   3. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.
      a. Primer: Interior gypsum board primer.
      b. Finish Coats: Interior semigloss acrylic enamel.
   4. Gloss Epoxy Finish: Two finish coats over a primer.
      a. Primer: Interior gypsum board primer (wet areas).
      b. Finish Coats: Interior gloss epoxy.

I. Ferrous Metal: Provide the following finish systems over ferrous metal:
   1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.
      a. Primer: Interior ferrous-metal primer.
      b. Finish Coats: Interior semigloss acrylic enamel.

J. Zinc-Coated Metal: Provide the following finish systems over interior zinc-coated metal surfaces:
   1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.
      a. Primer: Interior zinc-coated metal primer.
      b. Finish Coats: Interior semigloss acrylic enamel.

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SECTION 10 42 50

SIGNS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following types of signs:
   1. Panel signs.
      a. Interior room identification signs.
      b. Handicap accessibility signage.
      c. Parking signs (handicapped).
      d. Handicap entry signs.
      e. Maximum occupancy load signs.
   2. Dimensional letters and numbers.

1.03 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.

C. Shop drawings showing fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details.
   1. Provide message list for each sign required, including large-scale details of wording and lettering layout.
   2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.
   3. Templates: Furnish full-size spacing templates for individually mounted dimensional letters and numbers.
   4. Furnish full-size layouts for metal plaques.

D. Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.

1. Samples for selection of color, pattern, and texture:
    a. Cast Acrylic Sheet and Plastic Laminate: Manufacturer's color charts consisting of actual sections of material including the full range of colors available for each material required.
    b. Aluminum: Samples of each finish type and color, on 6-inch-long sections of extrusions and not less than 4-inch squares of sheet or plate, showing the full range of colors available.
2. Provide 1 typical interior door sign sample with specified colors.

1.04 QUALITY ASSURANCE

A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.

B. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

C. Handicapped Accessibility: Provide signs which are in conformance with the requirements of ANSI A117.1-2003 and the Americans with Disabilities Act of 1990 (ADA).

D. Design Concept: The Drawings indicate sizes, profiles, and dimensional requirements of signs and are based on the specific types and models indicated. Sign units by other manufacturers may be considered provided deviations in dimensions and profiles do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

1.05 DELIVERY AND HANDLING

A. Delivery: Provide protective covering or crating as recommended by the manufacturer to protect sign components and surfaces against damage during transportation and delivery.

B. Handle signs carefully to prevent breakage, surface abrasion, denting, soiling, and other defects. Comply with the manufacturer's written handling instructions for unloading components subject to damage.
    1. Inspect sign components for damage on delivery.
    2. Do not install damaged sign components.
    3. Repair minor damage to signs, provided the finished repair is equal in all respects to the original work and is approved by Architect; otherwise, remove and replace damaged sign components.

1.06 PROJECT CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

1.07 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Fiberglass Panel Sign Warranty: Submit a written warranty, signed by manufacturer, agreeing to repair or replace fiberglass panels that fail during the specified warranty period. Failures include, but are not limited to, the following:
   1. Coating degradation.
   2. Chalking.
   3. Fading.
   4. Fiberglass delamination or cracking.

C. Warranty Period: 5 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
   1. Manufacturers of Panel Signs:
      a. ABC Architectural Signing System.
      b. ASI Sign Systems, Inc.
      c. Best Manufacturing Company.
      d. Spanjer Brothers, Inc.
      e. Vomar Products, Inc.
   2. Manufacturers of Dimensional Letters:
      a. ASI Sign Systems, Inc.
      b. Metal Arts.
      c. Metallic Arts, Inc.
      d. The Southwell Company.
      e. Spanjer Brothers, Inc.
      f. Vomar Products, Inc.

2.02 MATERIALS

A. Steel Tubing: Cold-formed steel tubing conforming to ASTM A 500, Grade B, hot-dip galvanized after fabrication with a minimum of 2.0 oz. of zinc/sq. ft. (610 g of zinc/sq. m) of surface area conforming to ASTM A 123.

B. Fiberglass: Molded, seamless, thermosetting, glass-fiber-reinforced polyester panels in sizes and thicknesses indicated, with a minimum tensile strength of 15,000 psi (103 MPa) when

tested according to ASTM D 638 (ASTM D 638M) and with a minimum flexural strength of 30,000 psi (207 MPa) when tested according to ASTM D 790 (ASTM D 790M).

C. Cast Acrylic Sheet: Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested according to ASTM D 790, with a minimum allowable continuous service temperature of 176 deg F (80 deg C), and of the following general types:
   1. Opaque Sheet: Where sheet material is indicated as "opaque," provide colored opaque acrylic sheet in colors and finishes as selected from the manufacturer's standards.

D. Aluminum Castings: Provide aluminum castings of alloy and temper recommended by the sign manufacturer for the casting process used and for the use and finish indicated.

E. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.

F. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

G. Concrete for Post Holes: Mix portland cement complying with ASTM C 150, aggregates complying with ASTM C 33, and clean water to obtain concrete with a minimum 28-day compressive strength of 2500 psi (17 MPa). Use at least 4 sacks of cement/cu. yd. (225 kg of cement/cu. m), 1-inch (25-mm) maximum-size aggregate, maximum 3-inch (75-mm) slump, and 2 to 4 percent entrained air.

2.03 PANEL SIGNS

A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
   1. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch1.5 mm measured diagonally.

B. Basis-of-Design Product: ASI Sign Systems, Inc.; ASI Tactile Graphics Plaque Sign System or a comparable product of one of the following:
   1. Available Manufacturers:
      a. APCO Graphics, Inc.
      b. Best Manufacturing Co.
      c. Mohawk Sign Systems.

C. Sign Face: High impact aluminum tri-hydrate filled polyester acrylate resin, pressure molded into a single polymerized component, using manufacturer□s standard co-molding process.

D. Unframed Panel Signs: As shown on drawings, fabricate signs with edges mechanically and smoothly finished to comply with the following requirements:
   1. Edge Condition: Square cut.
   2. Corner Condition: Square.

3. Depth: 0.25 inch thickness.
4. Panel Appearance: As selected by Architect.
5. Color: As selected by Architect from manufacturer□s full range of colors.
6. Surface Texture: As selected by Architect.
7. Letter Style: Arial.
8. Letter Height: As scheduled.

E. Brackets: Fabricate brackets and fittings for bracket-mounted signs from extruded aluminum to suit panel sign construction and mounting conditions indicated. Background chassis shall be concealed by modules and accessories.

F. Graphic Content and Style: Provide sign copy that complies with requirements indicated in the Sign Schedule for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage.
   1. Provide signage indicating handicap entry at each set of entry doors into facility.
   2. Provide one wall mounted sign per door or set of doors throughout building.
      a. Provide signs with cutouts and removable inserts (maximum of three (3) per sign) with permanent ADA text.
   3. Provide maximum occupancy load signs in assembly rooms as required by code.

G. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.
   1. Raised-Copy Thickness: Not less than 1/32 inch0.8 mm.

H. Changeable Message Inserts: Fabricate signs to allow insertion of changeable messages in the form of transparent covers with paper inserts printed by Owner.
   1. Furnish paper and software for creating text and symbols for IBM compatible computers for Owner production of paper inserts.
   2. Furnish paper cut-to-size for changeable message insert.

I. Colored Coatings: For copy and background colors, provide Pantone Matching System (PMS) colored coatings, including inks and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for application intended.

J. Applied Copy: Die-cut characters from vinyl film of nominal thickness of 3 mils (0.076 mm) with pressure-sensitive adhesive backing. Apply copy to exposed face of panel sign, glass, doors, or wall surfaces as indicated.

K. Back-up Sign Panel: Provide back-up blank sign panels at all glass mounted sign locations. Back-up sign panel shall match finished sign face and shall be used to conceal sign attachment to glass. Back-up blank sign panels shall be used or located as directed by Architect.

2.04 EXTERIOR PARKING SIGNS

A. Panel Signs: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
   1. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally.

B. Steel Posts: 0.120-inch- (3.0-mm-), galvanized, seamless, square steel posts in length adequate for mounting method specified. Include post caps, fillers, spacers, junction boxes, access panels, and related accessories required for a complete installation. Comply with the following requirements for post shape, finish, and mounting method indicated:
   1. Post Size: 2 by 2 inches (50 by 50 mm) square.
   2. Post Mounting Method: Provide sign posts of length required for permanent installation by direct-burial mounting method.

C. Sign Panels: Provide smooth, even, level sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.
   1. Unframed Single-Sheet Panels: Provide unframed single-sheet sign panels with edges mechanically and smoothly finished to conform to the following:
      a. Panel Material: 0.125-inch- (3.2-mm-) thick fiberglass sheet.
         1) Panel Finish: Manufacturer's standard semigloss finish with UV inhibitors.
      b. Edge Condition: Square cut.
      c. Corner Condition: Square corners.

D. Graphic Content and Style: Provide sign copy that complies with the requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices.
   1. Copy Embedded in Fiberglass Panels: Apply computer-generated adhesive graphics to panel as a masking material. Apply acrylic polyurethane background-color flood coats, 0.015-inch (0.4-mm) minimum thickness. Include UV inhibitors. Remove masking material.
      a. Provide signage indicating handicap parking at all handicap parking spaces.
      b. Provide directional signage on site for bus, automobile and pedestrian access.

E. Fabrication:
   1. General: Provide manufacturer's standard single-post, single-panel-type post and panel signs. The completed sign assembly shall consist of a message panel supported on 1 post. Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
      a. Allow for thermal movement resulting from a maximum ambient temperature change (range) of 100 deg F (38 deg C). Design, fabricate, and install post and panel sign assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners.
         1) Base design on actual surface temperatures of metals due to both solar heat gain and nighttime-sky heat loss.

b. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress on exposed and contact surfaces.

c. Mill joints to a tight, hairline fit. Form joints exposed to the weather to exclude water penetration.

d. Preassemble signs in the shop to the greatest extent possible to minimize field assembly. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in a location not exposed to view after final assembly.

e. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2. Posts: Fabricate posts to lengths required for mounting method indicated.

a. Direct Burial: For permanent sign installation, provide posts 36 inches (900 mm) longer than height of sign to permit direct embedment in concrete foundations.

3. Panels: Form panels to required size and shape. Comply with requirements indicated for design, dimensions, finish, color, and details of construction.

a. Coordinate dimensions and attachment methods to produce message panels with closely fitting joints. Align edges and surfaces with one another in the relationship indicated.

b. Increase metal thickness or reinforce with concealed stiffeners or backing materials as required to produce surfaces without distortion, buckles, warp, or other surface deformations.

c. Continuously weld joints and seams, unless other methods are indicated; grind, fill, and dress welds to produce smooth, flush, exposed surfaces with welds invisible after final finishing.

2.05 DIMENSIONAL LETTERS AND NUMBERS

A. Last Letters and Numbers: Form individual letters and numbers by casting. Produce characters with smooth, flat faces, sharp corners, and precisely formed lines and profiles, free from pits, scale, sand holes, or other defects. Cast lugs into the back of characters and tap to receive threaded mounting studs. Comply with requirements indicated for finish, style, and size.

1. Metal: Aluminum, black anodized
2. letters size: 8” high

a. Font: Helvetica.

b. Attached to exterior building at main entrance see building names below.

B. Building Name Located at front entrance

Sign 1: HEADWORKS / DEWATERING BUILDING

Sign 2: SOLIDS HANDLING BUILDING

Sign 3: CENTER STREET LIFT STATION

(Building numbers to be determined)

2.06 FINISHES

A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the Architect from the manufacturer's standards.

B. Metal Finishes: Comply with NAAMM "Metal Finishes Manual" for finish designations and applications recommendations.

C. Aluminum Finishes: Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.
   1. Baked-Enamel Finish: AA-M4xC12C42R1x (Mechanical Finish: Manufacturer's standard, other nondirectional textured; Chemical Finish: Chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: as specified below). Apply baked enamel in compliance with paint manufacturer's specifications for cleaning, conversion coating, and painting.
      a. Organic Coating: Thermosetting-modified acrylic enamel primer/topcoat system complying with AAMA 603.8 except with a minimum dry film thickness of 1.5 mils, medium gloss.
         1) Color: As selected by the Architect from the manufacturer's standard colors.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
   1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.

B. Exterior Parking Signs:
   1. Excavation: In firm, undisturbed or compacted soil, drill or (using a post-hole digger) hand-excavate holes for each post to the minimum diameter recommended by sign manufacturer, but at least 4 times the largest post cross-section.
      a. Excavate hole depths approximately 3 inches (75 mm) lower than required post bottom, with bottom of posts set at least 36 inches (900 mm) below finished grade.
   2. Setting Posts: Center and align posts in holes 3 inches (75 mm) above bottom of excavation.
      a. Protect portion of posts aboveground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Check posts for vertical and top alignment and hold in position until concrete has achieved its initial set.

C. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using the methods indicated below:
   1. Provide screws, bolts, and other exposed fastening devices of the same material as the items being fastened. Provide types, gages, and lengths to suit installation conditions. Use theft-proof fasteners where exposed to view.

D. Bracket-Mounted Units: Provide the manufacturer's standard brackets, fittings, and hardware as appropriate for mounting signs that project at right angles from walls and ceilings. Attach brackets and fittings securely to walls or ceilings with concealed fasteners and anchoring devices to comply with manufacturer's directions.

E. Dimensional Letters and Numbers: Mount letters and numbers using standard fastening methods recommended by the manufacturer for letter form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish letter spacing and to locate holes for fasteners.

   1. Flush Mounting: Mount letters with backs in contact with the wall surface.

3.02 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

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SECTION 10 44 00

FIRE-PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Portable fire extinguishers.
   2. Fire-protection cabinets for the following:
      a. Portable fire extinguishers.
   3. Fire-protection accessories.

B. Related Sections include the following:
   1. Division 10 Section "Signs" for directional signage to out-of-sight fire extinguishers and cabinets.

1.03 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.
   1. Fire Extinguishers: Include rating and classification.
   2. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

B. Samples for Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of cabinet finish indicated.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide extinguishers listed and labeled by FM.

1.05 COORDINATION

A. Coordinate size of cabinets to ensure that type and capacity of fire extinguishers indicated and provided by Owner under separate Contract are accommodated.

B. Coordinate size of cabinets to ensure that type and capacity of hoses, hose valves, and hose racks indicated are accommodated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Portable Fire Extinguishers:
      a. Amerex Corporation.
      b. Badger; Div. of Figgie Fire Protection Systems.
      c. Buckeye Fire Equipment Company.
      d. General Fire Extinguisher Corporation.
      e. J.L. Industries, Inc.
      f. Larsen's Manufacturing Company.
      g. Potter-Roemer; Div. of Smith Industries, Inc.
   2. Fire-Protection Cabinets:
      a. General Accessory Manufacturing Co.
      b. J.L. Industries, Inc.
         1) Equal to: Cosmopolitan, 1036W17
      c. Larsen's Manufacturing Company.
      d. Potter-Roemer; Div. of Smith Industries, Inc.

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A 366/A 366M, commercial quality, stretcher leveled, temper rolled.

B. Stainless-Steel Sheet: ASTM A 666/A 666M, Type 302 or Type 304 alloy.

2.03 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.

B. Multipurpose Dry-Chemical Type: UL-rated 4-A:60-B:C, 10-lb (4.5-kg) nominal capacity, in enameled-steel container.

C. Electrical Room: Fire extinguisher 11 lb. should be a clean agent type defined by NFPA 2001. Equal to Amerex 397 Haloton 1 "Clean Agent".

2.04 FIRE-PROTECTION CABINETS

A. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
   1. Cabinet Metal: Stainless-steel sheet.

B. Cabinet Type: Suitable for the following:
   1. Fire extinguisher.

C. Cabinet Mounting: Suitable for the following mounting conditions:
   1. Semirecessed: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated.
   2. Surface Mounted Cabinet in locations where the wall is exposed CMU masonry or exposed concrete.

D. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.
   1. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
      a. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.

E. Cabinet Trim Material: Manufacturer's standard, as follows:
   1. Stainless-steel sheet.

F. Door Material: Manufacturer's standard, as follows:
   1. Stainless-steel sheet.

G. Door Glazing: Manufacturer's standard, as follows:
   1. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, as follows:
      a. Class 1 (clear).

H. Door Style: Manufacturer's standard design, as follows:
   1. Vertical duo panel with frame.

I. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.
   1. Provide minimum 1/2-inch- (13-mm-) thick door frames, fabricated with tubular stiles and rails, and hollow-metal design.

J. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever

handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

2.05 ACCESSORIES

A. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish.
   1. Provide brackets for extinguishers not located in cabinets.

B. Door Locks: Provide cylinder lock, with all cabinets keyed alike.

C. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Locate as indicated by Architect.
   1. Identify bracket-mounted extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to wall surface.
   2. Identify fire extinguisher in cabinet with the words "FIRE EXTINGUISHER" applied to door.
      a. Application Process: Silk-screened.
      b. Lettering Color: Red.
      c. Orientation: Vertical.

2.06 COLORS AND TEXTURES

A. Colors and Textures: As selected by Architect from manufacturer's full range for these characteristics.

2.07 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Cabinet and Door Finishes: Provide manufacturer's standard baked-enamel paint for the following:
   1. Interior of cabinets and doors.

2.08 STAINLESS-STEEL FINISHES

A. General: Remove or blend tool and die marks and stretch lines into finish. Grind and polish surfaces to produce uniform, directionally textured polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

B. Bright, Directional Polish: No. 4 finish.

C. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets are to be installed.

B. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's written instructions for installing fire-protection specialties.

B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
   1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
   2. Fasten mounting brackets to structure and cabinets, square and plumb.
   3. Fasten cabinets to structure, square and plumb.

3.03 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinets and doors damaged during installation.

C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

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SECTION 11 30 10

MEMBRANE BIOREACTOR (MBR) EQUIPMENT COORDINATION & INSTALLATION

PART 1 GENERAL

1.1 SCOPE

A. This section covers the delivery, installation, commissioning and acceptance testing of the Veolia microfiltration (MF) system and ancillary equipment furnished by the Owner. The Contractor is responsible for providing a complete installation of the equipment furnished by Veolia, the Membrane Filtration Equipment Manufacturer (MFEM).

B. The Contractor shall unload, unpack, assemble, and install equipment items furnished by the MFEM as shown on the MFEM Drawings and as specified herein. The MFEM equipment submittal, process, and electrical control drawings have been included with these Bidding Documents as Volume IV. In addition, the Contractor shall furnish and install additional equipment items, interconnecting piping, valves, instruments, power and control wiring, and all other appurtenances required to provide a complete and operable system. The equipment that is to be provided by the MFEM under this Contract to the Owner is denoted as Membrane Bioreactor (MBR) Procurement Contract Documents.

C. The Contractor shall reference the approved shop drawings and Change Orders for the procurement contract documents that form the basis for the equipment supply and use the current “Approved” equipment. Contractor shall use only shop drawing documents stamped “Approved.”

D. The MFEM will provide written instructions and installation manuals to the Contractor that details the installation procedures for all supplied equipment. The MFEM will provide onsite training to the Contractor for installation of the MFEM supplied equipment as specified in the MBR Procurement Contract Documents.

E. Upon completion of system installation, manufacturers of the component equipment shall inspect the completed work and shall submit a certificate of proper installation. The MFEM will also inspect the installation prior to commissioning.

F. The MFEM will furnish the equipment items associated with the system and will participate in the commissioning, acceptance, testing, and training of Owner’s personnel in operation of the MF system as a whole.

G. The Contractor shall be responsible for commissioning of individual items of equipment as defined in the individual equipment specifications. The Contractor shall coordinate MF system commissioning and participate in the startup of the MF system as required herein.

H. Work being performed under this specification will be in accordance with these Bid Documents and the Assigned Procurement Contract with Veolia.

1.2 RELATED SECTIONS

A. Section 01 60 00 – Product Requirements

B. Section 01 65 00 – Commissioning of Systems

C. Section 01 73 00 – Operation and Maintenance Data

D. Piping, pipe hanger and support, and valve requirements are included in Division 40

E. Electrical and instrumentation systems in Division 26

F. Veolia Membrane Bioreactor (MBR) Equipment Documentation

1.3 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

A. Coordination:

1. The installation of the MF system requires considerable coordination between the MFEM and the Contractor. The MFEM will provide assistance and provide the information needed to coordinate the installation of the MF system and the ancillary equipment.
2. The Contractor shall be responsible for installation of equipment furnished under this contract and for provision of interconnecting piping and electrical power supply and connections.
3. The Contractor shall coordinate the installation of the MF system provided by the MFEM and obtain all necessary instruction from the MFEM to ensure proper installation. The MFEM will review installation of equipment prior to commissioning of equipment.

1.4 SUBMITTALS

A. Shop Drawings

1. Shop drawing submittals shall be made in accordance with the requirements of Section 01 30 00, except as modified herein.

2. The Contractor shall submit the following documents from the MFEM for review by the Engineer:

   a. MFEM Installation Instructions

   b. MFEM Operations and Maintenance Manuals

   c. MFEM Detailed Plan of Commissioning

   d. MFEM Training Manuals

3. Coordination Meetings

   a. The Contractor, Owner, and MFEM shall meet to address any issues related to the-project. The meetings will be held at the Owner's location for a period of 8 hours.

   b. Instrumentation and Control Coordination Meetings:

      1) Two (2) meetings will be held to coordinate instrumentation and controls as indicated in Membrane Bioreactor Procurement Contract Documents.

B. General and Scope of Supply

1. All MF equipment and items produced previously under the Procurement Contract that will be supplied by the MFEM have previously been reviewed and approved by the Engineer. Drawings and submittal information for use in bidding and construction of the MFEM supplied equipment is included as Volume IV of these Contract Documents. These drawings outline the MFEM scope of supply, including a Bill of Materials list.

2. Contractor shall provide manufacturer catalog sheets with model numbers for all equipment furnished by the Contractor.

3. Contractor shall submit spare parts list for all equipment furnished by the Contractor. See individual equipment specifications for spare parts requirements.

4. Contractor shall submit operating and installation instructions for all equipment furnished by the Contractor.

1.5 PRODUCT TRANSPORTATION, RECEIPT, INSPECTION, AND STORAGE

A. Transportation of Goods

1. The MFEM will make all arrangements for transportation and delivery of all MFEM supplied equipment and materials to the jobsite.
2. Prior to the delivery of the Goods, the MFEM will develop and submit to the Contractor and Owner a bill of lading for the contents of all shipments. This list will detail contents, size, and weights of each item shipped. Upon receipt of the Goods, the bill of lading and the project bill of materials will be used to determine that all of the Goods are provided in conformance with the Specifications.
3. The MFEM is required to deliver the equipment within 180 days after the Notice to Commence Fabrication is issued by the Contractor. The MFEM and the Contractor shall coordinate deliveries that occur between specified Contract Times to accommodate Work of Contractor or Owner, limitations of storage space, and availability of equipment and personnel for handling products.

B. Protection of Goods

1. The MFEM will make all arrangements and provisions necessary for the protection of the MFEM furnished equipment to the jobsite.
2. All packages containing panels, electronic devices, and other microprocessor-based equipment shall contain a desiccant, volatile, corrosion inhibitor (VCI) blocks, a moisture indicator, and maximum-minimum indicating thermometer.

1.6 DEFINITIONS

A. MFEM: Membrane Filtration Equipment Manufacturer, Veolia

B. Microfiltration (MF) System: Membrane filtration system generally comprised of the following:

1. Air compressor
2. Membrane cassettes: ZW-500 D, two units
3. Permeate pump system
4. Repurposed scour air blower instrumentation
5. Chemical cleaning systems (by Owner)
6. Associated piping, valves, controls, and instrumentation

C. Contractor: The person, firm, or corporation with whom the Owner has entered into contract for facility construction and has been assigned the Procurement Contract by the Owner for installation of the Goods.

PART 2 PRODUCTS

2.1 MFEM SUPPLIED ITEMS

A. Reference Volume IV – Veolia Membrane Bioreactor (MBR) Equipment Documentation (procured by Owner) for detailed drawings, bill of materials, and related documentation for a list of MFEM supplied items.

2.2 INTERCONNECTING PIPING AND VALVES

A. The Contractor is responsible for all piping and valves required to provide a complete and operable system. All pipe and valves shall be provided in accordance with applicable sections (e.g., Division 40). The Contractor is responsible for coordination and confirmation of all interconnecting piping and valves from the MFEM.

B. The Contractor shall route and provide tubing and instrumentation drains for equipment and analyzers in a logical and neat manner.

2.3 INSTRUMENTATION AND CONTROLS

A. General

1. A main control panel and other ancillary control panels supplied by the MFEM will monitor and control membrane system operations (e.g., MF feed from the aerations basins, levels in the MF units, membrane performance, backpulse, CIP and maintenance clean processes, scour air supply, and compressed air supply). In addition, the units will have a unit control panel that will control the individual unit operations.

B. Division of Scope

1. The MFEM will provide the MF unit control panel as well as the main control panel as described above.
2. The PLC will be supplied and programmed by the MFEM to incorporate the required controls.
3. The Contractor shall provide all interconnecting field wiring for the MF system. The Contractor shall furnish and install all instrumentation and control system power and signal wiring, and all other connections and appurtenances shown on the Drawings or otherwise required to provide a complete and functional system.
4. The Contractor is responsible for all field instrumentation not provided through the MFEM.
5. The Contractor is responsible for performing a loop check on all installed wiring. The Contractor shall make a checklist confirming that each loop check has been

performed. After the list is complete and all other installation requirements are completed, the MFEM will begin the Commissioning.

2.4 MISCELLANEOUS COMPONENTS

A. Anchor Bolts: Anchor bolts shall be Type 316 stainless steel and at least ½ inch in diameter. The MFEM will provide all required anchor bolts for system components furnished by them, excluding anchorage components for non-freestanding panel support systems furnished by the Contractor.

PART 3 EXECUTION

3.1 DELIVERY, INSPECTION, AND STORAGE

A. Receipt of Goods

1. The MFEM will provide a technical representative to be present during all phases of equipment delivery under this Contract. A representative of the MFEM will be present when the MF units are delivered to the site, off-loaded, and unpacked by the Contractor, in order to provide technical guidance and verify delivery condition and handling methods.
2. The Contractor shall provide equipment and personnel necessary to unload, handle, and store products by methods designed to prevent soiling or damage and as directed by the MFEM. Contractor shall be responsible for proper storage of all equipment and materials onsite until installation of the equipment is required. If damage occurs to any items while handled or stored onsite, the Contractor shall be responsible for any costs associated with replacing or repairing the damaged items.

B. Inspection of Goods:

1. The Contractor and MFEM shall inspect equipment to ensure:
    a. Product complies with specifications
    b. Containers and packages are intact
    c. Labels are legible
    d. Products are properly protected and undamaged
2. Contractor shall unpack shipping crates to allow complete inspection upon off loading from the delivery trucks. The Contractor shall re-pack any crates or equipment for storage of the equipment after inspection.

C. Storage of Goods

1. Contractor shall handle and store equipment in accordance with instructions provided by the MFEM until required for installation.

2. The MFEM will:

   a. Provide the Contractor with a list of pumps, motors, drives, electrical equipment, instrumentation equipment (controls, devices, panels, etc.), and other equipment having anti-friction or sleeve bearings for storage in weather tight storage facilities, such as warehouses.

   b. Provide to the Contractor, at least thirty (30) days prior to delivery of the Goods, a list of panels, microprocessor-based equipment, and other Goods and devices subject to damage or useful life decrease due to temperature below 40° F, or above 120° F, relative humidity above ninety (90) percent, or exposure to rain.

   c. Provide the Contractor with a list of Goods that could be damaged by low or high temperature and require temperature-controlled storage space.

   d. Provide the Contractor a list of Goods required to be protected from contamination by dust, dirt, and moisture.

   e. Provide the Contractor with a list of Goods required to be maintained at specific humidity levels as recommended by manufacturer.

3. Electrical equipment, controls, and instrumentation will be protected against moisture or water damage. The Contractor shall provide and connect power to the space heaters provided in the equipment. The space heaters shall be operated at all times until equipment is placed in operation.

3.2 INSTALLATION OF GOODS

A. General: The Contractor shall be responsible for the proper installation of all MF system equipment. Installation of system components and interconnections between system components and other plant systems shall be in accordance with the Specifications, manufacturer's printed instructions, and approved shop drawings.

B. The Contractor is responsible for all expenses incurred if any membrane equipment is damaged during installation.

C. Field Services Provided by MFEM

1. The MFEM will provide a technical representative for a construction coordination meeting between the Engineer, Contractor, and Owner’s Representative at the project site for the Work.

2. The MFEM will provide to the Contractor installation manuals for procedures to install equipment provided by the MFEM.

3. The MFEM shall provide training to the Contractor for installation of proprietary membrane equipment. The training shall be conducted onsite by an authorized, experienced employee of the MFEM.

4. An employee of the MFEM shall be present onsite to oversee the proper placement and installation of MFEM equipment, including, but not limited to, tanks, pumps, compressors, and VFDs.

5. The representative of the MFEM shall also be present to oversee the assembly installation of the associated anchor bolts.

6. The MFEM shall be responsible for identification of the volume and concentration of the membrane module storage solution and rinsing requirements for membrane modules.

D. Contractor's Installations

1. The Contractor shall locate all equipment and install anchor bolts.

2. The Contractor shall connect system components as indicated on the MFEM installation instructions and the Contract Documents.

3. The Contractor shall install all piping shown on the Plans, noted in the MFEM or Engineer-provided process and instrumentation diagrams, MFEM documentation, and as required for a complete and functional system.

   a. The Contractor shall furnish and install all pipe supports accordance with the Contract Documents as shown on the drawings.

   b. Valves

      1) In horizontal pipe runs centered less than 4'-6" above the operating floor, orient valve stems as close to vertical as permitted by adjacent piping.

      2) In horizontal pipe runs centered between 4'-6" and 6'-6' above the operation floor, orient the valve stems as close to horizontal as permitted by adjacent piping.

      3) In vertical pipe runs, orient the valve stems in the most accessible position for operation from the operating floor.

      4) For manually operated valves located beneath the trench grating, coordinate modification of grating over valve nuts to accommodate the operating wrench and coordinate valve locations and configuration to ensure wrench can be operated from the floor without obstruction.

4. The Contractor shall install all electrical wiring.

   a. Refer to Division 26, Electrical.

   b. Instrumentation and Control Components

      1) Instrument Mounting: Mount each instrument as specified herein and in accordance with manufacturer's printed instructions. Provide block valves for all instrument taps unless otherwise noted.

      2) Mounting Locations:

a) Provide clear space for front and rear access to interior and/or panel mounted components.

b) Orient displays for simultaneous viewing of process variable and process line.

c) Provide clear floor space for approach and observation.

3) Instrumentation Tubing:

a) Tubing shall be 316 stainless steel seamless. The use of plastic tubing will not be allowed.

b) Differential pressure transmitters shall be connected with 1/2-inch O.D. by 0.049-inch wall tubing. All other tubing shall be 1/4-inch O.D. by 0.035-inch wall tubing.

c) Tubing runs shall be neatly installed on horizontal and vertical alignment. All bends, where possible, shall be 90-degree angles. Multiple runs of tubing shall be properly supported with standard commercial spacers such that the tubing runs are in the same plane and uniformly spaced. The maximum distance between supports shall be five feet.

d) Tubing runs to differential pressure transmitters shall continuously slope upward to the pressure taps on the process piping. High points in these tube runs will not be allowed.

e) All tubing fittings shall be stainless steel double ferrule type, Swagelok or equal.

f) Pipe threads shall be used only where absolutely necessary. Pipe thread joints shall be made up with Teflon tape.

E. After the installation is complete, the MFEM, Contractor, and Engineer shall jointly perform a pre-commissioning inspection of the System. The inspection shall identify the following:

1. Mechanical

a. Membrane units shall be completely installed and unit and interconnecting piping shall be pressure tested.

b. The permeate pump system shall be completely installed and pressure tested.

c. The chemical systems shall be completely installed and pressure tested.

d. The compressed air system shall be completely installed and the piping pressure tested.

e. The air scour blower system shall be completely installed and pressure tested.

f. All other ancillary systems to the membranes shall be completely installed and pressure tested.

2. Electrical

   a. All local control panels shall be installed and terminations completed.

   b. All 480, 120, and 24VDC power supplies shall be connected and verified.

   c. The documentation associated with the inspection of electrical terminations shall be provided by the Contractor to the MFEM.

3. The Contractor shall be responsible for making any adjustments and/or modifications to the installation process that may become necessary to ensure that all equipment is properly installed.

4. The inspection shall identify any equipment that has not been properly installed, detailing the outstanding installation issues on a "List of Items Requiring Attention," noting the party who shall be responsible for each correction, and identify the items that require correction before commissioning can begin.

5. Once the corrections identified have been made, a "Notice of Completed Installation" shall be issued by the Engineer and commissioning shall commence in accordance with the Membrane Filtration System Procurement Contract Documents.

3.3 COMMISSIONING

A. The Contractor is responsible for all expenses incurred if any membrane equipment is damaged due to construction debris during equipment commissioning.

B. Scheduling:

1. The Contractor shall be responsible for coordination of all commissioning activities. The Contractor is responsible for preparing a schedule, which incorporates the MFEMs "Detailed Plan of Commissioning Activities."

2. Contractor shall submit schedules at least 30-days prior to commencement of commissioning activities and 30-days prior to the MF system acceptance tests.

3. The MFEM will schedule onsite activities with commissioning and acceptance test schedules developed by the Contractor.

C. MFEM Responsibilities

1. The MFEM will prepare a "Detailed Plan of Commissioning Activities" that will be used as a guideline for commissioning of the Goods provided by the MFEM. The "Detailed Plan of Commissioning Activities" that will be used as a guideline for placing the facility into operation shall be coordinated by the Contractor, the Engineer and the Owner. The MFEM will be responsible for providing labor, materials, equipment, and incidentals necessary to perform the MF system "Detailed Plan of Commissioning Activities" commissioning.

2. The MFEM will provide one set of PRELIMINARY O&M Manuals for the membrane system.

3. As a part of the commissioning, the MFEM shall start-up and operate all support systems provided by MFEM, including but not limited to chemical feed systems, instrumentation, air compression equipment, and electric controls. This testing shall demonstrate that there are no water or air leaks in the System, that the piping has been installed and connected properly, that the electrical system is operating correctly, and that the instrumentation has been properly calibrated. Contractor shall coordinate this startup, testing, and commissioning with other plant processes and equipment commissioning.

4. The MFEM shall furnish materials, instruments, and incidental and expendable equipment required for commissioning/placing the equipment into operation.

5. The new membrane modules will be shipped to the site by the MFEM for installation by the Contractor. The MFEM shall oversee the installation the membrane modules by the Contractor.

6. The MFEM will be responsible for initial operation of the MF System and will make any required changes or adjustments necessary to perform the functions intended.

7. The MFEM shall retain the services of any manufacturer's representatives as required in the Contract Documents to assist with the commissioning / placing into operation of the Goods. The costs of these services shall be borne by the MFEM.

8. The MFEM will be responsible for having qualified manufacturers representatives on-site to place the rotating equipment (pumps, blowers, compressors). The MFEM will be responsible for testing for vibration, if required by the specifications.

D. Contractor's Responsibilities

1. Contractor is responsible for ensuring that installation is complete to a level that will allow the MFEM to complete commissioning activities, as described in the commissioning plan, without exceeding the MFEM scheduled number of days.
2. If Contractor installation is not complete to allow commissioning by the MFEM within the MFEM contracted days, the Contractor will be responsible for additional costs incurred as a result of delaying the MFEM.
3. The Contractor shall make provision for disposal of all storage and rinsing solutions.
4. The Contractor shall receive and store the new membrane modules. The Contractor shall unpack the new membrane modules and install them in accordance with the MFEM's installation instructions provided. The Contractor is responsible for assembly of modules into their support assemblies, membrane tank support structures and installation into membrane tank support structures.
5. When the modules have been installed, the Contractor shall assist the MFEM with leak testing.

E. When requested by the MFEM, the Engineer shall review the operation of the equipment to verify that the commissioning is complete.

F. Commissioning Inspection: After the installation is complete, the MFEM, Contractor, and Engineer shall jointly perform a commissioning inspection of the System. The inspection shall identify the following:

1. The Engineer shall perform random tests to determine if the equipment is operating properly and witness various operational sequences.

2. Perform and review the results of the Functional Acceptance Test (FAT) as required by the MFEM Procurement Documents.

3. The Engineer may initiate alarm conditions to determine if the control system is functioning properly.

4. The Engineer's review shall include a review of the control system commissioning requirements to determine conformance with the Contract Documents.

5. The Engineer's inspection shall identify any equipment that has not been properly installed or operating, detailing the outstanding installation issues on a "List of Items Requiring Attention" and noting the party who shall be responsible for each correction and identify the items require that correction.

6. Once the corrections have been made, a "Notice of Completed Commissioning" shall be issued by the Engineer and commissioning shall commence in accordance with the requirements of Section 01650.

G. Once the "Notice of Completed Commissioning" is issued, training of operation and maintenance personnel may commence.

3.4 OPERATOR TRAINING

A. Upon completion of the MF plant commissioning, the Owner shall submit a written "Notice of Completed Commissioning" to the MFEM and the Contractor. Upon receipt of the written "Notice of Completed Commissioning", the MFEM and the Contractor shall provide operator training.

B. The Contractor shall be responsible for coordination of all training activities.

C. If Contractor and MFEM training is not complete to allow Acceptance Testing by the MFEM within the MFEM contracted days, the Contractor shall be responsible for additional costs incurred as a result of delays to the MFEM.

D. The MFEM shall schedule onsite training activities and coordinate training with the Contractor.

E. The Contractor shall assist the MFEM with operator training during the times allocated in the Contract Documents.

F. The Contractor shall provide training for equipment provided by the Contractor under this contract.

G. Upon completion of the operator training, the Engineer shall submit a "Notice of Completed Training".

3.5 ACCEPTANCE TESTING

A. Upon completion of the operator training, the Owner shall submit a written "Notice of Completed Training" to the MFEM and the Contractor. Upon receipt of the written "Notice of Completed Training", the MFEM and the Contractor shall perform an Acceptance Test on the MF System.

B. If Contractor activities do not allow acceptance testing to be completed within the MFEM contracted days, the Contractor will be responsible for additional costs incurred as a result of delays to the MFEM.

C. The MFEM will supervise the Acceptance Testing of the MF System.

D. The MFEM and the Contractor shall perform a 30 day Acceptance Test on the MF System upon completion of installation and Commissioning.

E. The Contractor shall provide personnel on-site during the Acceptance Test to fix any problems encountered with the equipment installation.

F. The purpose of the Acceptance Test is to demonstrate the following:

1. The system was properly installed.
2. The system is ready to be placed into service by the Owner.
3. The system is in compliance with the service conditions, performance requirements, material specifications, and other requirements specified by the Contract Documents.

G. The MFEM will furnish all materials, instruments, and incidental and expendable equipment required for the Acceptance Tests, except otherwise specified.

H. The MFEM and Contractor shall be onsite during normal working hours during the Acceptance Testing period.

I. The MFEM and Contractor shall notify the Owner at least 48 hours prior to beginning the Acceptance Testing.

J. The Owner or authorized representative will be present to witness the Acceptance Testing.

K. If the Acceptance Test is interrupted at the request of the MFEM or the Contractor, or due to the performance of the equipment, the test will be restarted as required in Section 01 65 00.

L. Any interruption of the Acceptance Testing caused by the circumstances beyond the control of the MFEM or the Contractor may not require the testing to be restarted from the beginning. The elapsed time of acceptance testing prior to the interruption will be applied to the required testing period.

M. Successful completion of the Acceptance Testing and receipt of the revised operations and maintenance manuals for the MF System and the ancillary equipment provided by both the MFEM and the Contractor shall be required for final acceptance of the equipment.

3.6 OPERATIONAL ASSISTANCE

A. The MFEM will provide Operations Assistance to the Owner during the Acceptance Test.

B. Operational Assistance shall be provided by the MFEM to the Contractor to allow the Contractor to coordinate the Commissioning and Acceptance Testing of facilities not provided by the MFEM.

C. Operational Assistance shall be provided by the MFEM to the Contractor during such times when the MFEM is not involved in any scheduled activity associated with commissioning, operator training, or Acceptance Testing for the amount of time indicated in the Contract Documents.

D. If Contractor activities do not allow completion of the activities completed within the MFEM allocated time, the Contractor will be responsible for additional costs incurred as a result of delays to the MFEM.

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SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Escutcheons.
6. Equipment installation requirements common to equipment sections.
7. Supports and anchorages.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately

modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

2.1 MATERIAL COMPATABILITY

A. All materials used for plumbing systems shall be compatible with the room environment. The contractor and supplier shall coordinate with the chemicals and gases that shall be present in the room. Materials selected shall not be subject to negative effect such as premature corrosion, etc.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

F. Solvent Cements for Joining Plastic Piping:
   1. CPVC Piping: ASTM F 493.
   2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
   3. PVC to ABS Piping Transition: ASTM D 3138.

2.4 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C. Pressure Plates: Stainless steel. Include two for each sealing element. Use plastic resistant to Alum and Sodium Hypochlorite in corrosive spaces.

D. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

A. Stainless Steel Sheet: A316 Stainless Steel Sleeve. 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint. CPVC transitions to occur outside of corrosive spaces.

B. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated. To be used in non-corrosive areas.

C. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening. Not to be used in corrosive spaces.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated and rough brass.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated and rough brass.

2.7 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

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SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Metal pipe hangers and supports.
2. Metal framing systems.
3. Fastener systems.
4. Equipment supports.

B. See Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

C. See Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-suppression piping.

D. See Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.

E. See Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.2 DEFINITIONS

A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Metal pipe hangers and supports.
2. Powder-actuated fastener systems.

B. Shop Drawings:[**Signed and sealed by a qualified professional engineer.**] Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Equipment supports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. All materials used for plumbing systems shall be compatible with the room environment (probably methane and hydrogen-sulfide gases). The contractor and supplier shall coordinate with the chemicals and gases that shall be present in the room. Materials selected shall not be subject to negative effect such as premature corrosion, etc.

B. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

C. Manufacturers:

1. AAA Technology & Specialties Co., Inc.
2. Bergen-Power Pipe Supports.
3. B-Line Systems, Inc.; a division of Cooper Industries.
4. Carpenter & Paterson, Inc.
5. Empire Industries, Inc.
6. ERICO/Michigan Hanger Co.

7. Globe Pipe Hanger Products, Inc.
8. Grinnell Corp.
9. GS Metals Corp.
10. National Pipe Hanger Corporation.
11. PHD Manufacturing, Inc.
12. PHS Industries, Inc.
13. Piping Technology & Products, Inc.
14. Tolco Inc.

D. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

E. Nonmetallic Coatings: Plastic coating, jacket, or liner.

F. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of metal channels and other components.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. GS Metals Corp.
4. Power-Strut Div.; Tyco International, Ltd.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's coated finish.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Masterset Fastening Systems, Inc.
d. MKT Fastening, LLC.

e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Empire Industries, Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head.
e. MKT Fastening, LLC.
f. Powers Fasteners.

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi , 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30
2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. 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 180 deg F piping installations.

I. 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): 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. Use one of the following for light loads (MSS Type 31): up to 750 lb.

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

J. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

K. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

C. Fastener System Installation:

1. Install powder-actuated fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

D. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

F. Install hangers and supports to allow controlled thermal and seismic 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. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

I. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

3.3 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 smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.5 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

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SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.

1.2 SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Where applicable include CFM, GPM, static pressure, HP, and Voltage

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section

number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

C. 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: 1" for piping 2 1/2" and smaller in diameter. 2" for piping 3" and larger in diameter.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "[Interior Painting] [High-Performance Coatings]."

B. 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 (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.

C. Pipe Label Color Schedule:

1. Gas Piping:

    a. Background Color: Yellow.
    b. Letter Color: Black.

2. All Other Plumbing Piping:

    a. Background Color: Green.
    b. Letter Color: White

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SECTION 22 13 19
SANITARY WASTE PIPING & SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Piping
2. Cleanouts.
3. Floor drains.
4. Trench drains.
5. Roof flashing assemblies.
6. Miscellaneous sanitary drainage piping specialties.
7. Flashing materials.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 MATERIAL COMPATIBILITY

A. All materials used for sanitary waste piping and specialties shall be compatible with the room environment. The contractor and supplier shall coordinate with the chemicals and gases that shall be present in the room. Materials selected shall not be subject to negative effect such as premature corrosion, etc.

2.2 SANITARY WASTE PIPING

A. Sanitary waste piping below slabs shall be standard weight DWV schedule 40 solid core PVC ASTM F 1488 piping.

B. Sanitary waste piping above slabs shall be standard weight DWV schedule 40 solid core PVC ASTM F 1488 piping.

C. Sanitary waste and vent piping above grade in areas with ceiling return air plenums shall be standard weight cast iron pipe with no-hub, TY-SEAL, MG, or AB&I 'BEST SET' gasketed fittings for sizes 2" and larger; and Schedule 40 galvanized iron with tarred Durham drainage fittings for 1-1/2".
   1. No-Hub couplings: No-hub coupling shall conform to CISPI Standard 310 and shall be listed by NSF international.
   2. Compression Gaskets for Hub & Spigot: Compression gaskets shall conform to the requirements of ASTM Standard C564 and ASTM C1563.
   3. Joints for pipe fittings shall conform to the manufacturer's installation instructions and local code requirements.

2.3 CLEANOUTS

A. Exposed Cleanouts:

   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Josam Company; Josam Div.
      b. MIFAB, Inc.
      c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      d. Tyler Pipe; Wade Div.
      e. Watts Drainage Products Inc.
      f. Zurn Plumbing Products Group; Specification Drainage Operation.
   2. Size: Same as connected drainage piping
   3. Body Material: Hub-and-spigot, PVC soil pipe T-branch, or Hubless, PVC soil pipe test tee as required to match connected piping.
   4. Closure: Countersunk plug.
   5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Floor Cleanouts:

   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Josam Company; Josam Div.
      b. Oatey.
      c. Sioux Chief Manufacturing Company, Inc.
      d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

e. Tyler Pipe; Wade Div.

f. Watts Drainage Products Inc.

g. Zurn Plumbing Products Group; Light Commercial Operation.

h. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Size: Same as connected branch.

3. Type: Heavy-duty, adjustable housing.

4. Body or Ferrule: Cast iron.

5. Clamping Device: Required.

6. Outlet Connection: Inside calk.

7. Closure: Brass plug with straight threads and gasket.

8. Adjustable Housing Material: Cast iron with threads, set-screws or other device.

9. Frame and Cover Material and Finish: Polished bronze.

10. Frame and Cover Shape: Round.

11. Top Loading Classification: Heavy Duty.

12. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.

C. Wall Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Josam Company; Josam Div.

b. MIFAB, Inc.

c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

d. Tyler Pipe; Wade Div.

e. Watts Drainage Products Inc.

f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.

3. Size: Same as connected drainage piping.

4. Body: Hub-and-spigot, PVC soil pipe T-branch, or Hubless, PVC soil pipe test tee as required to match connected piping.

5. Closure: Countersunk or raised-head plug.

6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

7. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.4 FLOOR DRAINS

A. Cast-Iron Floor Drains: Zurn #Z-415-4 2" cast iron drain with nickel bronze round top. Drain to have deep seal P-trap. Provide Pro Vent systems Proset trap guard (or approved equal) in all floor drains.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Zurn Plumbing Products
2. Standard: ASME A112.6.3 with trap guard.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
10. Sediment Bucket: Required in large drains.
11. Top or Strainer Material: Bronze.
12. Top of Body and Strainer Finish: Polished bronze.
13. Top Shape: Round.
14. Top Loading Classification: Heavy Duty.
15. Trap Material: Cast iron.
16. Trap Pattern: Deep-seal P-trap.

2.5 TRENCH DRAINS

1. Zurn Z874-12 HDG (or prior approved equal) high density polyethylene (HDPE) pre-sloped drain system with galvanized iron frame and DGC-CBF black acid resistant epoxy coated ductile iron class C grating and grating hold-down devices. Channel shall be 12” wide, come in typical 80” lengths, and have a built in slope of 1.0%. Trench drain shall empty with 4” outlet into a 24”x24” catch basin (Zurn Z887-24 or prior approved equal) with DGC-CBF black acid resistant epoxy coated ductile iron class C grating and sediment bucket. Drain from catch basin shall be drilled for 4" outlet with deep seal trap. See plan for length and drain outlet locations.

2. Top Loading Classification: Heavy Duty – load class C.

3. Trap Material: Cast iron.

4. Trap Pattern: Deep-seal P-trap.

2.6 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Acorn Engineering Company; Elmdor/Stoneman Div.

b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 4.0-pounds/square feet, 0.0625-inch thick, lead flashing collar and skirt extending at least eight inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

1. Open-Top Vent Cap: Without cap.

2. Low-Silhouette Vent Cap: With vandal-proof vent cap.

3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.7 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.

2. Size: Same as connected waste piping.

a. NPS 2: 4-inch- minimum water seal.

b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.

2. Body: Bronze or cast iron.

3. Inlet: Opening in top of body.

4. Outlet: Larger than inlet.

5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

C. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.

2. Size: As required for close fit to riser or stack piping.

D. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

2. Size: Same as connected stack vent or vent stack.

E. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.

2. Size: Same as connected stack vent or vent stack.

2.8 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-pounds/square foot, 0.0625-inch thickness.

2. Vent Pipe Flashing: 3.0- pounds/square foot, 0.0469-inch thickness.

3. Burning: 6- pounds/square foot, 0.0938-inch thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Solder: ASTM B 32, lead-free alloy.

E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section Common Work Results for Plumbing for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    a. Radius, 30 Inches or Less: Equivalent to one percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to one percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to one percent slope, but not greater than 1-inch total depression.
3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

H. Install deep-seal traps on floor drains and other waste outlets, if indicated.

I. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.

2. Size: Same as floor drain inlet.

J. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

K. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

L. Install vent caps on each vent pipe passing through roof.

M. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

N. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-pounds/square foot, 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-pounds/square foot, 0.0625-inch thickness or thinner.

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 pipe size, with minimum length of 10 inches, and skirt or flange extending at least eight inches around pipe.

2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least eight around sleeve.

3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least eight inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section Sheet Metal Flashing and Trim.

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

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.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

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SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.

2. Mechanical sleeve seals.

3. Sleeves.

4. Escutcheons.

5. Equipment installation requirements common to equipment sections.

6. Supports and anchorages.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 QUALITY ASSURANCE

A. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

2.1 MATERIAL COMPATIBILITY

A. All materials used shall be compatible with the room environment. The contractor and supplier shall coordinate with the chemicals and gases that shall be present in the room. Materials selected shall not be subject to negative effect such as premature corrosion, etc.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

2.3 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solvent Cements for Joining Plastic Piping:

1. CPVC Piping: ASTM F 493.

2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.4 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C. Pressure Plates: Carbon steel. Include two for each sealing element.

D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Piping material shall be coordinated with chemicals and gases that may be present in the room environment. Pipe and fittings shall be compatible with the associated environment and not be negatively affected by pre-mature corrosion, etc.

C. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

D. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

E. 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.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Install piping to permit valve servicing.

H. Install piping at indicated slopes.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Install piping to allow application of insulation.

L. Select system components with pressure rating equal to or greater than system operating pressure.

M. Install escutcheons for penetrations of walls, ceilings, and floors.

N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.

2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 84 10 “Through Penetration Firestop Systems” for materials.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs.

C. Remove dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

F. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.

2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

4. PVC Nonpressure Piping: Join according to ASTM D 2855.

G. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

H. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

I. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 SECURING TO CONCRETE BASES

A. Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.

3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.

6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 03.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section Metal Fabrications for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

END OF SECTION

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SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment supports.

B. See Division 05 Section Metal Fabrications for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

C. See Division 21 for pipe hangers for fire-protection piping.

D. See Division 23 05 48 “Vibration and Seismic” for vibration isolation devices.

E. See Division 23 31 13 “Metal Ducts” for duct hangers and supports.

1.2 DEFINITIONS

A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Metal pipe hangers and supports.

2. Thermal-hanger shield inserts.

3. Powder-actuated fastener systems.

B. Shop Drawings: Signed and sealed by a qualified professional engineer**.** Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.

2. Metal framing systems. Include Product Data for components.

3. Equipment supports.

PART 2 - PRODUCTS

2.1 MATERIAL COMPATIBILITY

A. All materials used for hangers, supports, and shields shall be compatible with the room environment. The contractor and supplier shall coordinate with the chemicals and gases that shall be present in the room. Materials selected shall not be subject to negative effect such as premature corrosion, etc.

2.2 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.3 METAL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Available Manufacturers:

1. AAA Technology & Specialties Co., Inc.

2. Bergen-Power Pipe Supports.

3. B-Line Systems, Inc.; a division of Cooper Industries.

4. Carpenter & Paterson, Inc.

5. Empire Industries, Inc.

6. ERICO/Michigan Hanger Co.

7. Globe Pipe Hanger Products, Inc.

8. Grinnell Corp.

9. GS Metals Corp.

10. National Pipe Hanger Corporation.

11. PHD Manufacturing, Inc.

12. PHS Industries, Inc.

13. Piping Technology & Products, Inc.

14. Tolco Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of metal channels and other components.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.

2. ERICO/Michigan Hanger Co.; ERISTRUT Div.

3. GS Metals Corp.

4. Power-Strut Div.; Tyco International, Ltd.

5. Thomas & Betts Corporation.

6. Tolco Inc.

7. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- (690-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Available Manufacturers:

1. Carpenter & Paterson, Inc.

2. ERICO/Michigan Hanger Co.

3. PHS Industries, Inc.

4. Pipe Shields, Inc.

5. Rilco Manufacturing Company, Inc.

6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Available Manufacturers:

a. Hilti, Inc.

b. ITW Ramset/Red Head.

c. Masterset Fastening Systems, Inc.

d. MKT Fastening, LLC.

e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Available Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.

b. Empire Industries, Inc.

c. Hilti, Inc.

d. ITW Ramset/Red Head.

e. MKT Fastening, LLC.

f. Powers Fasteners.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel or other environment compatible metal shapes.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. 316 Stainless steel

C. Aluminum.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Use only hanger, support, and sheild material compatible with the room environment. Coordinate carefully with chemicals and gases that shall be present in the rooms where using hangers and support to ensure materials shall not pre-maturely corrode, etc.

B. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

C. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

D. In compatible areas, use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

E. In compatible areas, use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

F. Use padded hangers for piping that is subject to scratching.

G. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Metal Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN 100 to DN 400), requiring up to 4 inches (100 mm) of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN 20 to DN 600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.

4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).

5. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).

6. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange.

7. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.

8. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

I. 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 (150 mm) for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

J. 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): 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. Use one of the following for indicated loads:

a. Light (MSS Type 31): 750 lb (340 kg).

b. Medium (MSS Type 32): 1500 lb (680 kg).

c. Heavy (MSS Type 33): 3000 lb (1360 kg).

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

K. 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.

L. 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 (32 mm).

2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.

3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.

M. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

N. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic 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.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including flanges and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

M. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

    a. All Piping: Use thermal-hanger shield insert with clamp sized to match OD of insert.

    b. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.

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.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.

    b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.

    c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.

d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.

e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood inserts.

6. Insert Material: Length at least as long as protective shield.

7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

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SECTION 23 05 48
VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Restrained spring isolators.
5. Housed spring mounts.
6. Elastomeric hangers.
7. Pipe riser resilient supports.
8. Resilient pipe guides.
9. Restraining braces and cables.

1.2 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:

1. Basic Wind Speed: 110 MPH
2. Building Classification Category: IV.
3. Minimum 10 lb/sq. ft. multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

B. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: D
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: III.
    a. Component Importance Factor: 1.5.
    b. Component Response Modification Factor: 5.0.

c. Component Amplification Factor: 2.5.

3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 90.

4. Design Spectral Response Acceleration at 1-Second Period: 40.

1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Qualification Data: For professional engineer.

D. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 MATERIAL COMPATIBILITY

A. All materials used for vibration and seismic control shall be compatible with the room environment. The contractor and supplier shall coordinate with the chemicals and gases that shall be present in the room. Materials selected shall not be subject to negative effect such as premature corrosion, etc.

2.2 VIBRATION ISOLATORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings, or a comparable product by one of the following:

1. Ace Mountings Co., Inc.

2. Amber/Booth Company, Inc.

3. California Dynamics Corporation.

4. Isolation Technology, Inc.

5. Kinetics Noise Control.

6. Mason Industries.

7. Seismic Restraint Systems

8. Vibration Eliminator Co., Inc.

9. Vibration Isolation.

10. Vibration Mountings & Controls, Inc.

D. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

E. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

F. Restrained Mounts: All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded

element and attachment hardware from contacting the housing during normal operation.

2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

G. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

2. Minimum Additional Travel: 50 percent of the required deflection at rated load.

3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.

6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

H. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.

2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

4. Minimum Additional Travel: 50 percent of the required deflection at rated load.

5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

I. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.

2. Base: Factory drilled for bolting to structure.

3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel up or down before contacting a resilient collar.

J. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

K. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.

L. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.3 SEISMIC-RESTRAINT DEVICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings, or a comparable product by one of the following:

1. Amber/Booth Company, Inc.

2. California Dynamics Corporation.

3. Cooper B-Line, Inc.; a division of Cooper Industries.

4. Hilti, Inc.

5. Kinetics Noise Control.

6. Loos & Co.; Cableware Division.

7. Mason Industries.

8. Seismic Restraint Systems (SRS).

9. TOLCO Incorporated; a brand of NIBCO INC.

10. Unistrut; Tyco International, Ltd.

D. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES, or an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

E. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

F. Restraint Cables: ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

G. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

H. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

I. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

J. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES, or an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.2 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Comply with requirements in Division 07 for installation of roof curbs, equipment supports, and roof penetrations.

B. Equipment Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.

2. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, or an agency acceptable to authorities having jurisdiction providing required submittals for component.

C. Piping Restraints:

1. Comply with requirements in MSS SP-127.

2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.

3. Brace a change of direction longer than 12 feet.

D. Install cables so they do not bend across edges of adjacent equipment or building structure.

E. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES, or an agency acceptable to authorities having jurisdiction providing required submittals for component.

F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

H. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Set anchors to manufacturer's recommended torque, using a torque wrench.

5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.

3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.

4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.

5. Test to 90 percent of rated proof load of device.

6. Measure isolator restraint clearance.

7. Measure isolator deflection.

8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.6 HVAC VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE SCHEDULE

A. Supported or Suspended Equipment:

1. Equipment Location: HVAC Room.

2. Pads:

a. Material: Rubber.

b. Thickness: 1 inch.

c. Number of Pads: 2 thick.

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SECTION 23 05 53
IDENTIFICATION FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.

2. Warning signs and labels.

1.2 SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 MATERIAL COMPATIBILITY

A. All materials used for identification tags and labels shall be compatible with the room environment. The contractor and supplier shall coordinate with the chemicals and gases that shall be present in the room. Materials selected shall not be subject to negative effect such as premature corrosion, etc.

2.2 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Aluminum, 0.032-inch (0.8-mm) or anodized aluminum, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

4. Fasteners: Stainless-steel self-tapping screws.

5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.3 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

END OF SECTION