Project Manual

City of Sterling Heights
Parks & Recreation
Dodge Park Improvements
Sterling Heights, Michigan

DMA JOB #16078A

ARCHITECT:
DORCHEN/MARTIN ASSOCIATES, INC.
29895 GREENFIELD ROAD, SUITE 107
SOUTHFIELD, MICHIGAN 48076
ph. 248.557.1062
fax 248.557.1231

CIVIL ENGINEER:
NOWAK & FRAUS
46777 WOODWARD AVE.
PONTIAC, MICHICAN 48342
ph. 248.332.7931

LANDSCAPE ARCHITECT:
FELINO A. PASQUAL AND ASSOCIATES
24333 ORCHARD LAKE ROAD, SUITE G
FARMINGTON HILLS, MICHIGAN 48336
ph. 248.557.5588
fax 248.557.5416

STRUCTURAL ENGINEER:
JOHNSTON DESIGN, INC.
114 WOMPOLE DRIVE
CLARKSTON, MICHIGAN 48346
ph. 248.620.6489
fax 248.625.9530

M/E/P ENGINEERS:
STRATEGIC ENERGY SOLUTIONS
4000 W. ELEVEN MILE RD.
BERKLEY, MICHIGAN 48072
ph. 248.399.1900
fax 248.399.1901

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CITY OF STERLING HEIGHTS
INVITATION / ADVERTISEMENT FOR BID
Dodge Park Improvements

Proposal: General contractors are invited to submit sealed bids to the City of Sterling Heights, City Clerk's Office, 40555 Utica Road, Sterling Heights, MI 48313. The work includes the demolition of several existing park features and the construction of several new parks structures and features. The demolition includes but is not limited to the removal of the Parks & Recreation Building, four (4) pavilions, basketball court, fenced in-line skating rink as well as specific parking areas and walkways. The new work includes new and resurfaced parking lots, new and resurfaced pathways, an Amphitheater, Farmers Market with a seasonal ice rink, a Mini-Soccer Field, Splash Park seating areas and ticket booth, four (4) Sand Volleyball Courts and renovations to the existing Restroom Building.

Due Date: Bids will be received until **2:30 pm, Tuesday, July 11, 2017 by the City Clerk's Office** at which time and place all bids will be opened publicly and read in the **City Council Chambers**. Any bids received after the deadline will be deemed late and not opened nor considered.

Time of Completion: The Contractor shall complete the paperwork and execute the Contract within 14 days of the Award. Tentative contract award date: August 1, 2017. It is anticipated that the work will begin on August 14, 2017 and shall be completed by June 18, 2018 in accordance with the proposal.

Contract Documents: All Contract Documents will be available starting **Monday, June 19, 2017**.

All Contract Documents will also be available through the Michigan Inter-governmental Trade Network (MITN) www.mitn.info. Copies of bid documents obtained from any other source are not considered official copies. Bids or notification of bids issued by members of MITN are to be posted, in whole or in part, only on the MITN system. Only the bidders who obtain bid documents from the MITN system are guaranteed access to receive addendum information, if such information is issued. The City of Sterling Heights cannot guarantee the accuracy of any information not obtained from the MITN website and is not responsible for any errors contained by information received from other sources.

All Contract Documents will be on file and may be examined (after June 19, 2017) at the offices of Dorchen/Martin Associates, Inc., 29895 Greenfield Road, Suite 107, Southfield, MI 48076, (248) 557-1062.

Pre-Bid Meeting: A pre-bid meeting will be held on Thursday, June 29 2017 at 1:30 pm in the City Council Chambers located at the City of Sterling Heights, 40555 Utica Road, Sterling Heights, MI. Attendance is not required, but it is strongly recommended that bidders attend this meeting.

Bid Security: Each bid must be accompanied by certified check of the bidder, or a bid bond duly executed by the bidder as principal and having as surety thereon a surety company approved by the City in the amount of 5% of the bid as a guarantee on the part of the bidder that he will, if called upon to do so, enter into contract in the attached form, to do the work covered by such proposal and at the price stated therein and to furnish acceptable surety for its faithful and entire fulfillment. Such checks or bid bonds will be returned to all except the three lowest bidders within three days after the opening of bids, and the remaining checks or bid bonds will be returned promptly after the City and the accepted bidder have executed the Contract or if no award has been made within ninety days after the date of the opening of

bids, upon demand of the bidder at any time thereafter, so long as he has not been notified of the acceptance of his bid.

Bid Submission: Each proposal shall be submitted as detailed below:

Your hard copy bid must be submitted in a sealed envelope or other form of sealed packaging on the forms provided and shall be enclosed in a sealed envelope plainly marked "City of Sterling Heights Parks & Recreation, Dodge Park Improvements, "July 11, 2017 2:30 pm." on the outside. **NO PHONE OR FAX BIDS WILL BE ACCEPTED.** If a hard copy bid is to be express mailed, "**Bid Documents Enclosed**" must be conspicuously marked on the package.

RIGHTS RESERVED BY THE OWNER: The City of Sterling Heights reserves the right to reject any or all bids, to waive any informalities in the bidding and to accept the bid deemed to be in the best interest of the City.

REQUEST FOR QUALIFICATIONS

All bidders must complete the following Questionnaire. This information may be presented on another page if desired.

1. Name of Company submitting a bid:

2. Authorized Representative Name/Title:

3. Office Address:

4. Local Telephone/Fax Numbers:

24-Hour/7-Day Emergency Telephone Number:

E-mail address:

Website:

5. State the legal status of the company submitting the bid. A corporation shall provide the state of incorporation, a partnership shall provide the names of all partners:

6. Name of Owner, President, Managing Partner or CEO:

7. Give a brief summary of the history of the business:

8. How many full time employees? Part time?

9. How long have you been in business of a similar nature for the services contemplated within this bid?

10. List any licenses / professional certifications of the company or employees assigned to this contract that would be applicable to services contemplated within this bid.

REFERENCES

List at least three references with whom you have had similar contracts during the past three years. Include letters of reference when available.

1. Company or City_____

   Contact Name_____

   Telephone Number_____

   E-mail_____

2. Company or City_____

   Contact Name_____

   Telephone Number_____

   E-mail_____

3. Company or City_____

   Contact Name_____

   Telephone Number_____

   E-mail_____

Bidder's Signature_____ Date_____

Company_____

This form **must** be completed and returned with your bid.

11. How many years experience do you have in providing for the services contemplated within this bid? Please list the municipalities, when applicable:

12. How many clients does your company currently serve with the type of work described?

13. Has your company had a similar contract for services terminated for cause within the last three years? If yes, please explain.

14. Please provide information on your hiring practices, employee training and employee safety programs:

15. Provide information relative to the experience and financial capability of your company to carry out the terms of this contract:

16. Do you have any current contracts for similar services in Sterling Heights? If yes, please list location(s):

Questionnaire completed by:

Company Name:_____

Print Name_____

Title_____

Signature_____

Date:_____

This form must be completed and returned with your bid.

CITY OF STERLING HEIGHTS
INSTRUCTIONS TO BIDDERS
Dodge Park Improvements

SCOPE OF WORK
The work under this contract shall consist of the furnishing of all labor, material, equipment, services, and all incidental items necessary to complete the project in accordance with the Contract Documents.

INSPECTION OF SITE
Before submitting a Proposal, each bidder shall personally inspect the site of the proposed work to arrive at a clear understanding of the conditions under which the work is to be done. A pre-bid conference for prospective bidders will be held on Thursday, June 29, 2017 at 1:30 pm in the Council Chambers located at the City of Sterling Heights, 40555 Utica Road, Sterling Heights, Michigan.

Each bidder shall be held to have compared the premises with the Drawings and Specifications and to have satisfied himself as to the conditions of the premises, existing constructions, and any other conditions affecting the carrying out of the work, before delivery of his Proposal.

No allowance or extra consideration on behalf of the Contractor will subsequently be allowed by reason of error or oversight on the part of the Contractor or on account of interferences by the Owner's or by other Contractors' activities.

INVITATION / ADVERTISEMENT FOR BID
The Invitation / Advertisement for the proposed work contains information necessary to bidders. A copy of the Invitation / Advertisement shall be considered a part of the Instructions to Bidders as fully as if repeated herein.

PROPOSALS
Proposals will be received in accordance with the Invitation / Advertisement for Bid, and shall be submitted only on forms provided in the Project Manual.

All information shall be entered in ink or typewritten. Mistakes may be crossed out and corrections inserted before submission of your bid.

Corrections shall be initialed in ink by the person signing the bid. Corrections and/or modifications received after the closing time specified will not be accepted.

Proposals shall be made in full conformity with all the conditions set forth on the Drawings and in the Project Manual / Specifications. Bids are firm and cannot be altered or withdrawn for a period of 90 days after opening.

NAME AND STATUS OF BIDDER
The name and legal status of the bidder, either as a corporation, partnership, or individual, shall be stated on the Proposal form. A corporation bidder shall give the state in which incorporated, a partnership bidder shall give all the names of the partners. Partnerships and individual bidders will be required to state on the Proposal form the names of all persons interested therein.

Anyone signing a Proposal as an agent of another or others must submit with the proposal legal evidence of his authority to do so.

The place of residence of each bidder, or the office address and telephone number in the case of a firm or company, with County and State, must be given after his signature.

BIDDER'S QUALIFICATIONS

It is the intention of the Owner to award this contract to a Contractor fully capable, both financially and with regards to experience, of performing and completing the work in a satisfactory manner. If required by the Owner, each bidder under consideration may be required to furnish the Owner, within 48 hours at the Owner's request, the following information sworn to under oath by him:

1. Performance record, as well as the address and description of the bidder's place of business.
2. Itemized list of equipment available for use on the project.
3. A description of any similar project which the bidder has constructed in a satisfactory manner.
4. A certified or authenticated financial statement dated within sixty days prior to the opening of bids. Owner may require that any items of such statements be further verified.
5. A list of contracts on which the bidder is currently engaged.
6. Such additional information as will satisfy the Owner that the bidder is adequately prepared, in technical experience and otherwise, to fulfill the contract.

The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the Owner that such bidder is properly qualified to carry out the obligations of the Contract and to complete the work contemplated therein. Conditional bids will not be accepted.

SOIL CONDITIONS

The contractor, as such and as bidder, shall make his own determination as to soil conditions and shall assume all risk and responsibility and shall complete the work in whatever material and under whatever condition he may encounter or create, without extra cost to the Owner. This shall apply whether or not borings are shown on the drawings.

A small number of borings have been made. These borings have been made by a disinterested soils engineer and the reports are available in the project manual. The information is offered to the bidder as evidence of ground conditions at only certain locations and the bidder himself shall assume the entire responsibility for any conclusions which he may draw from it. The Owner does not guarantee, however, that the ground encountered during construction will conform with these borings and the bidders should secure such other information as they consider necessary to check and supplement the data.

SECURITY FOR FAITHFUL PERFORMANCE

The bids shall be accompanied by a letter from a surety company satisfactory to the Owner stating that the necessary bonds will be furnished by it to the Contractor bidding in the event that he is successful.

The successful bidder will be required to furnish the following guaranty bonds:

1. The bidder shall furnish a surety bond in an amount at least equal to one hundred percent of the Contract price as security for faithful performance of this Contract.
2. The Bidder shall also furnish a separate surety bond in an amount at least equal to one hundred percent of the Contract price as security for payment of all persons performing labor, furnishing materials and equipment rental in connection with this Contract.

WITHDRAWING PROPOSAL
A proposal after being submitted may be withdrawn when request therefore is made in writing by the Bidder before the time designated in the Invitation / Advertisement to Bid for the opening of proposals.

ORDER OF WORK
The right to prescribe the order in which to work called for under this contract is to be done will be retained by the Owner.

SUNDAY, HOLIDAY WORK AND NIGHT WORK
Sunday, Holiday and after hours work will be permitted with advance notification to the City.

BID SECURITY
Bid security shall accompany all bids as specified in the Invitation / Advertisement for Bid.

EXPLANATION TO BIDDERS BY ADDENDUMS
Neither the Owner nor the Architect will give verbal answers to inquiries, regarding the meaning of the Drawings or Specifications, or give verbal instructions, previous to the award of the contract. Any verbal statements regarding same by any persons, previous to the award, shall be unauthoritative.

Explanations desired by bidders shall be requested of the Architect in writing and, if explanations are necessary, a reply will be made in the form of an Addendum, a copy of which will be forwarded to each bidder who is known to have received Bidding Documents.

Addendums issued to bidders prior to date of receipt of proposals shall become a part of the Bidding Documents and all Proposals shall include the work described in the Addendums.

All requests for interpretation or requests to use unspecified products shall be made by Thursday, July 6, 2017 at 3:00 pm.

Failure of the Architect to send, or of the bidder to receive, any such interpretations shall not relieve the bidder from obligation under his bid as submitted.

RIGHT TO ACCEPT, TO REJECT, AND TO WAIVE DEFECTS
The Owner reserves the right: 1) To award bids received on the basis of individual items, or groups of items, or on the entire list of items, (2) To reject any or all bids, or any part thereof, (3) To waive any irregularity in the bids, (4) To accept the bid that is in the best interest of the City, (5) To reduce or eliminate this purchase without prior notice, (6) To split the award to realize the greatest cost savings, (7) To issue Post-Bid Addendums to clarify or request additional information, including pricing, (8) To require one or more selected bidders to perform the requested service on a trial basis, at the unit prices bid, as evidence of a bidders ability to satisfactorily perform the requested service, prior to a formal recommendation and approval by City Administration / City Council.

TIME OF COMPLETION
The Contractor shall use sufficient labor and equipment to complete and place in service all of the work being constructed within this contract within the time specified in the Proposal.

If the Contractor shall be unavoidably delayed in beginning or fulfilling this Contract by reason of excessive storms or floods, or by Acts of Providence, or by strikes, or by court injunction, or by stopping of the work by the Owner because of any emergency or public necessity, or by reason of alterations ordered by the Owner, the Contractor shall have no valid claim for damages on account of any cause or delay; but he shall in such case be entitled to such an extension of the time limit in the Proposal, as the Architect shall adjudge to be just and reasonable; provided, however, that formal claim for such extension shall be made in writing by the Contractor within one week after the date upon which such alleged cause or delay shall have occurred.

LIQUIDATED DAMAGES
It is expressly covenanted and agreed that time is and shall be considered of the essence of the Contract. In the event that the Contractor fails to perform the entire work agreed to by the time specified in the Proposal, the Contractor shall pay unto the Owner as and for liquidated damages and not as a penalty, the sum of one thousand dollars ($1,000.00) for each and every calendar day that the Contractor shall be in default. Said sum of ($1,000.00) per day, in view of the difficulty of estimating such damages with exactness, is hereby expressly fixed and agreed upon as damages which will be suffered by the Owner for reason of such defaults. It is also understood and agreed that the liquidated damages herein before mentioned are in lieu of the actual damages arising from such breaches of this Contract which said sums the Owner shall have the right to deduct from any monies in his hands otherwise due or to become due to the Contractor or to sue for and recover compensation for damages for non-performance of this Contract at the time stipulated herein and provided.

SUBCONTRACTORS
The General Contractor will provide a list of subcontractors whom the Contractor intends to employ. The Owner reserves the right to disapprove use of any proposed subcontractor. The bidder can submit another subcontractor within the time frame specified by Owner.

BID SUBMISSION INSTRUCTIONS
Please read these instructions carefully. ***Your bid may be disqualified if it is not submitted as detailed below.***

Hard Copy Bid Submission
Your hard copy bid must be submitted in a sealed envelope or other form of sealed packaging labeled as follows: ***NO fax, email or electronic submissions will be accepted.***

ITB-SH17-030: Parks & Recreation Dodge Park Improvements
Date Due: July 11, 2017 at 2:30 p.m.

If the hard copy bid is to be express mailed, **"Bid Documents Enclosed"** must be conspicuously marked on the package. All hard copy bids, regardless of method used for delivery, are to be delivered to the following address:

City of Sterling Heights
Office of the City Clerk
Attn: Mark Carufel, City Clerk
40555 Utica Road
Sterling Heights, MI 48313

Please keep in mind that due to the City's mail safety regulations, if your envelope/package is not labeled

as directed, ***it may not be opened and will be disposed****.*

DO NOT deliver your bid to the requesting department. All bids ***must*** be delivered to the Office of the City Clerk before the due date and time so they can be stamped "Received" and filed appropriately. Bids are considered received when in the possession of the City Clerk. If your bid is not received before the due date and time, it will be disqualified and will not be opened or considered.

The City of Sterling Heights officially distributes bid documents through the Michigan Inter-governmental Trade Network (MITN). Copies of bid documents obtained from any other source are not considered official copies. Bids or notification of bids issued by members of MITN are to be posted, in whole or in part, **ONLY** on the MITN system. Any other use is prohibited. Only those vendors who obtain bid documents from the MITN system are guaranteed access to receive addendum information, if such information is issued. The City of Sterling Heights cannot guarantee the accuracy of any information not obtained from the MITN website and is not responsible for any errors contained by information received from alternate sources.

If you received this document from a source other than the sources indicated, please notify us. It is recommended that all vendors register on the MITN website at www.BidNetDirect.com/mitn to obtain an official copy. All future bids, proposals, quotes and any addenda and tabulations will be posted on the MITN website.

SECTION 003119 – EXISTING CONDITIONS

PART 1 - GENERAL

1.1 REQUIREMENTS, CODES

A. The GENERAL CONDITIONS and GENERAL REQUIREMENTS are made part of the Section.

B. Rules, regulations or laws of any controlling Governmental Agency shall govern, when they are more stringent than the requirements of this Section.

1.2 EXISTING CONDTITIONS SURVEYS

A. The information is made available for the convenience of all Bidders and is not a part of the Contract.

B. All Bidders must interpret this information according to their own judgment and acknowledge that they are not relying upon the information shown as accurately describing the conditions which may be found to exist.

C. Other components of the information, including but not limited to recommendations, may not be relied upon by the Bidders. The Owner shall not be responsible for any interpretation.

D. All Bidders further acknowledge that they assume all risk contingents upon the nature of the existing conditions which shall be actually be encountered by them.

E. All Bidders should visit the site and become acquainted with all existing conditions in relationship to this information and may make their own investigations to satisfy themselves as to the existing conditions. Such investigations shall be conducted only under time schedules and arrangements approved in advance by the Owner.

1.3 SUBSURFACE CONDITIONS

A. The contractor shall make his own determination as to soil conditions and shall assume all risk and responsibility and shall complete the work in whatever material and under whatever condition he may encounter or create, without extra cost to the Owner. This shall apply whether or not borings are shown on the drawings.

B. A small number of borings have been made. These borings have been made by a disinterested soils engineer and the reports are available in the project manual. The information is offered as evidence of ground conditions at only certain locations and the Contractor himself shall assume the entire responsibility for any conclusions which he may draw from it. The Owner does not guarantee, however, that the ground encountered during construction will conform with these borings and the bidders should secure such other information as they consider necessary to check and supplement the data.

1.4 UTILITIES

A. Certain utility lines may be indicated within the Contract limit lines; others may exist within these lines and may be found upon inspection the Site. It is the Contractor's responsibility to contact all Utility Companies or Authorities which may be reasonably expected to have utilities in the area. He shall locate exactly any and all utilities and maintain in operating condition all active utilities, sewers, and drains encountered during construction. The Contractor shall repair to the satisfaction of the Utility Owner any improvement damaged during the course of the Work. Active utilities shall be removed and relocated only as directed by the Utility Owner or Authorities having jurisdiction. Existing utilities that are indicated to be removed shall be coordinated with the Utility Owner prior to the removal of said utilities. The Contractor shall report to the Utility Owner any existing damage prior to commencing Work.

1.5 EXISTING FACILITIES

A. The Contractor shall protect all existing facilities and all natural features that are not shown to be disturbed. The Contractor shall restore to their present condition any utility easement or public right-of-way that is disturbed by the Work under these Specifications to the satisfaction of the Governmental Agency that has jurisdiction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SITE INSPECTION

A. Site Visit: The Contractor shall visit the Site to become thoroughly familiar with the existing Site Conditions. A full understanding by the Contractor of the facilities, difficulties and restrictions attending execution of the Work is mandatory. The Contractor shall verify the location of all pertinent items. No additional compensation will be allowed for failure of the Contractor to be so informed.

B. Monuments: The Contractor shall locate and maintain all permanent bench marks, monuments and other reference points. If destroyed or disturbed by the Contractor, they shall be replaced as directed by the applicable Local Authority at no expense to the Owner.

END OF SECTION 003119

SOILS INVESTIGATION
PROPOSED FARMER'S MARKET AND AMPHITHEATER
40620 UTICA ROAD
STERLING HEIGHTS, MICHIGAN

DORCHEN/MARTIN ASSOCIATES, INC.
29895 GREENFIELD ROAD
SUITE 107
SOUTHFIELD, MICHIGAN 48076

APRIL 24, 2017
BY
McDOWELL & ASSOCIATES

McDowell & Associates
Geotechnical, Environmental & Hydrogeological Services • Materials Testing & Inspection
21355 Hatcher Avenue • Ferndale, MI 48220
Phone: (248) 399-2066 • Fax: (248) 399-2157
www.mcdowasc.com

April 24, 2017

Dorchen/Martin Associates, Inc.
29895 Greenfield Road
Suite 107
Southfield, Michigan 48076

Job No. 17-107

Attention: Mr. Sam Dorchen

Subject: Soils Investigation
Proposed Farmer's Market and Amphitheater
40620 Utica Road
Sterling Heights, Michigan

Gentlemen:

In accordance with your request, we have made a Soils Investigation at the subject project.

Seven (7) Soil Test Borings, designated as 1 through 7, were performed at the locations you required. The approximate locations of the borings are shown on the Soil Boring Location Plan which accompanies this report. The borings were drilled with our all-terrain track mounted drill rig and were advanced to depths of fifteen feet six inches (15'6") and twenty feet six inches (20'6") below the existing ground surface.

Soil descriptions, groundwater observations and the results of field and laboratory tests are to be found on the accompanying Logs of Soil Test Borings and summary sheet of Sieve Analysis results.

Boring 1 encountered five feet (5') of fill soils consisting of firm discolored brown sandy clay and slightly compact brown fine sand, followed by firm blue silty clay which was found throughout the remainder of this boring. Borings 2 through 7 encountered ten inches (10") to two feet ten inches (2'10") of topsoil, fill and possible fill soils consisting of medium compact to compact brown and dark brown fine sand to clayey sand, two feet six inches (2'6") to four feet seven inches (4'7") of medium compact to very compact brown silty fine sand to gravelly sand, followed by firm to stiff blue silty clay to sandy clay.

Soil descriptions and depths shown on the boring logs are approximate indications of change from one soil type to another and are not intended to represent an area of exact geological change or stratification. Also, the site shows signs of modification which could indicate soil conditions different from those encountered at the boring locations.

Water was encountered in the borings at depths ranging from two feet (2') to five feet (5') below the existing ground surface. Water was measured upon completion of the drilling operation in the borings at depths ranging from two feet eight inches (2'8") to fourteen feet (14'). Water was found to rise in one hour after drilling in Boring 2 to a depth of eight feet four inches (8'4") and in three-quarters of an hour in Boring 5 to a depth of two feet four inches (2'4"). It should be noted that short-term groundwater observations may not provide a reliable indication of the depth of the water

table. Water levels in granular soils fluctuate with seasonal and climatic changes, as well as with the amount of rainfall in the area immediately prior to the measurements.

Standard Penetration Tests made during sampling indicate that the native soils at the site have poor to fair strengths and densities. Tests taken at a depth of two feet six inches (2'6") gave results ranging from five (5) to seventeen (17) blows per foot. The five-foot (5') test values varied from two (2) to eighteen (18) blows per foot. At a depth of seven feet six inches (7'6"), the results ranged from seven (7) to eleven (11) blows per foot. At ten feet (10') and below, penetration indices varied from six (6) to thirteen (13) blows per foot.

It is understood that an open-air farmers market pavilion and an amphitheater structure will be constructed at the site. It is assumed that the structures will be either slab on-grade or somewhat elevated above the existing grade at the site and the structures will transmit relatively light loads to the supporting soils.

Based on the project information provided and the results of field and laboratory tests, it is believed that the new structures could be supported by conventional spread, pier or strip-type foundations. The footings or piers in unheated areas or areas which are subjected to frost should be constructed at or below a minimum frost penetration depth of three feet six inches (3'6") below finished grade. All interior and exterior load-bearing footings or piers should extend through non-engineered fill soils, soils containing a significant amount of organic substances or excessively weak soils. The footings or piers should be continuously reinforced in order to minimize the noticeable effects of differential settlement.

Footings or piers could be proportioned for the design soil pressures shown in the chart below provided this results in the footings or piers bearing on native non-organic soils.

Boring	Depth			Soil Pressure (psf)
1	5'0"	to	12'0"	2,000
2	2'6"	to	4'0"	1,500
	4'6"	to	12'0"	3,000
3	1'6"	to	4'6"	3,000
	5'0"	to	12'0"	2,000
4	1'6"	to	3'6"	1,500
	4'0"	to	7'0"	2,500
	7'6"	to	12'0"	2,000
5	2'0"	to	4'0"	2,500
	4'6"	to	12'0"	2,000
6	2'6"	to	4'6"	3,000

Boring	Depth			Soil Pressure (psf)
	5'0"	to	9'6"	2,500
	10'0"	to	12'0"	2,000
7	3'0"	to	4'6"	3,500
	5'0"	to	7'0"	3,000
	7'6"	to	12'0"	2,500

Based on the above chart, it appears that lower strength soils may be encountered in the vicinity of Borings 2 and 4 which may necessitate larger than normal footing sizes.

It should be noted that footing excavations may be near or below the level at which water was encountered in Borings 1 through 6. Depending upon the depth of the footings relative to the existing ground surface and the actual conditions at the time of construction, it may be necessary to depress the water table in these locations to allow for footings to be constructed. It is sometimes possible to construct strip footings a foot or so below the water table using a rapid sequence of excavation and placement of concrete. If this is not possible, it may be necessary to use special dewatering techniques to depress the water table in the vicinity of these borings. Extreme care must be exercised during any dewatering operation if any nearby buildings, structures or utilities are sensitive to settlement. Care must be taken to minimize the removal of soil fines during any pumping operation.

Wet sand soils were encountered in the borings below depths of two feet (2') to five feet (5'). Floor slabs in the amphitheater should be kept at least one foot (1') above the long-term groundwater level at the site. If floor slabs are constructed in close proximity to the groundwater level, then it is suggested that fairly elaborate drainage systems be provided. We suggest the following:

1. A minimum of six inches (6") of free-draining material should be placed below the slabs. This could be MDOT 2NS sand, but preferably would be a coarser material like pea stone. With a coarser material, a filter fabric should be placed over any on-site silt and fine sand soils.

2. A good moisture barrier should be placed above the free-draining granular material.

3. Exterior and interior footing six-inch (6") diameter drain tile should be installed with a drain tile under the slabs on about twenty foot (20') centers. If these tiles drain to a sump pit, there exists a possibility that during a power failure, the slab areas could flood and a back-up system should probably be provided.

4. If corrugated plastic drain tile with one-sixteenth inch (1/16") slot openings is used, it should be surrounded with a minimum of five inches (5") of 2NS sand. If there

is any question relative to the size of openings or the proper placement of the filter sand, a filter sock should be provided. If a coarse material like pea stone is used, it should be separated from any silt and fine sand with a filter fabric. If the tile is set in a coarse material like pea stone that is separated from any on-site silt and fine sand by a filter fabric, no additional filter media is required as long as the openings in the drain tile are compatible with the filter media.

If the possibility of more than normal differential movement can be tolerated, slab-on-grade floors or floor-supporting backfill could be placed at, or near, the present grade in the vicinity of the borings. Any topsoil, organic, soft, loose or obviously objectionable material should be removed and the subgrade thoroughly proof-compacted with heavy, rubber-tired equipment. If, during the proof compaction operation, areas are found where the soils yield excessively, the yielding materials should be scarified, dried and recompacted or removed and replaced with engineered fill. Where fill or backfill is required to raise the subgrade for concrete floors, it is suggested that clean, well-graded granular soils be used. If clay material is utilized, it should be placed within two percent (2%) of its optimum moisture content. The fill should be deposited in horizontal lifts not to exceed nine inches (9") in thickness with each lift being compacted uniformly to a minimum density of ninety-five percent (95%) of its maximum value as determined by the Modified Proctor Test (AASHTO T-180 or ASTM D-1557).

If the possibility of more than normal differential movement cannot be tolerated, then any existing fill material should be removed and replaced with engineered fill meeting the requirements outlined above, or slabs should be structurally supported.

Experience indicates that actual subsoil conditions at the site could vary from those found at the test borings made at specific locations. If is, therefore, essential that McDowell & Associates be notified of any variation of soil conditions to determine their effects on the recommendations contained in this report. The evaluations and recommendations presented in this report have been formulated on the basis of reported or assumed data relating to the proposed project. Any significant change in this data in the final design plans should be brought to our attention for review and evaluation with respect to the prevailing subsoil conditions.

It is recommended that the services of McDowell & Associates be engaged to observe the soils in the footing, pier, or mat excavations prior to concreting in order to test the soils for the required bearing capacities. Testing should also be performed to check that suitable materials are being used for controlled fills and that they are properly placed and compacted.

If we can be of any further service, please feel free to call.

Very truly yours,

McDOWELL & ASSOCIATES

Daniel A. Kaniarz, M.S., P.E.

DAK/wf

McDOWELL & ASSOCIATES
Geotechnical, Environmental, & Hydrogeologic Services
21355 Hatcher Avenue • Ferndale, MI 48220
Phone: (248) 399-2066 • Fax: (248) 399-2157

LOG OF SOIL BORING NO. 1

PROJECT Soils Investigation
Farmers Market and Amphitheater

LOCATION 40620 Utica Road
Sterling Heights, Michigan

JOB NO. 17-107

SURFACE ELEV. _____ **DATE** 4-18-17

Sample & Type	Depth	Legend	SOIL DESCRIPTION	Penetration Blows for 6"	Moisture %	Natural Wt. P.C.F.	Dry Den Wt. P.C.F.	Unc. Comp. Strength PSF.	Str. %
	1								
			Firm moist discolored brown sandy CLAY with topsoil and clayey sand seams, fill						
A	2			3					
UL				3	15.9	129			
	3			3					
			3'6"						
	4		Slightly compact wet brown fine SAND with traces of gravel and topsoil, fill						
B				1					
UL	5			1	22.9	124			
			5'0"	1			*	(500)	
	6		Soft moist brown silty CLAY with gray silt lenses						
			6'6"						
C	7			2					
UL			Firm moist variegated silty CLAY	3	22.2	128			
	8			4			*	(2000)	
			8'0"						
	9								
D				2					
UL	10			3	23.2	120			
				3			*	(2000)	
	11								
	12		Firm moist blue silty CLAY with gray silt lenses						
	13								
	14								
E				2					
UL	15			3					
				3					
			15'6"						
	16								
	17								
	18								
	19								
			Note: Used track rig.						
	20								
	21								
	22								
	23								
	24								
	25								

TYPE OF SAMPLE
D. - DISTURBED
U.L. - UNDIST. LINER
S.T. - SHELBY TUBE
S.S. - SPLIT SPOON
R.C. - ROCK CORE
( ) - PENETROMETER

REMARKS: *Calibrated penetrometer

Standard Penetration Test - Driving 2" OD Sampler 1' With 140# Hammer Falling 30": Count Made at 6" Intervals

GROUND WATER OBSERVATIONS

G.W. ENCOUNTERED AT	3	FT.	6	INS.
G.W. ENCOUNTERED AT		FT.		INS.
G.W. AFTER COMPLETION	10	FT.	8	INS.
G.W. AFTER HRS. .		FT.		INS.
G.W. VOLUMES heavy				

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LOG OF SOIL BORING NO. 2

PROJECT Soils Investigation
Farmers Market and Amphitheater

LOCATION 40620 Utica Road
Sterling Heights, Michigan

JOB NO. 17-107

SURFACE ELEV. _____ **DATE** 4-18-17

Sample & Type	Depth	Legend	SOIL DESCRIPTION	Penetration Blows for 6"	Moisture %	Natural Wt. P.C.F.	Dry Den Wt. P.C.F.	Unc. Comp. Strength PSF.	Str. %
			0'4" Moist dark brown sandy TOPSOIL, fill						
	1								
			Compact moist brown fine SAND with topsoil and tree roots, fill	2					
A	2			2	13.1	119			
UL				3					
	3		2'6" Medium compact moist brown fine SAND						
	4		4'0"						
B			Compact wet brown silty fine to medium SAND	2					
UL	5			6	17.2	125			
				6					
	6		5'6" Stiff moist variegated silty CLAY						
			6'6"						
C	7			3					
UL				5	23.0	121			
	8			6			*	(3000)	
	9								
D				4					
UL	10			5					
				6					
	11								
	12		Stiff moist blue silty CLAY with occasional gray silt lenses						
	13								
	14								
E				3					
UL	15			4					
				6					
	16								
	17								
	18								
			18'0"						
	19		Stiff moist blue silty sandy CLAY with trace of pebbles						
F				4					
UL	20			5					
			20'6"	6					
	21								
	22		Note: Used track rig.						
	23								
	24								
	25								

TYPE OF SAMPLE
D. - DISTURBED
U.L. - UNDIST. LINER
S.T. - SHELBY TUBE
S.S. - SPLIT SPOON
R.C. - ROCK CORE
( ) - PENETROMETER

REMARKS: *Calibrated penetrometer

Standard Penetration Test - Driving 2" OD Sampler 1' With 140# Hammer Falling 30": Count Made at 6" Intervals

GROUND WATER OBSERVATIONS

G.W. ENCOUNTERED AT	4	FT.	0	INS.
G.W. ENCOUNTERED AT		FT.		INS.
G.W. AFTER COMPLETION	13	FT.	1	INS.
G.W. AFTER 1 HR. .	8	FT.	4	INS.
G.W. VOLUMES	medium			

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LOG OF SOIL BORING NO. 3

PROJECT Soils Investigation
Farmers Market and Amphitheater

LOCATION 40620 Utica Road
Sterling Heights, Michigan

JOB NO. 17-107

SURFACE ELEV. _____ **DATE** 4-18-17

Sample & Type	Depth	Legend	SOIL DESCRIPTION	Penetration Blows for 6"	Moisture %	Natural Wt. P.C.F.	Dry Den Wt. P.C.F.	Unc. Comp. Strength PSF.	Str. %
	1		0'10" Moist dark brown sandy TOPSOIL with vegetation						
A	2		Compact moist brown fine to medium SAND with traces of silt and gravel	2					
UL				4	16.4	120			
	3			6					
			3'6"						
	4		Compact wet brown fine SAND						
B			4'6"	5					
UL	5		Stiff moist variegated silty CLAY	7	21.6	124			
				8			*	(4500)	
	6		6'0"						
C	7			3					
UL				3	22.2	125			
	8			4			*	(2000)	
	9								
D				3					
UL	10			3					
				4					
	11		Firm moist blue silty CLAY						
	12								
	13								
	14								
E				2					
UL	15			3					
				4					
	16		15'6"						
	17								
	18								
	19								
	20		Note: Used track rig.						
	21								
	22								
	23								
	24								
	25								

TYPE OF SAMPLE
D. - DISTURBED
U.L. - UNDIST. LINER
S.T. - SHELBY TUBE
S.S. - SPLIT SPOON
R.C. - ROCK CORE
( ) - PENETROMETER

REMARKS: *Calibrated penetrometer

Standard Penetration Test - Driving 2" OD Sampler 1' With 140# Hammer Falling 30": Count Made at 6" Intervals

GROUND WATER OBSERVATIONS

G.W. ENCOUNTERED AT	3	FT.	6	INS.
G.W. ENCOUNTERED AT		FT.		INS.
G.W. AFTER COMPLETION	2	FT.	8	INS.
G.W. AFTER HRS.		FT.		INS.
G.W. VOLUMES heavy				

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LOG OF SOIL BORING NO. 4

PROJECT Soils Investigation
Farmers Market and Amphitheater

LOCATION 40620 Utica Road
Sterling Heights, Michigan

JOB NO. 17-107

SURFACE ELEV. _____ **DATE** 4-18-17

Sample & Type	Depth	Legend	SOIL DESCRIPTION	Penetration Blows for 6"	Moisture %	Natural Wt P.C.F.	Dry Den Wt P.C.F.	Unc. Comp. Strength PSF.	Str. %
			0'11" Moist dark brown sandy TOPSOIL with trace of vegetation						
	1								
A	2			2					
UL			Medium compact moist brown fine SAND	2	13.7	112			
	3			3					
	4		3'9"						
B			Very compact wet brown silty fine SAND	4					
UL	5			8	17.3	122			
			5'6" Stiff moist brown sandy CLAY with trace of	10					
	6		6'0" pebbles						
C	7			3					
UL			Stiff moist blue silty CLAY with trace of pebbles	4	22.2	123			
	8			5			*	(2500)	
	9		8'6"						
D				2					
UL	10			2	23.3	121			
				4			*	(2000)	
	11								
	12								
	13								
	14		Firm moist blue silty sandy CLAY with trace of pebbles and occasional gray silt lenses						
E				3					
UL	15			3					
				4					
	16								
	17								
	18								
	19								
F			19'6"	3					
UL	20		Stiff moist blue silty CLAY	5					
				6					
	21		20'6"						
	22								
	23		Note: Used track rig.						
	24								
	25								

TYPE OF SAMPLE
D. - DISTURBED
U.L. - UNDIST. LINER
S.T. - SHELBY TUBE
S.S. - SPLIT SPOON
R.C. - ROCK CORE
( ) - PENETROMETER

REMARKS: *Calibrated penetrometer

Standard Penetration Test - Driving 2" OD Sampler 1' With 140# Hammer Falling 30": Count Made at 6" Intervals

GROUND WATER OBSERVATIONS

G.W. ENCOUNTERED AT	3	FT.	9	INS.
G.W. ENCOUNTERED AT		FT.		INS.
G.W. AFTER COMPLETION	4	FT.	0	INS.
G.W. AFTER HRS.		FT.		INS.
G.W. VOLUMES heavy				

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LOG OF SOIL BORING NO. 5

PROJECT Soils Investigation
Farmers Market and Amphitheater

LOCATION 40620 Utica Road
Sterling Heights, Michigan

JOB NO. 17-107

SURFACE ELEV. _____ **DATE** 4-18-17

Sample & Type	Depth	Legend	SOIL DESCRIPTION	Penetration Blows for 6"	Moisture %	Natural Wt. P.C.F.	Dry Den Wt. P.C.F.	Unc. Comp. Strength PSF.	Str. %
	1		Moist dark brown sandy TOPSOIL with vegetation, fill						
			0'9"						
A	2		Compact moist brown fine SAND with trace of topsoil, possible fill	3					
UL			2'0"	4	16.3	114			
	3			5					
			Compact wet brown silty fine to medium SAND						
	4								
B									
UL	5		4'6"	3					
			Stiff moist variegated silty CLAY	4	22.1	126			
			5'6"	6			*	(3000)	
	6								
C	7								
UL				2					
	8			3	22.7	124			
				4			*	(2000)	
	9								
D									
UL	10			2					
			Firm moist blue silty CLAY	3					
	11			4					
	12								
	13								
	14								
E									
UL	15			3					
				3					
				4					
	16		15'6"						
	17								
	18								
	19								
	20		Note: Used track rig.						
	21								
	22								
	23								
	24								
	25								

TYPE OF SAMPLE
D. - DISTURBED
U.L. - UNDIST. LINER
S.T. - SHELBY TUBE
S.S. - SPLIT SPOON
R.C. - ROCK CORE
( ) - PENETROMETER

REMARKS: *Calibrated penetrometer

Standard Penetration Test - Driving 2" OD Sampler 1' With 140# Hammer Falling 30": Count Made at 6" Intervals

GROUND WATER OBSERVATIONS

G.W. ENCOUNTERED AT	2	FT.	0	INS.
G.W. ENCOUNTERED AT		FT.		INS.
G.W. AFTER COMPLETION	4	FT.	0	INS.
G.W. AFTER ¾ HRS.	2	FT.	4	INS.
G.W. VOLUMES	heavy			

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LOG OF SOIL BORING NO. 6

PROJECT Soils Investigation
Farmers Market and Amphitheater

LOCATION 40620 Utica Road
Sterling Heights, Michigan

JOB NO. 17-107

SURFACE ELEV. _____ **DATE** 4-18-17

Sample & Type	Depth	Legend	SOIL DESCRIPTION	Penetration Blows for 6"	Moisture %	Natural Wt. P.C.F.	Dry Den Wt. P.C.F.	Unc. Comp. Strength PSF.	Str. %
			0'4" Moist dark brown sandy TOPSOIL with vegetation, fill						
	1								
			Compact moist brown fine SAND with traces of gravel, topsoil and slag, fill						
A	2			10					
UL			2'6"	9	13.9	124			
	3			8					
			Compact moist brown fine SAND						
	4		3'9"						
B				4					
UL	5		Compact wet brown silty fine to medium SAND with trace of gravel	5	16.5	128			
				8					
	6								
			6'0" Stiff moist brown silty sandy CLAY						
C	7		7'0"	2					
UL				4	22.5	126			
	8			5			*	(2500)	
	9								
			Stiff moist blue silty CLAY						
D				4					
UL	10			6					
				7					
	11		11'0"						
	12								
	13		Firm moist blue silty CLAY						
	14								
E				2					
UL	15			3					
				4					
	16		15'6"						
	17								
	18								
	19								
	20		Note: Used track rig.						
	21								
	22								
	23								
	24								
	25								

TYPE OF SAMPLE
D. - DISTURBED
U.L. - UNDIST. LINER
S.T. - SHELBY TUBE
S.S. - SPLIT SPOON
R.C. - ROCK CORE
( ) - PENETROMETER

REMARKS: *Calibrated penetrometer

Standard Penetration Test - Driving 2" OD Sampler 1' With 140# Hammer Falling 30": Count Made at 6" Intervals

GROUND WATER OBSERVATIONS

G.W. ENCOUNTERED AT	3	FT.	9	INS.
G.W. ENCOUNTERED AT		FT.		INS.
G.W. AFTER COMPLETION	3	FT.	9	INS.
G.W. AFTER HRS.		FT.		INS.
G.W. VOLUMES heavy				

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LOG OF SOIL BORING NO. 7

PROJECT Soils Investigation
Farmers Market and Amphitheater

LOCATION 40620 Utica Road
Sterling Heights, Michigan

JOB NO. 17-107

SURFACE ELEV. _____ **DATE** 4-18-17

Sample & Type	Depth	Legend	SOIL DESCRIPTION	Penetration Blows for 6"	Moisture %	Natural Wt. P.C.F.	Dry Den Wt. P.C.F.	Unc. Comp. Strength PSF.	Str. %
	1		Medium compact moist dark brown clayey SAND with topsoil and roots, fill						
A	2			3					
UL				3	10.8				
	3		2'10"	4					
			Compact moist brown gravelly SAND with trace of silt						
	4								
B				6					
UL	5			9	11.5	132			
			5'0" Compact wet brown fine SAND	7					
	6								
			6'0" Firm moist brown silty CLAY with occasional brown silt lenses						
C	7			3					
UL			7'0"	5	22.4	127			
	8			6			*	(3000)	
	9								
D				4					
UL	10			4	23.9	123			
				5			*	(2500)	
	11		Stiff moist blue silty CLAY						
	12								
	13								
	14								
E				3					
UL	15			4					
				5					
			15'6"						
	16								
	17								
	18								
	19								
	20		Note: Used track rig.						
	21								
	22								
	23								
	24								
	25								

TYPE OF SAMPLE
D. - DISTURBED
U.L. - UNDIST. LINER
S.T. - SHELBY TUBE
S.S. - SPLIT SPOON
R.C. - ROCK CORE
( ) - PENETROMETER

REMARKS: *Calibrated penetrometer

Standard Penetration Test - Driving 2" OD Sampler 1' With 140# Hammer Falling 30": Count Made at 6" Intervals

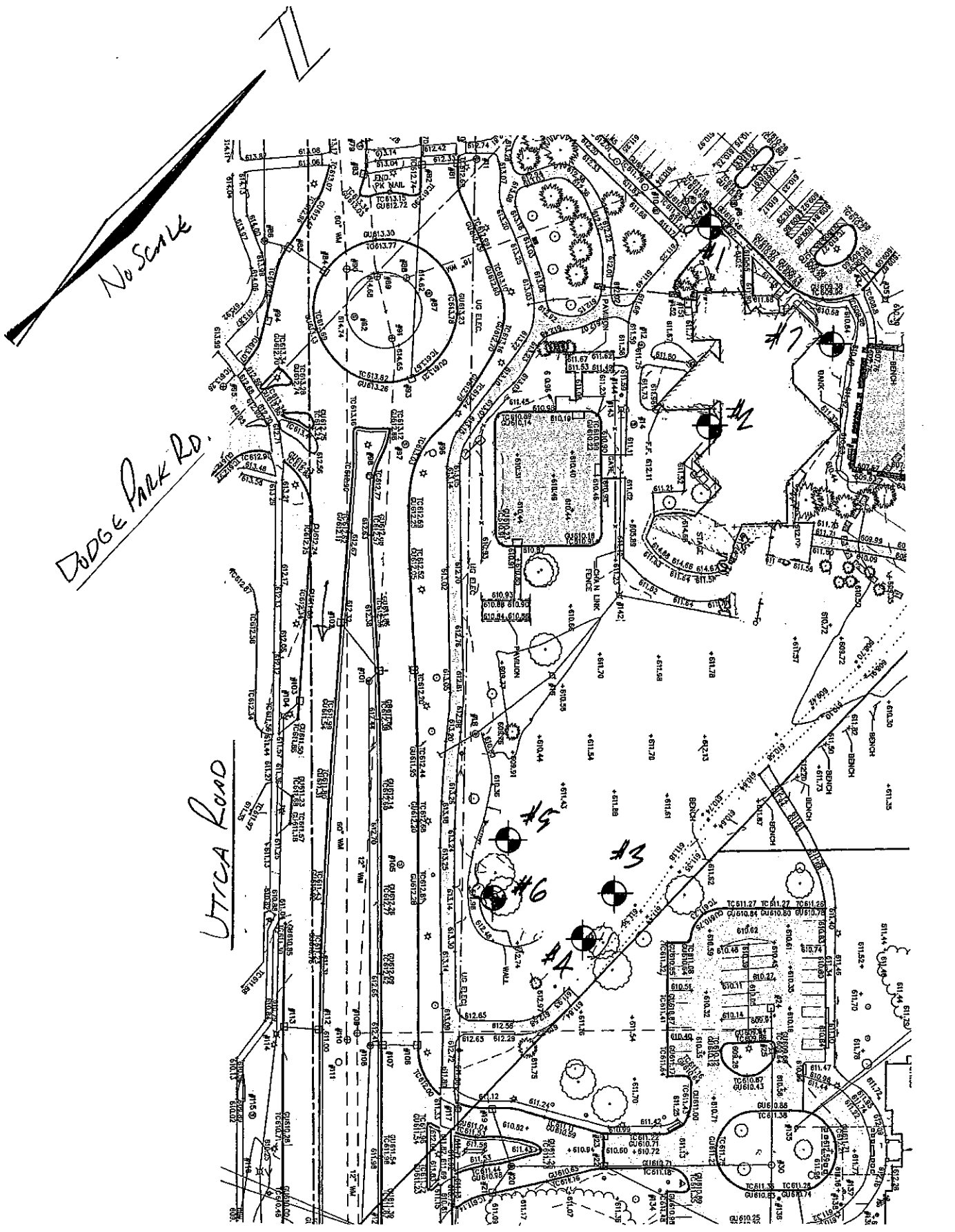
GROUND WATER OBSERVATIONS

G.W. ENCOUNTERED AT	5	FT.	0	INS.
G.W. ENCOUNTERED AT		FT.		INS.
G.W. AFTER COMPLETION	14	FT.	0	INS.
G.W. AFTER HRS.		FT.		INS.
G.W. VOLUMES	light			

Job No. 17-107

SIEVE ANALYSIS

Boring	Sample	% Passing #4 Sieve	% Passing #10 Sieve	% Passing #40 Sieve	% Passing #100 Sieve	% Passing #200 Sieve
2	B	100.0	100.0	85.2	39.2	16.4
3	A	97.1	92.6	68.7	12.8	8.4
4	B	100.0	100.0	91.8	53.5	17.4
5	A	98.8	97.0	75.5	23.8	14.3
6	B	94.9	87.4	68.1	20.8	13.5
7	B	80.6	70.9	51.4	12.5	8.8



Soil Boring Location Plan

#17-107

BID PROPOSAL FORM

Project:
City of Sterling Heights Parks & Recreation
Dodge Park Improvements

Owner:
City of Sterling Heights
40555 Utica Road
Sterling Heights, MI 48313

SUBMITTING CONTRACTOR:

(Name) _____

(Address 1) _____

(Address 2) _____

(Telephone) _____ (Fax) _____

(email) _____ (Date) _____

BIDS WILL BE RECEIVED UNTIL:
2:30 p.m. local time, Tuesday, July 11, 2017 by the City of Sterling Heights City Clerk's Office.

BIDS WILL BE PUBLICLY OPENED & READ AT:
2:30 p.m. local time, Tuesday, July 11, 2017 in the City of Sterling Heights Council Chambers.

TOTAL BASE BID AMOUNT:

The undersigned, as bidder, hereby declares this bid is made in good faith without fraud or collusion with any persons bidding, and that he/she is familiar with the location of the work described herein and the conditions under which it must be completed. He/she also declares that he/she has carefully examined the Contract Documents which he/she understands and accepts as sufficient for the purpose, and agrees that he/she will contract with the Owner to furnish all labor, materials, tools and equipment necessary to do all the work specified and prescribed herein and will accept in full payment therefore the sum of:

_____ _____ Dollars.
(Sum to be written out)

$_____

BID BREAKDOWN:

Provide itemized pricing as outlined on the following pages. The values of the items are to be included in your base bid.

NO.	ITEM DESCRIPTION	QTY	UNIT	UNIT PRICE	AMOUNT
	SITE IMPROVEMENTS				
1.	Remove Concrete	3600	SYD		
2.	Remove Curb and Gutter	4250	LF		
3.	Remove Handicap Parking Sign	17	EA		
4.	Remove Light Pole	17	EA		
5.	Remove Pavilion - small	2	EA		
6.	Remove Pavilion - large	2	EA		
7.	Remove Tree - 6"-12" Diameter	35	EA		
8.	Remove Tree - 12"-24" Diameter	18	EA		
9.	Remove Tree - 24"-36" Diameter	4	EA		
10.	Remove Asphalt	2,300	SY		
11.	Remove DTE and Water Hookup	12	EA		
12.	Remove Electrical Post	2	EA		
13.	Remove Electrical Panel and Canopy	1	EA		
14.	Remove Volleyball Poles	6	EA		
15.	Remove Horseshoe Pit	2	EA		
16.	Remove Bench	3	EA		
17.	Remove Hose Bib at Pavilions	2	EA		
18.	Remove Swing Sets	2	EA		
19.	Remove Jungle Gym	1	EA		
20.	Remove Basketball Court including Fence and Lighting	1	EA		
21.	Remove Chain Link Fence	20	LF		
22.	Pulverize Ex. Asphalt	17,200	SYD		
23.	HMA, 1100L (2”)	2,800	TONS		
24.	HMA, 1300T (2”)	2,800	TONS		
25.	21AA Crushed Concrete, Aggregate Base (C.I.P.)	1,075	CY		
26.	Fill, Pulverized Material, Parking, Drive, and Path	23,750	SYD		
27.	Subgrade Preparation	23,750	SYD		
28.	6” Concrete Curb and Gutter ‘A’	675	LF		
29.	6” Concrete Curb and Gutter ‘B’	3,510	LF		
30.	4” Concrete Sidewalk	21,750	SF		
31.	Handicap Parking Sign	17	EA		
32.	Pavement Markings	1	LS		
33.	Fill	1,000	CY		
34.	Excavation	1,000	CY		
35.	Subgrade Undercut	250	CY		
36.	Mass Grading	1	LS		

37.	12” C-76, Class IV, Storm Sewer Pipe	501	LF		
38.	Connect to Ex. Storm Manhole	4	EA		
39.	4’ Dia. Catch Basin with 2’ Sump	4	EA		
40.	Replace Structure Cover, Beehive	1	EA		
41.	Adjust Ex. Storm Structure RIM	7	EA		
42.	8” PVC, SCH 40, Storm Sewer	42	LF		
43.	6” PVC, SCH 40, Sanitary Sewer	706	LF		
44.	Sanitary Cleanout	9	EA		
45.	Sanitary Sewer Tap/Connection	4	EA		
46.	Adjust Ex. Sanitary Structure RIM	4	EA		
47.	Sanitary Manhole	2	EA		
48.	10” PVC Truss, Sanitary Sewer	212	LF		
49.	Directional Drill 10” Sanitary Sewer	47	LF		
50.	1” Type ‘K’ Copper Building Service	560	LF		
51.	Relocate 6” Hydrant Assembly	1	EA		
52.	1” Stop Box	4	EA		
53.	Water Main Connection	6	EA		
54.	Adjust Ex. Water Main Structure RIM	1	EA		
55.	8” Tapping Sleeve, GV in Well	2	EA		
56.	6” Hydrant Assembly	1	EA		
57.	6” D.I. CL54 Water Main	22	LF		
58.	8” D.I. CL54 Water Main	534	LF		
59.	Directional Drill 8” Water Main	43	LF		
60.	Soil Erosion, Silt Fabric Fencing	2,100	LF		
61.	Soil Erosion, Inlet Filter	28	EA		
62.	Soil Erosion, Temporary Crushed Concrete Drive	175	SYD		
63.	Traffic Control	1	LS		
64.	Volleyball Sand	815	CY		
65.	#57 Gravel, Volleyball court base	407	CY		
66.	Volleyball Subsurface Drainage System	1	LS		
67.	Volleyball Edging	533	LF		
68.	#8 Pea Gravel, Volleyball Edge	4	CY		
69.	Volleyball Net System	4	EA		
70.	Soccer Kickboards	1	LS		
71.	Soccer Protection Netting	1	LS		
72.	Soccer Goals	2	EA		
73.	Soccer Synthetic Turf and Base	1	LS		
74.	Soccer Subsurface Drainage System	1	LS		
75.	Concrete Curb at Soccer	382	LF		
76.	Swivel Grate ADA Grille	4	EA		

77.	Splash Park Landscape Wall	275	LF		
78.	Splash Park Fence Wall	300	LF		
79.	Splash Park Fence Piers	15	EA		
80.	Splash Park Steel Fence	285	LF		
81.	Splash Park Steel Fence Gates	4	EA		
82.	Splash Park Seat Wall	204	LF		
83.	Splash Park Synthetic Landscape Turf	2,570	SF		
84.	Large Park Grille	4	EA		
85.	Hot Coal / Ash Bin	4	EA		
86.	Maxiforce Removable Bollard	5	EA		
87.	Maxiforce Fixed Bollard	3	EA		
88.	Gas Fire Pits	2	EA		
89.	Horseshoe Pits	2	EA		
90.	Replace Parking Lot Light	12	EA		
91.	New Parking Lot Light	8	EA		
92.	Sport Court Light	8	EA		
93.	Pathway Bollard Light	5	EA		
94.	Site Electrical Panel re-fed	1	EA		
95.	Electrical Post reconnected	5	EA		
96.	Farmers Market / Market Plaza Decorative 8" Concrete	9,600	SF		
97.	Farmers Market / Market Plaza Decorative 6" Concrete	20,065	SF		
98.	Farmers Market / Market Plaza Decorative 4" Concrete	5,690	SF		
99.	Landscape Wall at Market Plaza	132	LF		
100.	Color Video / Audio Recording of Project Area	1	LS		

Site Improvements Subtotal _____

	LANDSCAPING						
`	KEY	BOTANICAL NAME	COMMON NAME	SIZE	QTY	UNIT PRICE	AMOUNT
		DECIDUOUS TREES					
1.	AS	Acer S. 'Majesty'	Majesty Sugar Maple	3" BB	4		
2.	AK	Acer P. 'Crimson King'	Crimson King Maple	3" BB	6		
3.	AR	Acer Rubrum	Red Maple	3" BB	3		
4.	ARM	Acer Rubrum (Multi-stem)	Red Maple (Multi-Stem)	3" BB	14		
5.	ARA	Acer R. 'Armstrong'	Armstrong Red Maple	3" BB	10		
6.	TB	Tilia Cordata 'Boulevard	Boulevard Linden	3" BB	11		
7.	TC	Tilia Cordata	Littleleaf Linden	3" BB	3		
8.	QR	Quercus Rubra	Red Oak	3" BB	4		
9.	QB	Quercus Bicolor	Swamp White Oak	3" BB	15		
10.	CB	Carpinus Betulus 'Fastigiata'	Pyramidal European Hornbeam	3" BB	20		
11.	ZS	Zelcova Serrata	Japanese Zelkova	3" BB	13		
12.	CO	Celtis Occidentalis	Hackberry	3" BB	2		
13.	CC	Cercis Canadensis	Eastern Redbud	8' BB	1		
14.	AB	Aescolus X.C. 'Brioti'	Brioti Red Horse Chesnut	2" BB	9		
15.	AC	Amelanchier Canadensis	Shadlow Serviceberry (Multi-Stem)	8' BB	8		
16.	MF	Malus Floribunda	Japanese Flowering Crabapple	2" BB	7		
17.	MS	Malus Sargentii	Snowdrift Crabapple	2" BB	11		
		SHRUBS					
18.	SK	Syringa Patula 'Miss Kim'	Miss Kim Dwarf Lilac	3' BB	15		
19.	RKP	Rosa X. 'Pink Kin'	Pink Knock-Out Rosa	3' BB	19		

20.	RK	Rosa X. 'Osa Easy Double Red'	Osa Easy Double Red Rose	#5 cont.	77		
21.	HA	Hydrangea A. Annabelle	Border Forsynthia	#3 cont.	8		
22.	RA	Ribes Alpinum	Alpine Currant	#3 cont.	75		
23.	VC	Viburnum Carlesii	Koreanspice Viburnum	3 1/2' BB	1		
24.	VM	Viburnum P.T. 'Mariesii'	Mariesi Doublefile Viburnum	3 1/2' BB	15		
25.	VMK	Viburnum X.B. 'Mohawk'	Mohawk Viburnum	3 1/2' BB	13		
26.	SG	Spiraea X.B. Bumalda 'Goldflame'	Goldflame Spirea	#3 cont.	238		
27.	HS	Hibiscus S. 'Aphrodite'	Aphrodite Althea	#3 cont.	2		
28.	RAG	Rhus Aromatica 'Gro-Low'	Gro-Low Fragrant Sumac	#5 cont.	168		
29.	BP	Berberis T. 'Rose Glow'	Rose Glow Barberry	#3 cont.	9		
30.	LV	Ligustrum X. Vicaryi	Vicary Privet	#5 cont.	36		
		EVERGREENS					
31.	BW	Buxus 'Green Velvet'	Green Velvet Boxwood	18" BB	55		
32.	TD	Taxus X.M. 'Densiformis'	Densiformis Yew	24"-30" BB	26		
33.	TE	Taxus X.M. 'Everlow'	Everlow Yew	24"-30" BB	102		
34.	TO	Thuja Occidentalis 'Hetz Midget'	Hetz Midget Arborvitae	#5 cont.	34		
35.	ACW	Abies Concolor (8')	Concolor White Fir	8' BB	9		
36.	ACWL	Abies Concolor (10')	Concolor White Fir	10'BB	3		

37.	PS	Pinus Strobus (8')	Eastern White Pine	8' BB	16		
38.	PSL	Pinus Strobus (10')	Eastern White Pine	10'BB	12		
39.	PA	Picea Abies (8')	Norway Spruce	8' BB	21		
40.	PAL	Picea Abies (10')	Norway Spruce	10'BB	13		
		PERENNIALS AND GRASSES					
41.	PAH	Pennisetum Alopecuroides 'Hamelin'	Dwarf Fountain Grass	#3 cont.	40		
42.	MSM	Miscanthus Sinensis 'Morning Light'	Morning Light Japanese Silver Grass	#5 cont.	7		
43.	NEP	Nepeta X. Faasseni 'Walkers Low'	Walkers Low Catmint	#1 cont.	13		
44.	DLY	Hemerocallis 'Happy Returns'	Happy Returns Daylily	#1 cont.	145		
45.	HOS	Hosta 'Patriot'	Patriot Hosta	#1 cont.	68		
46.	SB	Spiraea X.B. 'Anthony Waterer'	Anthony Waterer Spiraea	#5 cont.	96		
47.	SED	Sedum Spectabile 'Neon'	Neon Sedum	#1 cont.	72		
		LANDSCAPING MATERIALS		QTY	UNIT		
48.		Sod		6,800	SYD		
49.		Hydroseed		21,000	SYD		
50.		Cobblestone		24	TON		
51.		Mulch		96	CYD		
52.		Edging		1,500	LF		
53.		Top Soil		50	CYD		
54.		Irrigation		1	LS		

Landscaping Subtotal _____

	ITEM DESCRIPTION	QTY	UNIT	UNIT PRICE	AMOUNT
	STRUCTURES				
1.	Pavilion #1	1	LS		
2.	Pavilion #2	1	LS		
3.	Pavilion #3	1	LS		
4.	Pavilion #4	1	LS		
5.	Pavilion #5	1	LS		
6.	Splash Park Ticket Booth	1	LS		
7.	Renovated Restroom Building	1	LS		
8.	Farmers Market	1	LS		
9.	Seasonal Ice Rink	1	LS		
10.	Amphitheater	1	LS		
11.	Parks and Recration Building Demolition	1	LS		
12.	Permit Fees	1	LS		$10,000.00

Structures Subtotal _____

ALTERNATES:

Alternate #1 – Provide and Install 2" underground conduit from Restroom Building to Bridge

Alternate #1 will increase the Total Base Bid Amount By: _____

Alternate #2 – Provide and Install eight (8) bridge lights

Alternate #2 will increase the Total Base Bid Amount By: _____

RIGHT TO ACCEPT, TO REJECT, AND TO WAIVE DEFECTS

The Owner reserves the right: 1) To award bids received on the basis of individual items, or groups of items, or on the entire list of items, (2) To reject any or all bids, or any part thereof, (3) To waive any irregularity in the bids, (4) To accept the bid that is in the best interest of the City, (5) To reduce or eliminate this purchase without prior notice, (6) To split the award to realize the greatest cost savings, (7) To issue Post-Bid Addendums to clarify or request additional information, including pricing, (8) To require one or more selected bidders to perform the requested service on a trial basis, at the unit prices bid, as evidence of a bidders ability to satisfactorily perform the requested service, prior to a formal recommendation and approval by City Administration / City Council.

ACKNOWLEDGMENT:

The Undersigned agrees that if this proposal in accepted by the owner, he will furnish the required bonds and insurance and execute the contract within fourteen (14) days after notice of the award of the contract is mailed to him by the owner.

The owner reserves the right to reject any or all bids and to waive any irregularities in bidding. No bid may be withdrawn after the scheduled closing time for receiving bids for at least ninety (90) calendar days. Work shall commence on or prior to August 14, 2017 and be completed on or prior to June 18, 2018. Anticipated contract award date is August 1, 2017. Failure to complete contractual work within the times mentioned herein shall result in the contractor paying Liquidated Damages for each and every calendar day the contractor shall be in default as contained herein under Liquidated Damages.

The award of the contract will be based on the low bid submitted. However, the Owner reserves the right to accept any proposal or reject all bids, and to waive any defects or irregularities in the bids if it appears advantageous to the Owner to do so. In addition, the owner, at his sole discretion, reserves the right to award to the Bidder who, in the sole determination of the owner, will best serve the interest of the owner. The project will not be awarded by separate contracts.

LEGAL STATUS OF BIDDER:

The bidder shall indicate his/her legal status in the appropriate location below:
Fill out the appropriate location and strike out the other two (2).

- A Corporation duly organized and doing business under the laws of the state of ____ for whom _____, whose signature is affixed to this proposal, is duly authorized to execute contracts.

- A Partnership, all members of which, with addresses, are:

_____ _____
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

- An Individual, whose signature is affixed to this proposal.

_____ _____

Signed and Sealed this _____ day of _____, 2017___

Authorized Signature of Bidder:

_____

(Print Name) _____

(Title) _____

INSURANCE REQUIREMENTS

The Contractor shall not commence work under this contract until required insurance within this contract has been obtained. All insurance coverages shall be with insurance carriers licensed and admitted to do business in the State of Michigan and acceptable to the City of Sterling Heights. If any insurance is written with a deductible or self-insured retention, the contractor shall be solely responsible for said deductible or self-insured retention. The purchase of insurance and the furnishing of a certificate of insurance shall not be a satisfaction of the contractor's indemnification to the City of Sterling Heights. The contractor is responsible to meet all MIOSHA requirements for on-the-job safety.

The contractor shall procure and maintain during the life of this contract the following coverages:

Workers Compensation Insurance including Employers Liability Coverage, in accordance with all applicable Statutes of the State of Michigan.

Commercial General Liability Insurance on an "Occurrence Basis" with limits of liability not less than $3,000,000.00 per occurrence and aggregate, Personal Injury, Bodily Injury and Property Damage. Coverage shall include the following extensions:

(1) Contractual Liability Coverage
(2) Products and Completed Operations Coverage.
(3) Independent Contractors Coverage.
(4) Broad Form General Liability Extensions.
(5) Deletion of all Explosion, Collapse and Underground (XCU) Exclusions, if applicable.

Motor Vehicle Liability including Michigan No-Fault Coverages, with limits of liability of not less than $1,000,000.00 per occurrence combined single limit Bodily Injury and Property Damage. Coverage shall include all owned vehicles, all non-owned vehicles and all hired vehicles.

Additional Insured: Following the official award of bid by City Council, the Commercial General Liability Insurance and Motor Vehicle Liability as described above shall include an Additional Insured endorsement as follows:

> "It is understood and agreed that the following shall be "Additional Insured": The City of Sterling Heights, Michigan including all elected and appointed officials, all employees and volunteers, all boards, commissions and/or authorities and board members, including employees and volunteers thereof. It is understood and agreed by naming the City of Sterling Heights as additional insured, coverage afforded is considered to be primary and any other insurance the City of Sterling Heights may have in effect shall be considered secondary and/or excess."

Cancellation Notice: Policies as described above, shall include an endorsement stating the following: It is understood and agreed thirty (30) days, Advance Written Notice of Cancellation, Non-Renewal, Reduction and/or Material Change shall be sent to:

City of Sterling Heights
Reference: Bid ITB-DMA-16079(1)
Engineering Department
40555 Utica Road
P.O. Box 8009
Sterling Heights, MI 48311-8009

Owner's and Contractor's Protective Liability: The Contractor shall procure and maintain during the life

of this contact, Owner's and Contractor's Protective Liability with limits of liability not less than the specified amount per occurrence and/or aggregate combined single limit Bodily Injury and Property Damage. The City of Sterling Heights shall be "Named Insured" on said coverage. Thirty days notice of cancellation shall apply to this policy.

Proof of Insurance Coverage: The Contractor shall provide the Owner at the time the Contracts are returned by him for execution, certificates and policies as listed below:

- Four copies of Certification of Insurance for Worker's Compensation Insurance.
- Four copies of Certification of Insurance for Commercial General Liability Insurance.
- Four copies of Certification of Insurance for Vehicle Liability Insurance.
- Original Policy, or Original Binder pending issuance of policy, for Owner's and Contractor's Protective Liability Insurance.

If any of the above coverages expire during the term of this Contract, the Contractor shall deliver renewal certificates, endorsements and/or policies to the City of Sterling Heights at least ten (10) days prior to the expiration date.

If the required insurance (with the exception of the Additional Insured endorsement) is already in place, please include a copy of the Certificate of Liability Insurance with your bid. However, if required insurance is not already in place when submitting bid, contractors shall include a letter from their insurance agent **(labeled Exhibit A)** indicating that they will be able to secure a Certificate of Liability Insurance upon award of the contract.

BOND REQUIREMENTS

Bid Bond

Bids must be accompanied by a Bid Bond, Bank Issued Money Order, or Cashier's Check in the amount of 5 percent of the bid, which will be returned to the unsuccessful bidders after the award of the bid. The Bid Bond submitted by the successful bidder will be returned upon receipt of the required Performance Bond. No bid shall be considered unless it is accompanied by the required guaranty. Corporate checks will *not* be accepted as bid security.

Performance Bond

Surety Performance Bond - The Contractor whose bid is accepted shall furnish a performance bond at their own expense with a company acceptable to the City equal to the amount of one hundred percent of the Contract Price as security for the faithful performance of this Contract including any maintenance or warranty provisions. The Contractor shall furnish, also a separate surety bond in an amount at least equal to one hundred percent of all persons performing labor or furnishing materials in connection with this Contract. Premiums for the Performance Bond shall be paid by the Contractor. If at any time the City shall be dissatisfied with any surety or surety bond or Performance Bond, or if for any other reason such bond shall cease to be adequate security for the City, the Contractor shall within ten (10) days after notice from the City to do so, substitute an acceptable bond in performance and sum and signed by other sureties which are acceptable to the City. The premiums on such substitute bond shall be paid by the Contractor. The Performance Bond shall remain in full force and effect during the life of the Contract and during the term of any warranty or maintenance required by the specifications.

Additional or Substitute Bond – If at any time the City, for a justifiable cause, shall be or become dissatisfied with any sureties pursuant to the performance or Payment bonds, the Contractor shall within five days after notice from the City to do so, substitute an acceptable bond (or bonds) in such forms and sum and signed by such other surety or sureties as may be satisfactory to the City. The premiums on such bond shall be made until the new surety or sureties shall have furnished such an acceptable bond to the City.

The Contractor may not commence work and bid bonds or checks will not be returned until the performance bond has been received and approved by the City.

All bidders shall include a letter from their bonding agent **(labeled Exhibit B)** indicating that upon award of the contract, they will be able to secure a Performance Bond.

LABOR AND MATERIAL BOND

KNOW ALL MEN BY THESE PRESENTS, that we the undersigned _____ of _____ as Principal and _____ of _____ as Sureties, are hereby held and firmly bound unto the City of Sterling Heights in the full and just sum of _____ ($_____), for the payment of which will and truly be made, we do hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

Sealed with our seals, and dated this _____ day of _____ A.D., 20___; where in said Principal has covenanted and agreed as follows, to-wit:

To furnish all the labor and material for: Job No. _____

Job Title:

_____

AND WHEREAS; this bond is given in compliance with and subject to the provisions of Act. No. 213, of the Public Acts of Michigan.

NOW THEREFORE; the condition of this obligation is such that if payment shall be made by the Principal to any sub-contractor or by him or any sub-contractor as the same may become due and payable of all indebtedness which may arise from him to a sub-contractor or party performing labor or furnishing materials or supplies or any sub-contractor to any person, firm or corporation, on account of any labor performed or materials or supplies furnished in the performance of said contract then this obligation shall be void, otherwise, the same shall be in full force and effect.

AND PROVIDED, that any alterations which may be made in the terms of said contract, or in the work to be done under it, or the giving by the Owner to the Contractor any extension of time for the performance of said contract or any other forbearance on the part of either party to the other shall not in any way release the Principal and the Surety or either of them, their heirs, executors, administrators, successors or assigns from any liability hereunder. Notice to the Surety of any such alteration extension of time or forbearance is hereby waived.

_____ L.S.

Signed, Sealed & Delivered in the Presence of: By: _____

_____

_____

_____ L.S.

_____ _____(Surety)

MAINTENANCE AND GUARANTEE BOND

KNOW ALL MEN BY THESE PRESENTS, that _____, as Principal, and _____ as Surety, are held and firmly bound unto the City of Sterling Heights, Macomb County, Michigan, in the sum of _____ ($_____)* good and lawful money of the United States of America, to be paid to the City of Sterling Heights, its legal representatives, and assigns, and we bind ourselves, our heirs, executors, administrators, successors, and assigns, and each and everyone of them jointly and severally firmly by these present.

SEALED WITH OUR SEALS AND DATED THIS _____ day of _____, 20____.

WHEREAS, the above named principal has entered into a certain written contract with the City of Sterling Heights, dated this _____ day of _____, 20_____, wherein the said principal covenanted and agreed as follows, to wit:

_____

NOW THEREFORE, the condition of this obligation is such that by and under said contract, the above named principal has agreed with the City of Sterling Heights, that, for a period of two (2) years from the date of approval of the Final Estimate, to keep in good order, and to repair any defect in all the work done under said contract, either by the principal, his subcontractors, or his material suppliers, that may develop during said period, due to improper materials, defective equipment, workmanship or arrangements, and any other work affected in making good such imperfections, all to be made good without expense to the Owner, (excepting only such part or parts of said work as may have been disturbed without the consent or approval of the principal after the final acceptance of the work,) and, whenever directed so to do by the City of Sterling Heights by notice served in writing, either personally or by mail, on the principal at _____, or _____, its Legal Representatives, or its successors, or on the surety at _____, to proceed at once to make such repairs as directed by the City of Sterling Heights, and in case of failure so to do within one week from the date of service of such notice, or within reasonable time not less than one week as shall be fixed in said notice, then the City shall have the right to purchase such materials and employ such labor and equipment as may be necessary for the purpose, and to undertake do and make such repairs itself, and charge the expense thereof to, and be fully reimbursed for same by said principal or surety.

If any repair is necessary to be made at once to protect life and property, the City may take immediate steps to repair or barricade such defects without notice to the contractor. In such case the City shall not be held to obtain the lowest figures for the doing of the work, or any part thereof, but all sums actually paid therefore shall be charged to the principal or surety. In this connection the judgment of the City is final and conclusive.

If the principal, for a period of two (2) years from the date of approval of a final estimate, shall keep the work so constructed under the contract in good order and repair, excepting only such part or parts of the work which have been disturbed without the consent or approval of the principal after the final acceptance of same, and, whenever notice is given as hereinbefore specified, at once proceed to make the repair as the notice directs, or reimburse the City for any expenses incurred by it in making

such repairs should the principal or surety fail to do so, then the above obligation shall be void; otherwise, it will remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have caused this instrument to be executed by their respective authorized officers this _____ day of _____, 20___.

Signed, Sealed and Delivered
in the Presence of:

_____
"Principal"

_____
Witness

_____
Witness

_____
"Surety"

_____
Witness

_____
Witness

City of Sterling Heights
A Michigan Municipal Corporation
"Owner" Acting by & through:

_____
Witness

_____
Mayor

_____
Witness

_____
City Clerk

*Amount equal to 25% of the Contract Price

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that we the undersigned _____ as Principal and _____ of _____ as Sureties, are hereby held and firmly bound unto the City of Sterling Heights in the full and just sum of _____ ($_____), for the payment of which will and truly be made, we do hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

The Condition of the above obligation is such that if the said Principal shall well and faithfully do and perform the things agreed to by such Principal to be done and performed under the annexed Contract according to the terms thereof, then this obligation shall be void, otherwise the same shall remain in full force and effect.

It is mutually agreed and understood that in cases where changes are required, either by the Owner or by the Owner's Engineer, or by mutual agreement, such changes shall not modify, discharge or release this bond.

Signed and Sealed this _____ day of _____, 20___.

By: _____

SEAL Principal

Signed, Sealed, & Delivered
in the Presence of:

_____ By: _____

Seal-Surety

BID SUBMITTERS CHECK LIST

All information required by the terms of the bid documents must be furnished.

MISTAKES OR OMISSIONS CAN RESULT IN THE REJECTION OF YOUR BID.

Important items for you to check are included in, but not limited to, those listed below. This checklist is furnished only to assist you in submitting a proper bid.

_____ Is your bid properly signed? (refer to bid documents)

_____ Have you entered a unit price for each bid item?

_____ H you entered the unit price or lump sum price in both words and figures? (unit price or lump sum price in words governs)

_____ Are decimals in unit price in the proper places? Are your figures legible?

_____ Are any bid bonds or bid deposits, if required, included in your bid package?

_____ Did you complete and include the **Qualification Questionnaire, Hold Harmless, Non-Iran Linked Business Certification** and **References** forms?

_____ Is the envelope containing your bid properly identified and addressed?

_____ Will your bid arrive on time? Late bids will ***not*** be considered. **Bids must be received in the Office of the City Clerk and stamped no later than 2:30 p.m. with the official time stamp in the City Clerk's office by the date specified.**

_____ Did you submit your original bid form (no additional copies are required)? **PLEASE DO NOT RETURN COPIES OF OUR SPECIFICATIONS/INSTRUCTIONS. RETURN ONLY THE FORMS REQUIRING YOUR COMPLETION, AS WELL AS EXHIBITS A (Insurance Requirements) AND B (Bond Requirements).** Failure to include all pages may result in your bid being deemed non-responsive.

_____ Did you check the MITN website for any addendums which may have been posted? **Addendums may be posted at any time.**

CONTRACT

Articles of Agreement, Made and Entered into this _____ day of _____ 20____, by and between _____ of _____ hereinafter called the Contractor and the City of Sterling Heights, Michigan, hereinafter called the Owner, Witnesseth, that the Contractor and the Owner for the considerations hereinafter named agree as follows:

1. That all Contract Documents, as defined in "Instructions to Bidders" in the Specifications, hereto attached or herein referred to shall be and are hereby made a part of the agreement and Contract.

2. The Contractor shall, under penalty of bond attached, furnish all labor, materials, and equipment necessary and perform all of the work as set forth in his Proposal in strict accordance with the drawings, specifications, and other documents which have been made a part of this Contract in the manner, time and place as therein set forth:

_____

3. In consideration whereof, the City of Sterling Heights agrees to pay the Contractor the amounts provided in the attached proposal, being the product of the unit prices therein set forth, multiplied by the number of units actually constructed, all in the time and manner as set forth in the "General Conditions" under the heading "Payments to Contractor."

4. In witness whereof, said parties have hereunto set their hand and seals the day and year first above written.

_____ _____
Witness Contractor "Principal"

_____ _____
Witness By

_____ _____
Title

CITY OF STERLING HEIGHTS
A Michigan Municipal Corporation "Owner"

Acting by and Through:

_____ _____
Witness Mayor

_____ _____
Witness City Clerk

CONTRACTOR'S AFFIDAVIT

STATE OF MICHIGAN)
) SS
COUNTY_____)

The undersigned, _____ hereby represents that on _____ he (it) was awarded a Contract by _____ hereinafter called the Owner, to _____ in accordance with the terms and conditions of Contract Number(s) _____; and the undersigned further represents that the subject work has now been accomplished and the said contract has now been completed.

The undersigned hereby warrants and certifies that all of his (its) indebtedness arising by reason of the said contract has been fully paid or satisfactorily secured; and that all claims from subcontractors and others for labor and material used in accomplishing the said project, as well as all other claims arising from the performance of the said contract, have been fully paid or satisfactorily settled. The undersigned further agrees that, if any such claim should hereafter arise, he (it) shall assume responsibility for the same immediately upon request to do so by the Owner.

The undersigned, for a valuable consideration, the receipt of which is hereby acknowledged, does further hereby waive, release and relinquish any and all claims or right of lien which the undersigned now has or may hereafter acquire upon the subject premises for labor and material used in accomplishing said project owned by the Owner.

This affidavit is freely and voluntarily given with full knowledge of the facts on this _____ day of _____, 20___.

Contractor

By:_____

Title:_____

Subscribed and Sworn to before me, a Notary Public in and for _____ County, Michigan, on this _____ day of _____, 20____.

_____
Notary Public

My Commission Expires: _____

CONTRACTOR'S DECLARATION

I hereby declare that I have not, during the period _____ to _____ A.D., 20____ performed any work, furnished any material, sustained any loss, damage or delay for any reason, including soil conditions encountered or created, or otherwise done anything for which I shall ask, demand, sue for, or claim compensation from:

the Owner, or his agents, in addition to the regular items set forth in the contract numbered:

_____ and dated _____ A.D., 20____, for:

_____

executed between myself and the Owner, and in the Change Orders for work issued by the Owner in writing as provided thereunder, except as I hereby make claim for additional compensation and/or extensions of time as set forth on the itemized statement attached hereto.

There is / is not an itemized statement attached.

Date:_____

By:_____

Title:_____

NON-COLLUSION AFFIDAVIT

STATE OF MICHIGAN)
) SS
COUNTY_____)

_____ being duly sworn deposes and says; that he is _____ (state official capacity in firm) the party making the foregoing proposal or bid, that such bid is genuine and not collusion or sham; that said bidder has not colluded, conspired, connived, or agreed directly or indirectly with any bidder or person, to put in a sham bid or to refrain from bidding, and has not in any manner, directly or indirectly, sought by agreement or collusion, or communication or conference with any person, to fix any overhead, profit or cost element of said bid price or that of any other bidder, or to secure any advantage against the City of Sterling Heights or any person interested in the proposed contract; and that all statements contained in said proposal or bid are true.

_____
Signature of Person Submitting Bid

Subscribed and sworn to this _____ day of _____, 20___, before me, a Notary Public in and for said County.

My Commission Expires:

_____ _____
Notary Public

HOLD HARMLESS AND INDEMNITY

To the fullest extent permitted by law, the contractor expressly agrees to indemnify and hold the City of Sterling Heights (City), its elected and appointed officials, employees and volunteer and others working on behalf of the City, harmless from and against all loss, cost, expense, damage, liability or claims, whether groundless or not, arising out of the bodily injury, sickness or disease (including death resulting at any time therefrom) which may be sustained or claimed by any person or persons, or the damage or destruction of any property, including the loss of use thereof, based on any act or omission, negligent or otherwise, of contractor or anyone acting in its behalf in connection with or incident to this contract or the work to be performed hereunder, except that the contractor shall not be responsible to the City on indemnity for damages caused by or resulting from the City's sole negligence; and the Contractor shall, at its own cost and expense, defend any such claim and any suit, action, or proceeding which may be commenced hereunder, and the Contractor shall pay any and all judgments which may be recovered in any such suit, action or proceeding, and any and all expense, including, but not limited to, costs, attorneys' fees and settlement expenses which may be incurred therein.

PLEASE PRINT:

Company Name_____

Authorized Representative_____

Signature/Date_____

This form **must** be completed and returned with your bid.

NON-IRAN LINKED BUSINESS CERTIFICATION

Pursuant to Michigan law before accepting any bid or proposal or entering into any contract for goods and services with any prospective Vendor, the Vendor must certify that it is not an "Iran Linked Business".

By signing below, I certify and agree on behalf of myself and the company submitting this proposal the following: (1) that I am duly authorized to legally bind the company submitting this proposal; and (2) that the company submitting this proposal is not an "Iran Linked Business," as that term is defined in Section 2(e) of the Iran Economic Sanctions Act, being Michigan Public Act No. 517 of 2012; and (3) That I and the company submitting this proposal will immediately comply with any further certifications or information submissions requested by the City in this regard."

PLEASE PRINT:

Company Name_____

Authorized Representative_____

Signature/Date_____

This form **must** be completed and returned with your bid.

SECTION 007200 – GENERAL CONDITIONS

PART 1 - GENERAL

1.1 CONTRACT DOCUMENTS AND RELATED DATA

A. Intent of Contract Documents: The intent of the Contract Documents is that the Contractor furnish all labor and materials, equipment and transportation necessary for the proper execution of the work unless specifically noted otherwise. The Contractor shall do all the work shown on the Drawings and described in the Specifications and all incidental work considered necessary to complete the project in a substantial and acceptable manner, and to fully complete the work, ready for use and operation by the City of Sterling Heights.

B. Errors and Corrections: If the Contractor finds any discrepancies between the Drawings and Specifications and site conditions, any errors or omissions in the Drawings or Specifications, or if he wishes to question the materials or procedures prescribed, the Contractor shall stop work and immediately notify the Architect. The Architect shall review these conditions, and if he may deem it necessary, he shall direct changes to be made before the work is to continue. The Contractor shall not be allowed to take advantage of any such error, omission, or discrepancy, as full instructions will be furnished by the Architect, and the Contractor shall carry out such instructions as if originally specified. In no case shall the Contractor proceed with the work in uncertainty, and any work done by the Contractor after the discovery of any error, omission, or discrepancy, until authorized, will be at the Contractor's risk and responsibility.

C. Conflict Between the Drawings and Specifications: If there is conflicting variance between the Drawings and Specifications, the provisions of the Specifications shall control. In case of conflict between the General Conditions of the Contract or any modifications thereof and the Detailed Specifications, the Detailed Specifications shall control.

D. Additional Instructions: Further instructions may be issued by the Owner during the progress of the work by means of drawings or otherwise, to make more clear or more specific the Drawings and Specifications, or as may be necessary to explain or illustrate changes in the work to be done.

E. Copies of Contract Documents to Be Furnished: Except as provided for otherwise, all required copies of the Contract Documents and Drawings necessary for the execution of the work shall be furnished to the Contractor without charge.

F. Ownership of Contract Documents: All original or duplicated Drawings and Contract Documents and other data prepared by the Architect, Landscape Architect, and Engineer shall remain the property of the City. They shall not be re-used on other work.

G. Contract Documents at the Job Site: One complete set of all Drawings and Contract Documents shall be maintained at the job site and shall be available to the Owner or its representative at all times.

H. Drawings and Specifications Cooperative: The Drawings and Specifications are intended to be complimentary. They shall be construed as supplementary and explanatory each to the other,

and any work called for in the Drawings and not particularly mentioned in the Specifications, or described in the Specifications and not particularly shown on the Drawings is to be regarded as included under this Contract.

I. Surveys: The Engineer shall furnish substantial stakes and marks conveniently placed showing the location and elevation of the various parts of the work, and the Contractor shall furnish such labor and assistance as the Engineer may require in setting the stakes and marks. No work shall be undertaken until such marks and stakes have been set by the Engineer. The Contractor shall take due and proper precautions for the preservation of these stakes and marks and shall see to it that the work at all times proceeds in accordance therewith. If it shall become necessary to replace any mark or stake due to failure of the Contractor to take proper precautions for its preservation, or because of the carelessness upon the part of his employees, or those of his subcontractors or suppliers of materials, the City will replace them at a charge of ten dollars for each mark or stake so replaced; and such cost will be deducted from the amount due to Contractor at the time of the final estimate.

1.2 RELATIONS BETWEEN THE CITY AND THE CONTRACTOR

A. Inspection of Work: All materials and each part or detail of the work shall be subjected at all times to inspection by the City, Inspector, or Agents of the City, and the Contractor will be held strictly to the true intent of the Specifications in regard to quality of materials, workmanship, and the diligent execution of the Contract. Such inspection may include mill or plant inspection, and any material supplied under these specifications is subject to such inspection. The City shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the Contractor as is necessary to make a complete and detailed inspection.

1.3 CONTRACTOR'S UNDERSTANDING AND RESPONSIBILITIES

A. Understanding: Unless otherwise provided for in the Contract Documents, the Contractor shall do all the work and shall furnish all the tools and appliances except as herein otherwise specified, necessary or proper for performing and completing the work required by this contract, in the manner and within the time herein prescribed.

B. Responsibilities: The Contractor shall assume full responsibility for the work and take all precautions for preventing injuries to persons and property on or about the work. He shall bear all losses resulting to him because:
   1. Of the amount or character of the work.
   2. The conditions under which the work is done are different from what was estimated or expected.
   3. The nature of the ground in which the work is done is different from what was estimated or expected.
   4. Of the weather, floods, elements, or other causes. He shall assume the defense and save harmless the City and its individual officers and agents from all claims relating to:
      a. Labor provided and materials furnished for the work.
      b. Inventions, patents, and patent rights used in doing the work.
      c. Injuries to any persons or property, received or sustained by or from the Contractor, his agents or employees, in doing the work or arising out of the work performed or to be performed.

d. Any act, or neglect, of the Contractor, his agents or employees.

The mention of any specific duty or liability of the Contractor in this or in any part of the Contract Documents shall not be construed as a limitation or restriction upon any general liability or duty imposed on the Contractor by the Contract Documents.

C. Contractor's Supervision and Organization: The work under this Contract shall be under the direct charge and direction of the Contractor. The Contractor shall give efficient superintendence to the work, using his best skill and attention. The Contractor shall at all times keep on the site of the work, during its progress, a competent superintendent shall represent and have full authority to act for the Contractor in the latter's absence, and all directions given to him shall be as binding as if given to the Contractor directly. On written request in each case, all such directions will be confirmed in writing to the Contractor.

1. The Contractor shall establish and maintain an office on the site of the work, or at some convenient point adjacent thereto, during the continuance of this Contract and shall have at all times during working hours, a representative authorized to receive and execute any and all orders, when given by the Engineer; and such order, when given out and received by said representatives, shall be deemed to have been given to and received by the Contractor.

D. Lands for Work: The City shall provide the lands upon which the work under this Contract is to be done.

E. Private Property: The Contractor shall not enter upon private property for any purpose without obtaining written permission, (a copy of which is to be given to the Engineer). The Contractor shall be responsible for the preservation of all public property, trees, monuments, etc., along and adjacent to the street and/or right-of-way, and shall use every precaution necessary to prevent damage to pipes, conduits, and other underground structures and shall protect carefully from disturbance or damage, all monuments and property marks until the Engineer or an authorized agent has witnessed or otherwise referenced their location for their land use and shall not remove them until directed.

F. Adjacent Properties: The Contractor shall at no time cause a disruption to daily services such as trash collection and mail delivery to adjacent and/or surrounding residential or commercial properties.

1.4 REMOVAL OF TOOLS, EQUIPMENT, AND SUPPLIES AFTER COMPLETION

A. At the termination of this Contract, before acceptance of the work by the Engineer, the Contractor shall remove all of his equipment, tools, and supplies from the property of the City. Should the Contractor fail to remove such equipment, tools, and supplies, the City shall have the right to remove them, and all costs for removal are to be charged to the Contractor.

1.5 CITY’S RIGHT TO SUSPEND WORK

A. The City shall have the right to suspend the whole or part of the work by written order, whenever in the judgment of the City such suspension is required in the general interest of the City, or if the Contractor has not fulfilled his obligations under the Contract Documents. Upon

receipt of the City's written order, the Contractor shall suspend the work covered by the order and shall take such means and precautions as may be necessary to protect the finished and partially finished work. Work shall not be resumed until ordered in writing by the City.

1.6 CITY'S RIGHT TO CORRECT WORK

A. If the Contractor should neglect to prosecute the work properly or fail to perform any provision of this Contract, the City, after four hours written notice to the Contractor may, without prejudice to any other remedy he may have, make good such deficiencies and may deduct the cost thereof from the payment then or thereafter due the Contractor.

1.7 DEFAULT OF CONTRACT

A. When in the opinion of the City, the work or any part of the work to be done under this contract has been abandoned, is unnecessarily delayed, or cannot be completed at the rate of progress, or within the time specified, or the Contractor is willfully violating any of the covenants of this Contract, or is carrying it out in bad faith, or has been adjudged as bankrupt, or if he should make a general assignment for the benefit of his creditors, the City, in writing, may declare the Contractor in default and so notify him to discontinue the work.

1. The City may then call upon the Sureties to complete the work, or may complete it by other means. The City may take over and use materials and equipment at the site of the work, and other materials and equipment used elsewhere for the work at the time of default, and may procure other materials, equipment and all else necessary for the completion of the work. The City may recover the cost of completing the work by deducting the amount thereof from any monies due or which may become due the Contractor under this Contract; and when such monies are insufficient to pay said cost, the amount of said cost in excess of such monies shall be paid by the Contractor, or by the Surety.

1.8 CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE CONTRACT

A. If the work should be stopped under an order of any court or other public authority for a period of ninety days, through no fault of the Contractor, or of anyone employed by him, then the Contractor may, upon seven days written notice to the City, stop work or terminate this contract.

1.9 RIGHTS OF VARIOUS INTEREST

A. Whenever work being done by the City's forces or by other Contractors is contiguous to work covered by this Contract, the respective rights of the various interests involved shall be established by the Engineer, to secure the completion of the various portions of the work in general harmony.

1.10 SUBCONTRACTS

A. The Contractor shall, as soon as practicable after the signing of the Contract, notify the City in writing of the names of the Subcontractors proposed for the work, and any other information as the City may require. The Contractor shall not employ any Subcontractor that the City, within a reasonable length of time, may object to as unfit or incompetent, and subcontractors may not be changed during construction of the work except at the request or approval of the City.

B. The Contractor is responsible to the City for the acts and omissions of his own employees.

C. Nothing contained in the Contract Documents shall create contractual relations between any subcontractor and the City.

1.11 SEPARATE CONTRACTS

A. The City reserves the right to let other contracts with the work. The Contractor shall cooperate with other contractors in regard to storage of materials and execution of their work, and he shall properly coordinate and connect his work with theirs.

B. The contractor shall inspect the work by other contractors, which may affect his work and shall report to the City or its representative any irregularities, which will not permit him to complete his contract in a satisfactory manner. Failure to report such irregularities shall indicate that the work of other contractors has been satisfactorily constructed so as to receive his work, except as to defects, which may develop in the other contractor's work after the execution of his work. To ensure proper execution of his work, the Contractor shall measure work already in place and shall notify the Engineer of any discrepancy between the drawings and the erected work.

1.12 EXAMINATION OF COMPLETED WORK

A. At the City's request, the Contractor shall permit inspection of the completed work. If the City or its representative find the work to be defective or nonconforming to the Contract Document, due to the fault of the Contractor or his subcontractors, the Contractor shall stand all expense of such examination, reconstruction and any time loss involved. If the work is found by the City to meet the Contract requirements, the additional work will be paid for in accordance with "MEASUREMENT AND PAYMENT" hereof, and if the completion of the work has been delayed thereby, a suitable extension of time shall be granted. If the Contractor is required to remove or uncover completed work for examination due to his failure to give timely notice to the City of the readiness for such examination, the Contractor shall stand all expenses although the work is found to meet all Contract requirements.

1.13 WORK DURING EMERGENCY

A. In the event of an emergency endangering life, property, or the work, the Contractor shall provide and install all materials and equipment to alleviate the emergency condition. The City shall be notified as soon as possible, but the Contractor shall not wait for instructions before proceeding to correct the emergency situation.

1.14 CONTRACTOR’S EMPOLYEES

A. The Contractor shall employ only competent, efficient workmen and shall not use on the work any unfit person or one not skilled in the work assigned to him, and shall at all times maintain good order among his employees. Whenever the City shall inform the Contractor, in writing, that, in his opinion any employee is unfit, unskilled, disobedient, or is disrupting the orderly progress of the work, such employee shall be removed from the work and shall not again be employed on it.

1.15 STRUCTURES AND TREES ADJOINING THE WORK

A. The Contractor shall assume full responsibility for the protection of all pavements, curbs, bridges, railroads, poles, and any other surface structures, and all water mains, sewers, gas mains, and other underground and overhead services and structures along and near the work which may be affected by his operations, and shall indemnify, defend and save harmless the City against all damages or alleged damages to any such structures arising out of his work. The Contractor shall bear the cost of repair or replacement of any such structure damaged as a result of his operations.

B. No trees or shrubbery of any kind shall be removed or destroyed by the Contractor without the written permission of the City, or as noted on the plans, and the Contractor will be held fully responsible for any damages caused by his work to adjoining trees and shrubs.

1.16 MAINTENACE OF SERVICE

A. Maintenance of Service: Drainage through existing sewers and drains shall be maintained at all times during construction. Any re-routing or reconstruction which may be necessary shall be done by a means approved by the City.

B. Safety precautions shall be followed at all times to prevent accidents to vehicular and pedestrian traffic. Signs, barricades, temporary roads and drives, and detour roads, shall be maintained by the Contractor as directed by the City, as indicated on the Specifications and Drawings.

C. In the event of the failure to comply with these provisions, the City may, with or without notice, cause the same to be done, and will deduct the cost of such work from any money due the contractor under this Contract. However, the performance of such work by the City, or at the City's insistence, shall in no way serve to release the Contractor from his general or particular liability for the safety of the public or the work.

1.17 GENERAL REQUIREMENTS FOR MATERIAL AND WORKMANSHIP

A. Suitable Tools and Equipment: The Contractor shall furnish all tools and equipment necessary to execute the work. Any tools or equipment that the Engineer may deem unsuitable or insufficient for execution of the work shall be removed from the work and suitable equipment or tools shall be substituted by the Contractor, as approved by the Engineer.

B. Materials Furnished by the Contractor: All materials used in the work shall meet the requirements of the various specifications and no material shall be used until it has been

approved by the Engineer. All materials used for the work shall be furnished by the Contractor unless specifically indicated otherwise.

C. Storage of Materials: The Contractor shall store his material and equipment upon or near the site, so disposed as to not interfere with:
   1. Work being done by the City.
   2. Work being done by other Contractors employed by the City.
   3. Existing street drainage.
   4. Fire hydrants.
   5. Access to or the use of public or private property.
   6. General health, safety and welfare of the City.

D. Rejected Materials and Workmanship: The Engineer shall have the authority to reject defective materials or workmanship, or require correction. Unacceptable workmanship shall be satisfactorily corrected. Rejected materials shall be segregated, marked, and promptly removed from the site and replaced with proper materials. If the Contractor fails to promptly proceed with the replacement of rejected materials and/or the correction of defective workmanship, the City may, by contract or otherwise, replace such material and/or correct such workmanship, and charge the cost thereof against the Contractor.

E. Workmanship: The work shall be performed in accordance with the best modern practices with materials and workmanship of the highest quality for the particular purpose or as specifically provided in the Contract Documents and Drawings. The Engineer shall judge and determine the Contractor's compliance with these requirements.

F. Inspection and Testing of Materials: Where called for in the Specifications, samples or materials in the quantity named shall be submitted to the Engineer for approval. Where tests are required they shall be made at the expense of the Contractor, except as otherwise called for in the Specifications. For materials covered by ASTM or other standard specifications, unless otherwise stipulated, the required tests are to be submitted to the Engineer for approval.

G. Cleanup: The Contractor shall remove from the City's property and all private property, at his own expense, all temporary structures, rubbish, and waste materials resulting from his operations.

1.18 CONTRACTOR’S TITLE TO MATERIALS

A. No materials or supplies for the work shall be purchased by the Contractor or by any subcontractor subject to any chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller. The Contractor warrants that he has good title to all materials and supplies used by him in the work, free from all liens, claims or encumbrances.

1.19 CHANGES IN THE WORK

A. The City shall have the right to require, by written order, changes in, additions to, or deductions from the work required by the Contract Documents; provided that if changes, additions or deductions are made, the general character of the work as a whole is not changed thereby.

Adjustments in the Contract price, if any, because of any change, addition, or deduction in the work shall be determined as hereinafter provided, and any claim for extension of time for completion shall be adjusted at the time of ordering the change, addition, or deduction. No claim for change, addition, or deduction, or adjusting of price, or extension of time for completion thereof, shall be made or allowed unless done in pursuance of written order from the City specifically authorizing such change, addition or deduction. Drawings without a written order shall not be considered such authority. Written notice of such claims shall be made to the Engineer before the commencement of the work. Where the written order diminishes the quantity of work to be done, this order shall not constitute a basis for a claim for damages or anticipated profits on the work that may be dispensed with.

B. Under circumstances, which, in the judgment of the Engineer so necessitate, the Engineer shall have authority to require, by written order, changes in, additions to, or deductions from the work. Such written order by the Engineer shall be subject to later confirmation by the City when the extent and costs have been established. It is understood and agreed that in case any change in, addition to, or deduction from the work is required, said change shall in no way invalidate the Contract and shall not affect or discharge the bonds furnished by the Contractor.

1.20 BASIS FOR DETERMING COST OF CHANGES IS WORK

A. Adjustments, if any, in the Contract price by reason of change in the work shall be limited to the amount specified in the written order authorizing the change in the work. Adjustments shall be determined by one or more of the following methods, the City reserving the right to select the method or methods at the time the written order is issued:
   1. An Acceptable Lump Sum Proposal: To facilitate checking and acceptance, the proposal shall be itemized with quantities and prices given for the various items.
   2. Unit Price: The unit prices may be the "Unit Price" set in the Contract, or fixed by subsequent agreement between the Engineer and the Contractor.
   3. On a Cost-Plus-Limited-Basis, Not to Exceed a Specified Maximum Limit of Cost: "COST" as herein shall be the actual and necessary costs incurred by the Contractor by reasons of the change in the work for Labor, Materials, Equipment Rental, and Insurance Premiums:
      a. Labor costs shall be the amount shown on the Contractor's payrolls, with payroll taxes added when such taxes can be shown to have incurred. In no case shall the rates charged for labor exceed the rates paid by the Contractor for the same class of labor employed by him to perform work under the regular items of the Contract.
      b. Material costs shall be the net price paid for material delivered to the site of the work. If any material previously required is omitted by the written order of the City after it has been delivered to or partially worked on by the Contractor and consequently will not retain its full value for other uses, the Contractor shall be allowed the actual cost of the omitted material less a fair market value of the material, as determined by the City.
      c. Equipment Rental shall be the actual additional costs incurred for necessary equipment. Costs shall not be allowed in excess of usual rentals charged in the area for similar equipment of like size and condition, including the costs of necessary supplies and repairs for operating the equipment. No costs, however, shall be allowed for the use of equipment on the site in connection with other work unless its use incurs actual and additional costs to the contractor. If equipment not on the

site is required for the change in the work only, the cost of transporting such equipment to and from the site shall be allowed.

d. Insurance Premiums shall be limited to those based on labor payroll and to the types of insurance required by the Contract. The amount allowed shall be limited to the net costs incurred, as determined from the labor payroll covering the work. The Contractor shall, upon request of the City, submit verifications of the applicable insurance rates and premium computations.

e. "Plus" as herein used is defined as percentage to be added to the items of "Cost" to cover superintendence, use of ordinary tools, bonds, overhead expense and profit. The percentage shall not exceed fifteen percent on work done entirely by the Contractor and shall not exceed an aggregate total of twenty percent on work done by a subcontractor.

f. "Specified Maximum Limit of Cost" is the amount stated in the written order of the City authorizing the change in the work. The amount to be allowed the Contractor shall be the "cost", and "plus", the percentage or the specified maximum ─ whichever is the lesser amount. The Contractor shall keep complete, accurate daily records of the net actual cost of changes in the work, and shall present such information in such form and at such times as the City may direct.

1.21 PATENTS

A. The Contractor shall hold and save the City harmless from liability of any nature or kind, including cost and expense for, or on account of, any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the Contract, including its use by the City unless otherwise specifically stipulated in the Contract Documents.

B. License and/or Royalty Fees for the use of a process, which is authorized by the City for the project must be reasonable, and paid to the holder of the patent, or his authorized licensee, directly by the City and not by or through the Contractor.

C. If the Contractor uses any design, device or materials covered by letters, patent or copyright, he shall provide for such use by suitable agreement with the owner of such patented or copyrighted design, device or material. It is mutually agreed and understood, that without exception, the Contract prices shall include all royalties or cost arising from the use of such design, device or materials, in any way involved in the work. The Contractor and/or his sureties shall indemnify and save harmless the City from any and all claims for infringement by reason of the use of such patented or copyrighted design, device or materials or any trademark or copyright in connection with work agreed to be performed under this contract, and shall indemnify the City for any cost, expense or damage which it may be obliged to pay by reason of such infringement at any time during the prosecution of the work after completion of the work.

D. In the event that any claim, suit, or action at law or in equity of any kind, whatsoever, it is brought against the City, involving any such patents or license rights, then the City shall have the right to, and may, retain from any money due or to become due to the Contractor, such sufficient sum as is considered necessary to protect said City against loss, and such sum may be retained by the City until such claim or suit shall have been settled and satisfactory evidence to that effect shall have been furnished the City.

1.22 "OR EQUAL" CLAUSE

A. Whenever in any of the Contract Documents an article, material or equipment is defined by describing a proprietary project, or by using the name of a manufacturer or vendor, the term "or equal" if not inserted, shall be implied. The specific article, material or equipment mentioned shall be understood as indicating the type, function, minimum standard or design, efficiency and quality desired, and shall not be construed in such a manner as to exclude manufacturer's products of comparable quality, design and efficiency. The Contractor shall comply with the requirements of the Contract Documents relative to the City's approval of material and equipment before they are incorporated in the work.

1.23 USE OF COMPLETED PORTIONS OF THE WORK

A. The City may, at any time during progress of the work, after written notice to the Contractor, take over and place in service any completed portions of the work which are ready for service, although the entire work of the Contract is not fully completed, and not withstanding that the time for completion of the entire work or such portions may not have expired. In such event, the Contractor will be relieved of maintenance of said portion, except as covered by his guarantee of same. The use of any portion of the work by the City under the provisions of this section shall not constitute final acceptance of the work and shall not be construed to be a final estimate for such work. The date of final estimate shall be the date of final estimate for the entire project covered under this Contract.

1.24 FAIR EMPLOYMENT PRACTICES ACT

A. The Contractor agrees that neither he nor his subcontractor will discriminate against any employee or applicant for employment, to be employed in the performance of this contract, with respect to his hire, tenure, terms, conditions or privileges of employment, or any matter directly or indirectly related to employment because of his race, color, religion, national origin, or ancestry. Breach of this covenant may be regarded as a material breach of this Contract.

1.25 QUALIFICAITONS FOR EMPLOYMENT

A. No person under the age of sixteen years shall be employed on the project under this Contract. No person whose age or physical condition is such as to make his employment dangerous to his health or safety, or to the health or safety of others shall be employed on the project under this contract, provided that this shall not operate against the employment of physically handicapped persons, otherwise employable, where such persons may be safely assigned to work, which they can ably perform.
   1. No Discrimination Against Handicappers: Contractor agrees that neither he nor his subcontractors will discriminate against an employee or applicant for employment with respect to hire, tenure, terms, conditions, or privileges of employment, or a matter directly or indirectly related to employment, because of a handicap as defined by Public Act No. 478 of the Public Acts of 1980, that is unrelated to the individual's ability to perform the duties of a particular job or position. Breach of this covenant shall be regarded as a material breach of the contract.

1.26 OTHER PROHIBITED INTERESTS

A. No official of the City who is authorized in such capacity and on behalf of the City to negotiate, make, accept or approve, or to take part in negotiating, making, accepting or approving any architectural, engineering, inspection, construction or materials supply contract or any subcontract in connection with the construction of the project, shall become directly or indirectly interested personally in this contract, or in any part hereof. No officer, employee, architect, attorney, engineer of or for the City to exercise any legislative, executive, supervisory or other similar functions in connection with the construction of the project, shall become directly or indirectly interested personally in this Contract or in any part thereof, any material supply contract, subcontract, insurance contract, or any contract pertaining to the project.

1.27 SANITARY REGULATIONS

A. Necessary sanitary conveniences for the use of workmen on the work, properly secluded from public observation, shall be constructed and maintained in sanitary condition by the Contractor, and their use shall be strictly enforced.

1.28 SUNDAY, HOLIDAY AND NIGHT WORK

A. All construction under these Specifications shall not begin before sunup or at the earliest 7:00 a.m., and all construction shall cease at sundown or at the latest 7:30 p.m. The Contractor shall adhere to this schedule unless specifically authorized in writing by the City Engineer. Sunup and sundown shall be determined by the shutting off or turning on the streetlights in the area of the project. This shall expressly forbid the running or operating of any mechanical equipment except during the permitted hours. The Contractor shall schedule his construction so that operations including installing pipe, backfilling, finishing pavement, applying curing compound, cleanup and placing of proper barricades and lighting, and any other construction are done during the required time. No inspection personnel will be furnished for hours in addition to those specified.

B. No Sunday or holiday work will be allowed unless specifically authorized in writing by the City Engineer. Holidays shall be any day when the City offices of the City of Sterling Heights are officially closed.

1.29 RIGHTS-OF-WAY AND SUSPENSION OF WORK

A. The City shall furnish all land and rights-of-way necessary for the carrying out of this Contract and the completion of the work therein contemplated and will use due diligence in acquiring said land and rights-of-way as speedily as possible. It is possible that all lands and rights-of-ways may not be obtained as herein contemplated before construction begins, in which event the Contractor shall begin his work upon such land and rights-of-way as the City may have previously acquired and no claim for damages whatsoever will be allowed by reason of the delay in obtaining the remaining lands and rights-of-ways. Should the City be prevented or enjoined from proceeding with the work, or from authorizing its prosecution, either before or after the Commencement, by reason of any litigation, or by reason of its inability to procure any lands or rights-of-way for the said work, the Contractor shall not be entitled to make or assert

claim for damage by reason of said delay, or to withdraw from the Contract except by consent of the City - but time for completion of the work will be extended to such time as the City determines will compensate for the time lost by such delay, such determination to be set forth in writing.

1.30 PROGRESS OF WORK

A. The work shall be prosecuted regularly and uninterruptedly unless the City shall otherwise specifically direct, with such force and at such points as to ensure its full completion within the time herein stated.

B. If, in the opinion of the City, it is necessary or advisable that certain portions of the work be done immediately, the Contractor, upon written order, shall proceed, the Engineer may do or cause to be done, such work, and the cost of the same will be deducted from any money due or to become due the Contractor under this Contract.

1.31 TIME FOR COMPLETETION AND LIQUIDATED DAMAGES

A. It is hereby understood and mutually agreed between the Contractor and the City, that the date of beginning and the time for completion as specified in the Contract of the work to be done hereunder are Essential Conditions of this Contract; and it is further mutually understood and agreed that the work embraced in this Contract shall be commenced on a date to be specified in the work order.

B. The Contractor agrees that said work shall be prosecuted regularly diligently, and uninterruptedly at such rate of progress as will ensure full completion thereof within the time specified. It is expressly understood and agreed, by and between the Contractor and the City, that the time for the completion of the work described herein is a reasonable time for the completion of the same, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality.

C. If the said Contractor shall neglect, fail or refuse to complete the work within the time herein specified, or any proper extension thereof granted by the City, then the Contractor does hereby agree, as a part consideration for the awarding of this Contract, not as a penalty but as liquidated damages for such breach of contract as hereinafter set forth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the Contract for completing the work.
   1. The contractor shall pay unto the Owner as and for liquidated damage the sum of one thousand dollars ($1,000.00) for each and every calendar day that the contractor shall be in default. Liquidated damages shall be deducted as they are accrued and shall be documented.

D. The said amount is fixed and agreed upon by and between the Contractor and the City because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the City would in such event sustain, and said amount is agreed to be the amount of damages which the City would sustain and said amount shall be retained from time to time by the City from current periodical estimates.

E. If the contractor wishes to apply for a time extension beyond the date agreed to by or at the times herein mentioned or referred to in the Proposal, a written letter must be submitted to the City during the project construction but in no instance later than 14 days prior to the completion date as specified in the Proposal.

1.32 PERMITS

A. The Contractor shall secure, at no cost to the City, all permits and licenses necessary for the prosecution of the work.

1.33 PROTECTION OF WORK AND PROPERTY

A. The Contractor shall continuously maintain adequate protection of all his work from damage and shall protect all public property and private abutting property from injury and loss arising in connection with this Contract. He shall without delay, make good any such damage, injury or loss, and shall defend and save the City harmless from all such damages of injuries occurring because of his work. He shall furnish and maintain all passageways, barricades, guard fences, lights and danger signals, provide watchmen and other facilities for protection required by public authority or by local conditions or as directed by the Engineer, all at no additional cost to the City. The Contractor shall assume full responsibility of loss or damage resulting from caving earth and from storms, floods, frosts, and other adverse weather conditions, and from all other causes whatsoever not directly due to the acts or neglect of the City, including fire, vandalism, and malicious mischief, and shall turn the finished work over to the City in good condition and repair, at the time of final estimate. For the purpose of this section, the decision of the Engineer, with respect to existing conditions and for the need for corrective action by the Contract, shall be final.

1.34 SERVICE OF NOTICE

A. The address given by the Contractor in the proposal is hereby designated as the place where all notices, including letters and other communications shall be served, mailed, or delivered. This place may be changed at any time by the Contractor by written notice to the Engineer. Nothing herein contained shall preclude or render inoperative, service of any notice upon the Contractor by delivering it to him personally, or by serving notice to his agent or representatives in charge of any part of the work. In addition, where the Contractor is a corporation, such notice may be delivered to any of its officers or directors.

1.35 NO WAIVER OF CONTRACT

A. Neither the acceptance of the whole or any part of the work by the Owner or his Engineer, or any of its agents, nor any order, measurements, or certificate by the Engineer, nor any order by the Owner for the payment of money, nor any payment for the whole or any part of the work by the Owner, nor any extension of time, nor any possession taken by the Owner or its agents, shall operate as a waiver for any portion of the Contract or any power therein reserved to the Owner, or any right to damages therein reserved to the Owner, or any right to damages therein

provided; nor shall any waiver of any breach of the contract be held to be a waiver of any other or subsequent breach.

1.36 PAYMENT NOT TO BE STOPPED

A. The owner shall not, nor shall any officer thereof, be precluded or stopped by any return or certificate made or given by the Engineer, or other officer, agent or appointee, under the provisions of this agreements, at any time (either before or after the final completion and acceptance of the work and payment made therefore pursuant to any such return or certificates showing the true and correct amount of money due, therefore, notwithstanding any such return or certificate, or any payment made in accordance therewith) from demanding and receiving from the Contractor or his sureties, separately or collectively, such sums as may have been improperly paid said Contractor by reason of any such return or certificate which has been untruly or incorrectly compiled.

1.37 MAINTENANCE AND GUARANTEE

A. The Contractor, as a condition precedent to final payment, shall execute a guarantee to the City warranting for a period of two years from the date of final payment to keep in good order and repair any defect in all the work done under this Contract, either by the Contractor or his subcontractors, or the material suppliers, that may develop during said period due to improper materials, defective equipment, workmanship, or arrangements, and any other work affected in making good such imperfections shall also be made good. All without expense to the City, and the Contractor shall execute, in favor of the City, the attached Maintenance and Guarantee Bond.

B. When the specifications call for a guarantee period greater than two years, the Contractor shall provide such longer guarantee period.

1.38 MEASUREMENT AND PAYMENT

A. Basis of Payment: The City shall pay and Contractor receive the prices bid in the proposal, or agreed upon, less any deduction for any uncompleted portion, based upon measurements made by the Engineer or as otherwise herein stipulated, and such measurements shall be final and conclusive.

B. Request for Payment: Unless otherwise designated in the contract, the individual who signed the contract on behalf of the Contractor shall be the designate of the Contractor who will submit written requests for payment and the Architect shall be the person representing the City to whom requests for payment are to be submitted.
   1. The Contractor shall submit to the Architect and the City an application for each payment and shall submit a Contractor's Declaration declaring that he has not performed any work, furnished any material, sustained any loss, damage or delay, for any reason, including soil conditions encountered or created or otherwise done anything for which he will ask, demand, sue for, or claim compensation from the City and if required shall submit receipts or other vouchers showing his payments for material and labor, including payments to Subcontractors.

2. The processing of progress payments by the City may be deferred by the City until the work having a prior sequence, as provided in the contract documents, is in place and is approved.

C. Action of Payment Request: Payments, based on progress estimated, will be made on a monthly basis for work completed through the end of the preceding month, in accordance with the provisions of Act No. 524, Michigan Public Acts of 1980. Upon the failure of the City to make a timely progress payment, the person designated to submit requests for progress payments may include reasonable interest not to exceed seven percent on amounts past due in the next request for payment.
   1. The City shall retain a portion of each progress payment of ten percent of the dollar value of the work in place until work is fifty percent in place. After the work is fifty percent in place, additional retainage shall not be withheld unless the City determines that the contractor is not making satisfactory progress, or for other specific cause relating to the Contractor's performance under the contract. If the City so determines, the City may retain not more than ten percent of the dollar value of work more than fifty percent in place.
   2. No allowance will be made for materials furnished unless incorporated in the finished work, unless otherwise stated.
   3. The retained funds shall not be commingled with other funds of the City and shall be deposited in an interest bearing account in a regulated financial institution in this state wherein all such retained funds are kept by the City which shall account for both retainage and interest on each construction contract separately. The City shall not be required to deposit retained funds in an interest bearing account if the retained funds are to be provided under a state or federal grant and the retained funds have not been paid to the City. The type and amount of the interest bearing account shall be determined by the City in its sole discretion.

D. Dispute Regarding Retained Funds and Interest: The Contractor agrees, in accordance with Act 524, Michigan Public Acts of 1980, that in the event a dispute arises over the avoidable or unacceptable delay in the performance of the work, the matter shall be submitted for resolution to an agent designated by the City. The dispute resolution process shall be used only for the purpose of determining the rights of the parties to retain funds and interest earned on retained funds and is not intended to alter, abrogate or limit any rights with respect to remedies that are available to enforce or compel performance of the terms of the contract by either the Contractor or the City. The Contractor and the City agree to share equally all of the costs and expenses of the agent.

E. City's Right to Withhold Payment: Should the City’s request to withhold payment caused by the Contractor's failure to comply with the written order of the City, or with the Contract Documents; or, should the Contractor fail to provide satisfactory evidence that he has paid all claims of every nature, the City may withhold payment until such orders, requirements, or claims have been settled as approved by the City.

F. Contractor's Responsibility for Payment: Unless otherwise indicated in the Contract documents, the Contractor shall furnish all materials and service, and perform all work described by the Contract Documents. He shall pay for: replacement of all survey bench marks, reference points, and stakes provided by the Owner; lands or easements procured by the Contractor; insurance; performance and maintenance bonds, royalties, permits and licenses.

G. Payment for Uncorrected Work: Should the City direct the Contractor not to correct damaged work or work which was not performed as required in the Contract Documents, an equitable deduction of payment shall be made to compensate for the uncorrected work.

H. Payment for Rejected Work and Materials: Removal of work and materials rejected by the City or its representative, and the replacement of acceptable work and materials by the Contractor shall be at the Contractor's expense, and he shall pay for replacing all work and materials of other Contractors which may have been destroyed or damaged through the Contractor's faulty execution of his work, as determined by the City.

I. Claims for Extra Work: No bill or claim for extra work or material shall be allowed or paid unless the doing of such extra work, or the furnishing of such extra material shall have been authorized in writing by the City. The price for such work shall be determined by the actual cost, to which shall be added a percentage to be determined by mutual agreement between the Engineer and the Contractor, to cover general expenses and superintendence, profit, contingencies, use of tools, Contractor's risk and liability insurance. Claims for extras (previously authorized in writing by the City) shall be presented for payment by the Contractor, as soon as practicable after completion of such extra work, and before making up the final estimate.
   1. It shall be the Contractor's responsibility to notify the City of any impending work which may be subject to "Claims for Extras" so that the City may keep an accurate and daily record of all labor, material and equipment used. Subject notification shall in no way attest to the validity of such claims.

J. City May Furnish Materials, Etc.: The City may, at its discretion, furnish to the Contractor any materials or supplies or transportation required for extra work, and the Contractor shall not be entitled to any allowance of percentage on account of materials or supplies or transportation so furnished.

K. Payment for Work Suspended by the City: If the work or any part of the work shall be suspended by the City because the Contractor has not fulfilled his obligation under the Contract Documents, the Contractor shall not be entitled to additional compensation other than a possible extension of Contract time as determined by the City.

L. Payment for Work Done by the City: Correction of deficiencies in the work or removal of the Contractor's tools, material, or equipment by the City shall be paid for by the Contractor or withheld from payments due the Contractor.

M. Payment for Work Done by the City Following the City's Termination of the Contract: Should the City terminate the Contract, the Contractor shall receive no further payment until the work is completed. If the unpaid balance of the Contract price exceeds the expense of completing the work, including compensation for additional administrative and management services, such excess shall be paid to the Contractor. If such expenses exceed such unpaid balance, the Contractor shall pay the difference to the City. The expense incurred through the Contractor’s default shall be certified by the City.

N. Payment for Work Terminated by the Contractor: Upon suspension of the work or termination of the contract by the Contractor, he may recover from the City payment for all work completed, and any loss sustained upon any plant or materials, and reasonable profit and damages as determined by the City.

O. Payment for Samples and Tests: Samples furnished by the Contractor shall be furnished at the Contractor's expense. The Contractor shall assume the costs for testing the samples as indicated in the various sections of the Contract Documents.

P. Final Payment: No payment shall be considered as acceptance of the work or any portion thereof prior to the final completion of the work, and the payment of the final estimate.

Q. Within thirty days after the completion of the work under this contract to the satisfaction of the City, in accordance with all and singular terms and stipulations herein contained, the City shall make final payment, from a final estimate made by the City. Before final payment is made, the Contractor shall, as directed by the City, make a Contractor's Affidavit that he has paid all claims of every nature, or secured a release from the surety or sureties approving payment of final estimate by the City. The final payment, when made, shall be considered as final approval and acceptance of the completed work herein specified.

R. The acceptance by the Contractor of the final payment aforesaid shall operate as, and shall be, a release to the City and its agents, from claims and liability to the Contractor for anything done or furnished, relating to the work or for any act or neglect of the City or of any person relating to or affecting the work.

S. Correction of Defective Work After Final Payment: The Contractor shall remove any defects due to negligence or defective materials or faulty workmanship, which appear within two years after the date of completion and acceptance, and shall execute the attached Maintenance and Guarantee Bond.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 007200

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Project consists of redevelopment of Dodge Park with new and repaved parking areas, new and resurfaced pathways, new Amphitheater, new Farmers Market with a refrigerated seasonal ice rink, new Splash Park deck and seating areas, new mini-soccer field, four (4) new sand volleyball courts and renovations to the existing restroom building.

1. Project Location: Dodge Park, 40620 Utica Road, Sterling Heights, Michigan 48313
2. Owner: City of Sterling Heights, 40555 Utica Road, Sterling Heights, Michigan 48313

B. Architect Identification: The Contract Documents, dated June 19,2017, were prepared for Dodge Park Improvements by Dorchen/Martin Associates, Inc., Architects & Planners, 29895 Greenfield Road, Suite #107, Southfield, Michigan 48076, (ph.) 248.557.1062, (fax) 248.557.1231 and their consultants.

C. The Work consists of the redevelopment of Dodge Park including:

1. The site work includes, but is not limited to:
   a. Demolition of the existing Parks & Recreation Building and Bandshell.
   b. Demolition of four (4) pavilions.
   c. New and repaved asphalt parking lots.
   d. New park access drive at the west end of the park.
   e. New site lighting.
   f. New and resurfaced asphalt pathways.
   g. New concrete walks.
   h. New concrete and artificial turf Splash Park deck and seating areas.
   i. New mini-soccer field.
   j. Four (4) new sand volleyball courts.
   k. New horse shoe pit.
   l. New landscaping.

2. The new structures include:
   a. A new Amphitheater including staff and performer areas.
   b. A new Farmers Market including public restrooms and a seasonal ice rink with a refrigerated slab.
   c. A ticket booth for the Splash Park.
   d. Renovations to the existing Restroom Building

3. The work area at the resurfaced and new pathways is considered to be the pathway and 2 feet either side and areas adjacent to the pathway for re-grading.

4. The work area at the pavilions is considered to be the pavilion foundations, concrete slab, decorative pier bases and partial height walls, and site area 4 feet all sides of the slab and

adjacent areas for re-grading. The work for Pavilion #3 is considered to include the above plus the construction of the public restrooms and storage area.

D. Project will be constructed under a general construction contract.

1.2 USE OF PREMISES

A. General: Contractor shall have use of premises for construction operations during construction period with the following exceptions.

1. Contractor's use of premises is limited by Owner's right to perform work or to retain other contractors on portions of Project.
2. Contractor shall be responsible for coordinating its work and use of premises with the requirements of the Owner's work and/or those performing work under separate contracts as listed in this Specification Section.
3. Contractor's use of premises is to be limited to the areas of work as defined in the drawings. Full restoration to areas outside of the Contractor's work area that become damaged during construction is the responsibility of the Contractor.

B. Lands for Work: The City shall provide the lands upon which the work under this Contract is to be done. The west end of Dodge Park will be closed to the public at the start of construction, August 14th with the remainder being closed on August 28th and will not reopen to the public until project completion. The demolition of the existing Parks & Recreation Building can take place after September 5, 2017.

C. Private Property: The Contractor shall not enter upon private property for any purpose without obtaining written permission, (a copy of which is to be given to the Owner). The Contractor shall be responsible for the preservation of all public property, trees, monuments, etc., along and adjacent to the street and/or right-of-way, and shall use every precaution necessary to prevent damage to pipes, conduits, and other underground structures and shall protect carefully from disturbance or damage, all monuments and property marks until the Engineer or an authorized agent has witnessed or otherwise referenced their location for their land use and shall not remove them until directed.

1.3 WORK UNDER OTHER CONTRACTS

A. Separate Contracts: Owner has awarded or will award separate contracts for performance of certain construction operations at Project site. Contractor is responsible for coordinating its construction activities with those performing the work under these contracts. The separate contracts include the following:

1. Installation of new playground.
   a. The removal of the existing and installation of the new playground will be performed by a playground company under contract by the City of Sterling Heights. Co-ordination of construction activities may be required with respect to this work and will need to be verified with the City.
2. The installation of new modular athletic surfacing, basketball hoops and mesh ball containment system at the basketball court.

a. This work will be under a separate contract and will need to be coordinated with construction activities.

3. The installation of mesh ball containment system at the volleyball courts.
   a. This work will be under a separate contract and will need to be coordinated with construction activities.
4. The installation of the pavilion structures.
   a. The installation of the Poligon pavilion structure will be by Poligon. The Contractor will be responsible for coordinated his work at the pavilions with the installation of the pavilion structure.
5. Installation of park amenities.
   a. Park amenities such as garbage cans, benches, picnic tables and bike racks will be under a separate contract and will need to be coordinated with other construction activities.
6. Splash Park underground piping, equipment, spray features, equipment housing structure along with its associated foundation and concrete slab:
   a. This work will be under a separate contract and will need to be coordinated with construction activities.
7. Furniture Contract:
   a. The City of Sterling Heights will bid and award a separate contract for the provision, delivery and installation of building furniture in the Amphitheater. This work will be conducted simultaneously with work under this Contract.

8. The City of Sterling Heights will be responsible for the provision and installation of telephone equipment, sound systems, cable television service and television sets, intercom and security alarm systems, fire extinguishers, refrigerators, and dedication plaque(s).

   a. General Contractor is responsible for coordinating with Owner and providing a schedule for delivery/installation of these items.

B. Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

1.4 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 34-division format and CSI/CSC's "MasterFormat" numbering system.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

    a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012500 – SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Specifications and general provisions of the Subcontract, including contractual Exhibits, related attachments, and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions for products, fabrication, or installation methods.
   1. Substitutions shall only be considered prior to bidding and according to the terms outlined in the Subcontract Documents. Formal acceptance of proposed substitutions shall be distributed to bidders prior to the bid date.
   2. Substitution requests submitted after the bid date will only be considered when circumstances do not allow products or methods to be met as defined in the Subcontract documents.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Subcontract Documents and proposed by Subcontractor.
   1. Substitutions for Cause: Changes proposed by Subcontractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form: Use form acceptable to Architect.
   2. Documentation: Show compliance with requirements for substitutions and the following as applicable.
      a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
      b. Coordination information, including a list of changes or revisions needed to other parts of the Work by separate Subcontractors that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size,

durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of A/E of Record and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES or applicable code organization or similar third party.
j. Detailed comparison of Subcontractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Subcontract Time. If specified product or method of construction cannot be provided within the Subcontract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Subcontract Sum.
l. Subcontractor's certification that proposed substitution complies with requirements in the Subcontract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Subcontractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect’s Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Subcontractor of acceptance or rejection of proposed substitution within 10 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
   a. Forms of Acceptance: Change Order, Design Revision Notice (DRN), Field Change Notice (FCN), or Field Change Request (FCR) for changes in the Work.
4. Architects acceptance or denial to substitution requests shall be documented by addendum.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
   1. Conditions: Architect will consider Subcontractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      b. Substitution request is fully documented and properly submitted.
      c. Requested substitution will not adversely affect Subcontractor's construction schedule.
      d. Requested substitution has received necessary approvals of authorities having jurisdiction.
      e. Requested substitution is compatible with other portions of the Work.
      f. Requested substitution has been coordinated with other portions of the Work.
      g. Requested substitution provides specified warranty.
      h. If requested substitution involves more than one subcontractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all subcontractors involved.

B. Substitutions for Convenience: Not allowed.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 012500

SECTION 012660 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 CHANGES IN THE WORK

A. The Owner and Architect shall have the right to require, by written order, changes in, additions to, or deductions from the work required by the Contract Documents; provided that if change, additions or deductions are made, the general character of the work as a whole is not changed thereby. Adjustments in the Contract Price, if any, because of any change, addition or deduction in the work shall be determined as hereinafter at the time of ordering the change, addition or deduction. No claim for change, addition or deduction or adjustment of price, or extension of time for completion thereof, shall be made or allowed unless done in pursuance of written order from the Architect specifically authorizing such change, addition, or deduction. Drawings without a written order shall not be conceded such authority. Written notice of such claims shall be made to the Architect before the commencement of the work. When the written order diminished the quantity of work to be done, this order shall not constitute a basis for a claim for damages or anticipated profits on the work that may be dispensed with.

B. Basis for Determining Cost of Changes in the Work: Adjustments, if any in the Contract Price by reason of change in the work shall be limited to the amount specified in the written order authorizing the change in the work. Adjustments shall be determined by one or more of the following methods, the Owner reserving the right to select the method or methods at the time the written order is issued:
   1. An acceptable Lump Sum Proposal
   2. Unit Price
   3. On a Cost-Plus-Limited Basis, Not to Exceed a Specified Maximum Limit of Cost.
      a. “Cost” as herein shall be the actual and necessary costs incurred by the contractor by reasons of the change in work : Labor, Materials, Equipment Rental, Insurance Premiums.

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

   1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.

2. Within 14 days after receipt of Proposal Request, unless noted otherwise, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
5. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

C. Proposal Request Form: Use AIA Document G709 or alternate form acceptable to involved parties.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General Project coordination procedures.
2. Coordination Drawings.
3. Project meetings.

B. See Division 1 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

C. See Division 1 Section “Summary” for a detailed description of General Contractor’s responsibilities for coordinating with those performing work under separate contracts.

1.2 COORDINATION

A. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.

3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Pre-installation conferences.
7. Project closeout activities.

1.3 PROJECT MEETINGS

A. General: Schedule and conduct meetings at Project site as required, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 days of the meeting.

B. Preconstruction Meeting: A preconstruction meeting shall be scheduled. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing.
    d. Designation of responsible personnel.
    e. Procedures for processing field decisions and Change Orders.
    f. Procedures for processing Applications for Payment.
    g. Distribution of the Contract Documents.
    h. Submittal procedures.
    i. Preparation of Record Documents.
    j. Use of the premises.
    k. Responsibility for temporary facilities and controls.
    l. Parking availability.
    m. Office, work, and storage areas.
    n. Equipment deliveries and priorities.
    o. First aid.
    p. Security.
    q. Progress cleaning.
    r. Working hours.

C. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

    a. Contract Documents.
    b. Options.
    c. Related Change Orders.
    d. Purchases.
    e. Deliveries.
    f. Submittals.
    g. Review of mockups.
    h. Possible conflicts.
    i. Compatibility problems.
    j. Time schedules.
    k. Weather limitations.
    l. Manufacturer's written recommendations.
    m. Warranty requirements.
    n. Compatibility of materials.
    o. Acceptability of substrates.
    p. Temporary facilities and controls.
    q. Space and access limitations.
    r. Regulations of authorities having jurisdiction.
    s. Testing and inspecting requirements.
    t. Required performance results.
    u. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements.
4. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at biweekly intervals. Progress meetings shall be tentatively scheduled for every other Tuesday morning at 9:00 a.m.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to

do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Change Orders.
14) Documentation of information for payment requests.

3. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

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

1.4 PROGRESS OF WORK

A. The work shall be prosecuted regularly and uninterruptedly unless the Owner or Architect shall otherwise specifically direct, with such force and at such points as to ensure its full completion within the time herein stated.

B. If, in the opinion of the Owner or Architect, it is necessary or advisable that certain portions of the work be done immediately, the Contractor, upon written order, shall proceed, the Owner or Architect may do or cause to be done, such work, and the cost of the same will be deducted from any money due or to become due the Contractor under this Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's Construction Schedule.
2. Submittals Schedule.
3. Daily construction reports.
4. Field condition reports.

1.2 SUBMITTALS

A. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:

1. Scheduled date for first submittal.
2. Specification Section number and title.
3. Submittal category (action or informational).
4. Name of subcontractor.
5. Description of the Work covered.
6. Scheduled date for Architect's final release or approval.

B. Contractor's Construction Schedule: Submit two printed copies of initial schedule, one a reproducible print and one a blue- or black-line print, large enough to show entire schedule for entire construction period.

C. Daily Construction Reports: Submit two copies at twice monthly intervals minimum.

D. Field Condition Reports: Submit two copies at time of discovery of differing conditions.

1.3 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.

2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
2. Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial as well as Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Work under More Than One Contract: Include a separate activity for each contract.
2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
3. Work Stages: Indicate important stages of construction for each major portion of the Work.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis to demonstrate the effect of the proposed change on the overall project schedule.

2.3 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording events at Project site, including the following:

1. List of subcontractors.
2. High and low temperatures and general weather conditions.
3. Accidents.
4. Stoppages, delays, shortages, and losses.
5. Meter readings and similar recordings.
6. Orders and requests of authorities having jurisdiction.
7. Services connected and disconnected.
8. Equipment or system tests and startups.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Submit with a request for information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals minimum, update schedule to reflect actual construction progress and activities. Issue schedule one week before next regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Actual Completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.

2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013233 – AUDIO-VIDEO DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for the following”
   1. Preconstruction Color Audio-Video Recording of the Project Area.

PART 2 - PRODUCTS

2.1 PRECONSTRUCTION VIDEO

A. All recording must be made on continuous running, full color audio videotapes or DVDs.
   1. DVD-Video is a standard for storing video content on DVD media. Though many resolutions and formats are available, the DVD-Video discs must use either 4:3 or anamorphic 16:9 aspect ratio MPEG-2 video, stored at a resolution of 720×480 (NTSC). Audio is stored using the Dolby Digital (AC-3) or Digital Theater System (DTS) formats, ranging from 16-bits/48 kHz to 24-bits/96 kHz format with monaural to 7.1 channel "Surround Sound" presentation, and/or MPEG-1 Layer 2. Any of the three formats can be used: DVD-R/RW (minus/dash), DVD+R/RW (plus), DVD-RAM. The minimum resolution for this disc must be 720 × 480 pixels. The DVD must contain chapters for easy navigation (and continuation of a partially watched film). The DVD must not use Content Scramble System (CSS) encryption, which will prohibit from copying the disc.
   2. DVDs must be indexed according to sequence of address and street identification using a DVD counter or as otherwise specified by the City.

PART 3 - EXECUTION

3.1 AUDIO-VIDEO RECORDING

A. The Contractor shall engage the services of a professional electrographer actively engaged in color audio-video tape recordings of projects similar to the work included under this Contract.

B. The firm performing this work shall have the equipment and experience necessary to produce a one-half inch color audio-video tape or a digital video disc (DVD) format of the prescribed quality, meeting all of the requirements specified herein.

C. The City may require the submission of satisfactory evidence that will verify the ability of the electrographer to perform the work.

D. All tapes, DVDs and written records shall become the property of the Owner.

E. Taped coverage shall include all surface features located in and around the zone of influence of construction supported by appropriate audio descriptions. Audio descriptions shall be made simultaneously with video coverage.

F. In order to provide the viewer with proper visual orientation, all recorded material shall contain a display showing the direction of north by means of an adequate number of highly visible arrows or place cards, on or near the structures mentioned above.

G. Audio track one will carry the original sound recording describing the interior views being displayed in the upper right hand corner of the television picture. Both tracks will be simultaneous to respective coverage.

H. Scene illumination will consist of ambient lighting; utilizing only artificial lighting produced by lamps and other household fixtures. No high-wattage supplementary lighting will be permitted which will change the image being recorded.

I. Any taped coverage not acceptable to the City shall be refilmed at no additional charge. The City shall have the authority to designate areas for which coverage may be added or omitted.

J. All tapes and/or DVDs shall be properly identified as to location, time and date in a manner acceptable to the City.

K. A record of the contents of each tape shall be supplied by a sheet identifying each segment in the tape by location, cassette number, tape counter number, viewing side, starting point, traveling direction and ending point.

L. The information shall be submitted to the City at least one week prior to commencement of construction.

M. To preclude the possibility of tampering or editing in any manner, all video recordings must, by electronic means, display continuously and simultaneously generated transparent digital information to include the date and time of recording, as well as the corresponding engineering stationing numbers. The date information will contain the month, day and year; for example 10/5/16 and be placed directly below the time information. The time information shall consist of hours, minutes and seconds, separated by colons. For example, 10:35:18. This transparent information will appear on the extreme upper left-hand third of the screen.

N. Audio-video tapes must be originally recorded with minimum horizontal resolution of 240 lines. Reprocessed tapes will not be acceptable.

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

B. See Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.

C. See Division 1 Section "Quality Requirements" for submitting test and inspection reports and Delegated-Design Submittals.

D. See Division 1 Section "Closeout Procedures" for submitting warranties, Project Record Documents and operation and maintenance manuals.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsive action.

B. Informational Submittals: Written information that does not require Architect's approval. Submittals may be rejected for not complying with requirements.

1.3 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

C. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Allow 15 days for processing each resubmittal.
4. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

D. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 4 by 5 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information on label for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name and address of Contractor.
    e. Name and address of subcontractor.
    f. Name and address of supplier.
    g. Name of manufacturer.
    h. Unique identifier, including revision number.
    i. Number and title of appropriate Specification Section.
    j. Drawing number and detail references, as appropriate.
    k. Other necessary identification.

E. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

F. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.

1. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.

G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.

1. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.

H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

I. Use for Construction: Use only final submittals with mark indicating action taken by Architect in connection with construction.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

1. Number of Copies: Submit a minimum of four (4) copies of each submittal, unless otherwise indicated. Architect will return two copies. Mark up and retain one returned copy as a Project Record Document. Electronic submittals are also acceptable.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's written recommendations.
b. Manufacturer's product specifications.
c. Manufacturer's installation instructions.
d. Manufacturer's catalog cuts.
e. Wiring diagrams showing factory-installed wiring.
f. Printed performance curves.
g. Operational range diagrams.
h. Compliance with recognized trade association standards.
i. Compliance with recognized testing agency standards.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Include the following information, as applicable:

a. Dimensions.
b. Identification of products.
c. Fabrication and installation drawings.
d. Roughing-in and setting diagrams.
e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
f. Shop work manufacturing instructions.
g. Templates and patterns.
h. Schedules.
i. Notation of coordination requirements.
j. Notation of dimensions established by field measurement.

2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches.

D. Coordination Drawings: Comply with requirements in Division 1 Section "Project Management and Coordination."

E. Samples: Prepare physical units of materials or products, including the following:

1. Comply with requirements in Division 1 Section "Quality Requirements" for mockups.
2. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

    a. Submit two (2) full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return one (1) with options selected.

3. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.

4. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's sample where so indicated. Attach label on unexposed side.
5. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

F. Product Schedule or List: Prepare a written summary indicating types of products required for the Work and their intended location.

G. Delegated-Design Submittal: Comply with requirements in Division 1 Section "Quality Requirements."

H. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."

I. Application for Payment: Comply with requirements in contract documents.

J. Schedule of Values: Comply with requirements in contract documents.

K. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit two (2) copies of each submittal, unless otherwise indicated. Architect will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Requirements."

B. Contractor's Construction Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."

C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.

E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.

G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.

H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.

I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.

J. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

K. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.

L. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

M. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

N. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section "Closeout Procedures."

O. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

P. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer.

Q. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections.

R. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken as follows:

1. Final Unrestricted Release: Where the submittal is marked "REVIEWED," the Work covered by the submittal may proceed provided it complies with the Contract Documents. Final acceptance will depend on that compliance.
2. Final-but-Restricted Release: Where the submittal is marked "FURNISH AS CORRECTED," the Work covered by the submittal may proceed provided it complies with both Architect’s notations and corrections on the submittal and the Contract Documents. Final acceptance will depend on that compliance.
3. Returned for Resubmittal: Where the submittal is marked “REVISE AND RESUBMIT," do not proceed with the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity for the product submitted. Revise or prepare a new submittal according to Architect’s notations and corrections.
4. Rejected: Where the submittal is marked "REJECTED," do not proceed with the Work covered by the submittal. Prepare a new submittal for a product that complies with the Contract Documents.

C. Informational Submittals: Architect will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 014000 – QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
2. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. See Divisions 2 through 33 Sections for specific test and inspection requirements.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size, physical example assemblies to illustrate finishes and materials. Mockups are used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples.

D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.3 GENERAL REQUIREMENTS

A. Suitable Tools and Equipment: The Contractor shall furnish all tools and equipment necessary to execute the work. Any tools or equipment that the Engineer may deem unsuitable or insufficient for execution of the work shall be removed from the work and suitable equipment or tools shall be substituted by the Contractor, as approved by the Engineer.

B. Materials Furnished by the Contractor: All materials used in the work shall meet the requirements of the various specifications and no material shall be used until it has been approved by the Engineer. All materials used for the work shall be furnished by the Contractor unless specifically indicated otherwise.

C. Permits, Inspection and Codes: The Contractor shall secure, comply with, and pay for all permits required by Ordinance or Law and for all inspections as required. No extra charges will be allowed for any changes necessary for code compliance regardless of the method of installation shown on the Drawings and indicated in the Specifications.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Noise producing activities shall be held to a minimum. The Contractor shall comply with all applicable noise abatement ordinances.

B. All areas within the construction site shall be kept sufficiently dampened to prevent dust. The Contractor shall comply with all applicable anti-pollution ordinances.

C. The Contractor shall assure that trucks leaving the site shall do so in such a manner that mud and earth will not be deposited on adjacent streets. Any mud or earth deposited on streets shall be promptly removed by the Contractor.

D. Pursue the Work to prevent soil erosion, and the transport of soils off-site. Perform the Work, and take preventative measures in compliance with applicable laws. Obtain all permits necessary for conducting the Work.

E. Fuel tanks located on-site by the Contractor shall be arranged so that spilled fuel will not enter a sewer or stream in caste of an accident or vandalism.

1.5 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

1.6 LAYOUT AND GRADE CONTROL

A. Staking and Checking: The Contractor shall establish and maintain site control, both horizontal and vertical. Where required by law, he shall obtain the services of a Registered Land Surveyor to provide direct supervision of the surveying Work, including staking for construction. The Contractor shall carefully and thoroughly review the Plans and the field staking and shall immediately notify the Engineer of any errors or inconsistencies.

1.7 MAINTENANCE OF DRAINAGE

A. Drain Operations: Contractor shall maintain existing drainage systems, and prevent flooding of the site and adjacent properties due to his operations. The Contractor shall stage work to assure proper drainage to and from the Site during construction, and shall avoid draining the Site to areas used by pedestrians or vehicular traffic.

1.8 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

C. Reports: Prepare and submit certified written reports that include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates 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.
10. Ambient conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.9 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

D. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.

G. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

1.10 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of the types of testing and inspecting they are engaged to perform.
2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Contractor shall not employ the same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Special Tests and Inspections: Owner will engage a testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.

1. Testing agency will notify Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
5. Testing agency will retest and re-inspect corrected work.

D. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.

E. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
5. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field-curing of test samples.
5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
6. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.11 WORKMANSHIP

A. The work shall be performed in accordance with the best modern practices with materials and workmanship of the highest quality for the particular purpose or as specifically provided in the Contract Documents and Drawings. The Owner or Architect shall judge and determine the Contractor's compliance with these requirements.

1.12 REJECTED MATERIALS AND WORKMANSHIP

A. The Engineer shall have the authority to reject defective materials or workmanship, or require correction. Unacceptable workmanship shall be satisfactorily corrected. Rejected materials shall be segregated, marked, and promptly removed from the site and replaced with proper materials. If the Contractor fails to promptly proceed with the replacement of rejected materials and/or the correction of defective workmanship, the City may, by contract or otherwise, replace such material and/or correct such workmanship, and charge the cost thereof against the Contractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": The term "approved," when used to convey Architect's action on Contractor's submittals, applications, and requests, is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. “Contract” or “Contract Documents”: The agreement covering the performance of the work hereinafter defined, and payments therefore; including Advertisement / Instructions to Bidders, General Conditions, Bid Submittal Form, Executed Contract, Contract Bonds, Insurance, Specifications, and Drawings; all of which documents are to be treated as one instrument whether or not set forth at length in the Form of Contract.

D. “Drawings”: Those drawings listed in the List of Drawings with addenda thereto.

E. “Specifications”: Al of the directions, requirements, and standards of performance applying to the work as hereinafter detailed and designated under the General Specifications and the several divisions of the Detailed Specifications including supplementary specifications.

F. “Contractor”: The Terms Contractor, Construction Manager and/or General Contractor shall be interchangeable and shall mean the Person, Firm, or Corporation entering into the Contract with the Owner to construct and install the Work covered by the Contract Documents.

G. “Subcontractor”: Any person, firm, or corporation, other than employees of the Contractor who or which contracts with the Contractor to furnish, or actually furnishes labor, or labor and materials, or labor and equipment, at or about the site, but shall not include one who merely furnishes materials or equipment.

H. “City”: The City of Sterling Heights, Michigan or its properly authorized agents and representatives.

I. “Owner”: The party of the first part of this Contract.

J. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by Architect, requested by Architect, and similar phrases.

K. “Engineer”: Shall mean Nowak & Fraus Engineers through its Project Representatives.

L. “Inspector”: Any representative of the City designated to inspect the work.

M. “Soils Engineer”: A licensed Soil Engineer retained for interpreting and making recommendations on geotechnical testing, quality control and aspects of the Work.

N. “Site” or “Project Site”: The area upon or in which the Contractor's operations are carried on, and such other areas adjacent thereto as may be designated as such by the City.

O. “The Work”: Structures, equipment plant, labor, materials, and facilities or things now or later required to be furnished, installed, or done by the Contractor under or pursuant to this Contract, including extra work; and "Performance Of Work" and words of similar sense shall mean the furnishing, installations or doing thereof.

P. “Or Equal”: Equal to or similar to the specific article, material, or equipment referred to in the Drawings or Specifications. The specific article, material, or equipment mentioned shall be understood as indicating the type, function, minimum standard or design efficiency and quality desired and shall not be construed in such a manner as to exclude manufacturer's products of comparable quality, design and efficiency. The Contractor shall comply with the requirements of the Contract Documents relative to the Architect’s or City's approval of materials and equipment before they are incorporated in the work.

Q. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on Drawings or to other paragraphs or schedules in Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference.

R. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

S. "Furnish": The term "furnish" means to supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

T. "Install": The term "install" describes operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

U. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.

V. "Installer": An installer is the Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

W. The term "experienced," when used with an entity, means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if

bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.

C. Conflicting Requirements: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

1. 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, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

D. Abbreviations and Acronyms for Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

1. The inclusion of an abbreviation in the following list is not an inherent indication that the abbreviation or organization is referred to in the Project Specifications or other Contract Documents.

AA	Aluminum Association, Inc. (The)
AAADM	American Association of Automatic Door Manufacturers
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
AAN	American Association of Nurserymen (See ANLA)
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists (The)
ABMA	American Bearing Manufacturers Association
ACI	American Concrete Institute/ACI International
ACPA	American Concrete Pipe Association

ADC	Air Diffusion Council
AEIC	Association of Edison Illuminating Companies, Inc. (The)
AFPA	American Forest & Paper Association (See AF&PA)
AF&PA	American Forest & Paper Association
AGA	American Gas Association
AHA	American Hardboard Association
AHAM	Association of Home Appliance Manufacturers
AI	Asphalt Institute
AIA	American Institute of Architects (The)
AISC	American Institute of Steel Construction, Inc.
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ALA	American Laminators Association (See LMA)
ALCA	Associated Landscape Contractors of America
ALSC	American Lumber Standard Committee
AMCA	Air Movement and Control Association International, Inc.
ANLA	American Nursery & Landscape Association (Formerly: AAN - American Association of Nurserymen)
ANSI	American National Standards Institute
AOSA	Association of Official Seed Analysts
APA	APA-The Engineered Wood Association
APA	Architectural Precast Association
API	American Petroleum Institute
ARI	Air-Conditioning & Refrigeration Institute
ASCA	Architectural Spray Coaters Association

ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	ASME International (The American Society of Mechanical Engineers International)
ASSE	American Society of Sanitary Engineering
ASTM	American Society for Testing and Materials
AWCI	AWCI International (Association of the Wall and Ceiling Industries International)
AWCMA	American Window Covering Manufacturers Association (See WCMA)
AWI	Architectural Woodwork Institute
AWPA	American Wood-Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association (The)
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International)
CCC	Carpet Cushion Council
CCFSS	Center for Cold-Formed Steel Structures
CDA	Copper Development Association Inc.
CEA	Canadian Electricity Association (The)
CFFA	Chemical Fabrics & Film Association, Inc.
CGA	Compressed Gas Association
CGSB	Canadian General Standards Board
CIMA	Cellulose Insulation Manufacturers Association
CISCA	Ceilings & Interior Systems Construction Association

CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute
CPA	Composite Panel Association (Formerly: National Particleboard Association)
CPPA	Corrugated Polyethylene Pipe Association Division of Plastics Pipe Institute
CRI	Carpet and Rug Institute (The)
CRSI	Concrete Reinforcing Steel Institute
CSA	CSA International (Formerly: IAS - International Approval Services) Division of Canadian Standards Association
CSI	Construction Specifications Institute (The)
CSSB	Cedar Shake & Shingle Bureau
CTI	Cooling Tower Institute
DHI	Door and Hardware Institute
EIA/TIA	Electronic Industries Alliance/Telecommunications Industry Association
EIMA	EIFS Industry Members Association
EJMA	Expansion Joint Manufacturers Association, Inc.
FCI	Fluid Controls Institute
FGMA	Flat Glass Marketing Association (See GANA)
FM	Factory Mutual System (See FMG)
FMG	FM Global (Formerly: FM - Factory Mutual System)
GA	Gypsum Association
GANA	Glass Association of North America (Formerly: FGMA - Flat Glass Marketing Association)
GRI	Geosynthetic Research Institute

GTA	Glass Tempering Division of Glass Association of North America (See GANA)
HI	Hydraulic Institute
HI	Hydronics Institute Division of Gas Appliance Manufacturers Association
HMMA	Hollow Metal Manufacturers Association Division of National Association of Architectural Metal Manufacturers
HPVA	Hardwood Plywood & Veneer Association
HPW	H. P. White Laboratory, Inc.
IAS	International Approval Services (See CSA International)
ICEA	Insulated Cable Engineers Association, Inc.
ICRI	International Concrete Repair Institute
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The)
IESNA	Illuminating Engineering Society of North America (The)
IGCC	Insulating Glass Certification Council
ILI	Indiana Limestone Institute of America, Inc.
IRI	HSB Industrial Risk Insurers
ITS	Intertek Testing Services
IWS	Insect Screening Weavers Association (Now defunct)
KCMA	Kitchen Cabinet Manufacturers Association
LGSI	Light Gage Structural Institute
LMA	Laminating Materials Association (Formerly: ALA - American Laminators Association)
LPI	Lightning Protection Institute
LSGA	Laminated Safety Glass Association

	(See GANA)
MBMA	Metal Building Manufacturers Association
MFMA	Maple Flooring Manufacturers Association
MFMA	Metal Framing Manufacturers Association
MHIA	Material Handling Industry of America
MIA	Marble Institute of America
ML/SFA	Metal Lath/Steel Framing Association (See SSMA)
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry, Inc.
NAAMM	National Association of Architectural Metal Manufacturers
NAAMM	North American Association of Mirror Manufacturers (See GANA)
NACE	NACE International (National Association of Corrosion Engineers International)
NAIMA	North American Insulation Manufacturers Association (The)
NAMI	National Accreditation and Management Institute, Inc.
NAPM	National Association of Photographic Manufacturers (See PIMA)
NBGQA	National Building Granite Quarries Association, Inc.
NCMA	National Concrete Masonry Association
NCPI	National Clay Pipe Institute
NCTA	National Cable Television Association
NEBB	National Environmental Balancing Bureau
NECA	National Electrical Contractors Association
NeLMA	Northeastern Lumber Manufacturers' Association
NEMA	National Electrical Manufacturers Association
NETA	InterNational Electrical Testing Association

NFPA	National Fire Protection Association
NFRC	National Fenestration Rating Council
NGA	National Glass Association
NHLA	National Hardwood Lumber Association
NLGA	National Lumber Grades Authority
NOFMA	National Oak Flooring Manufacturers Association
NPA	National Particleboard Association (See CPA)
NRCA	National Roofing Contractors Association
NRMCA	National Ready Mixed Concrete Association
NSA	National Stone Association
NSF	NSF International (National Sanitation Foundation International)
NTMA	National Terrazzo & Mosaic Association (The)
NWWDA	National Wood Window and Door Association (See WDMA)
PCI	Precast/Prestressed Concrete Institute
PDCA	Painting and Decorating Contractors of America
PDI	Plumbing & Drainage Institute
PGI	PVC Geomembrane Institute/Technology Program University of Illinois-Urbana Champaign
PIMA	Photographic & Imaging Manufacturers Association (Formerly: NAPM - National Association of Photographic Manufacturers)
RCSC	Research Council on Structural Connections
RFCI	Resilient Floor Covering Institute
RIS	Redwood Inspection Service Division of the California Redwood Association
RMA	Rubber Manufacturers Association

SAE	SAE International
SDI	Steel Deck Institute
SDI	Steel Door Institute
SEFA	Scientific Equipment and Furniture Association
SGCC	Safety Glazing Certification Council
SIGMA	Sealed Insulating Glass Manufacturers Association
SJI	Steel Joist Institute
SMA	Screen Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SPI	The Society of the Plastics Industry, Inc.
SPIB	Southern Pine Inspection Bureau (The)
SPI/SPFD	The Society of the Plastics Industry, Inc. Spray Polyurethane Foam Division (See SPI)
SPRI	SPRI (Single Ply Roofing Institute)
SSINA	Specialty Steel Industry of North America
SSMA	Steel Stud Manufacturers Association (Formerly: ML/SFA - Metal Lath/Steel Framing Association)
SSPC	SSPC: The Society for Protective Coatings
STI	Steel Tank Institute
SWI	Steel Window Institute
SWRI	Sealant, Waterproofing & Restoration Institute
TCA	Tile Council of America, Inc.
TPI	Truss Plate Institute
TPI	Turfgrass Producers International
UFAC	Upholstered Furniture Action Council

UL Underwriters Laboratories Inc.

UNI Uni-Bell PVC Pipe Association

USG United States Gypsum Company
A Subsidiary of USG Corporation

USITT United States Institute for Theatre Technology, Inc.

USP U.S. Pharmacopeia

WASTEC Waste Equipment Technology Association

WCLIB West Coast Lumber Inspection Bureau

WCMA Window Covering Manufacturers Association
(Formerly: AWCMA - American Window Covering Manufacturers Association)

WDMA Window & Door Manufacturers Association
(Formerly: NWWDA - National Wood Window and Door Association)

WIC Woodwork Institute of California

WMMPA Wood Moulding & Millwork Producers Association

WWPA Western Wood Products Association

E. Abbreviations and Acronyms for Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

1. The inclusion of an abbreviation in the following list is not an inherent indication that the abbreviation or agency is referred to in the Project Specifications or other Contract Documents.

BOCA BOCA International, Inc.

CABO Council of American Building Officials
(See ICC)

IAPMO International Association of Plumbing and Mechanical Officials (The)

ICBO International Conference of Building Officials

ICC International Code Council
(Formerly: CABO - Council of American Building Officials)

F. Abbreviations and Acronyms for Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the

recognized name of the entities in the following list. Names are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

1. The inclusion of an abbreviation in the following list is not an inherent indication that the abbreviation or agency is referred to in the Project Specifications or other Contract Documents.

CE	Army Corps of Engineers CRD Standards
CFR	Code of Federal Regulations
CPSC	Consumer Product Safety Commission
DOC	Department of Commerce
DOD	Department of Defense DOD Specifications and Standards
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration Department of Transportation
FCC	Federal Communications Commission
FDA	Food and Drug Administration
FED-STD	Federal Standard (See FS)
FS	Federal Specification (Available from DOD, GSA, and NIBS)
FTMS	Federal Test Method Standard (See FS)
GSA	General Services Administration
HUD	Department of Housing and Urban Development
LBL	Lawrence Berkeley Laboratory (See LBNL)
LBNL	Lawrence Berkeley National Laboratory
MILSPEC	Military Specification and Standards (See DOD)
NCHRP	National Cooperative Highway Research Program

(See TRB)

NIST National Institute of Standards and Technology

OSHA Occupational Safety & Health Administration
(See CFR 29)

RUS Rural Utilities Service
(See USDA)

TRB Transportation Research Board

USDA Department of Agriculture

USPS Postal Service

G. Abbreviations and Acronyms for State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

1. The inclusion of an abbreviation in the following list is not an inherent indication that the abbreviation or agency is referred to in the Project Specifications or other Contract Documents.

CAPUC State of California, Public Utilities Commission

CBHF State of California, Department of Consumer Affairs
Bureau of Home Furnishings and Thermal Insulation

TFS Texas Forest Service
Forest Products Laboratory

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for temporary facilities and controls, including support facilities, and security and protection facilities.

B. See Division 1 Section "Execution Requirements" for progress cleaning requirements.

1.2 USE CHARGES

A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing and inspecting agencies and personnel of authorities having jurisdiction.

1.3 PROJECT CONDITIONS

A. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:

1. Keep temporary services and facilities clean and neat.
2. Relocate temporary services and facilities as required by progress of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.

B. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails.

C. Wood Enclosure Fence: Plywood, 8 feet high, framed with four 2x4 inch rails, with preservative-treated wood posts spaced not more than 8 feet apart.

D. Tarpaulins: Fire-resistive labeled with flame-spread rating of 15 or less.

E. Water: Potable.

2.2 EQUIPMENT

A. Field Offices: Prefabricated or mobile units with lockable entrances, operable windows, and serviceable finishes; heated and air conditioned; on foundations adequate for normal loading.

B. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.

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

C. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

D. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water, drinking-water units, including paper cup supply.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas as required and adequate to support loads and to withstand exposure to traffic during construction period. Locate temporary roads and paved areas within construction limits indicated on Drawings.

1. Provide a reasonably level, graded, well-drained subgrade of satisfactory soil material, compacted to not less than 95 percent of maximum dry density in the top 6 inches.

2. Provide gravel paving course of subbase material not less than 3 inches thick; roller compacted to a level, smooth, dense surface.
3. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Dewatering Facilities and Drains: Comply with requirements in applicable Division 31 Sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. Maintain Project site, excavations, and construction free of water.

D. Project Identification and Temporary Signs: Prepare Project identification and other signs in sizes indicated. Install signs where indicated to inform public and persons seeking entrance to Project. Do not permit installation of unauthorized signs.

1. Engage an experienced sign painter to apply graphics for Project identification signs. Comply with details indicated.
2. Prepare temporary signs to provide directional information to construction personnel and visitors.

E. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 1 Section "Execution Requirements " for progress cleaning requirements.

1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.

F. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility services. Sheds may be open shelters or fully enclosed spaces within building or elsewhere on-site.

G. Protection and Shoring: The Contractor shall protect all existing facilities within the Site, and shall provide and install sheeting, shoring and bracing and take all necessary precautions to maintain support for structures, utilities and appurtenances.

3.3 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.

B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to authorities having jurisdiction.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
2. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from the project site during the course of the project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

C. Stormwater Control: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.

D. Tree and Plant Protection: Install temporary fencing outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

E. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Maintain security by limiting number of keys distributed to authorized personnel. Furnish one set of keys to the Owner.

F. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.

G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.

H. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Store combustible materials in containers in fire-safe locations.
2. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
3. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
4. Develop and supervise an overall fire-prevention and first-aid fire-protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
5. Provide hoses for fire protection of sufficient length to reach construction areas. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.4 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.

1. Maintain operation of temporary enclosures and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
2. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 1 Section "Closeout Procedures."

END OF SECTION 015000

SECTION 015339 – TEMPORARY TREE PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

B. Related Requirements:

1. Section 015000 - Temporary Facilities and Controls
2. Section 312000 – Earthmoving
3. Section 311000 – Site Clearing
4. Section 312500 – Erosion and Sedimentation Controls

1.3 REFERENCED STANDARDS

A. All work under this section shall be completed in general conformance with construction plan details, Municipality standards and/or the Michigan Department of Transportation's (MDOT) standard specifications for construction (current edition), MDOT's standard plans (current edition), MDOT's construction manual (current edition), MDOT's quality assurance procedures manual (current edition), and as specified herein.

1.4 DEFINITIONS

A. Caliper: Diameter of a trunk measured by the average of the smallest and largest diameters at a height 6 inches (150 mm) above the ground for trees up to and including 4-inch (100-mm) size at this height and as measured at a height of 12 inches (300 mm) above the ground for trees larger than 4-inch (100-mm) size.

B. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by the average of the smallest and largest diameters at a height 54 inches (1372 mm) above the ground line for trees with caliper of 8 inches (200 mm) or greater as measured at a height of 12 inches (300 mm) above the ground.

C. Damage: Physical change to the site or its vegetation caused by equipment, materials, labor or grading operations, which has occurred after on-site work operations have begun.

D. Drip line: The outer perimeter of the plant canopy projected on the ground plane.

E. Existing Vegetation: Any existing tree, shrub or ground cover presently on site.

F. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

G. Protective Barrier: A temporary device installed during the full period of construction to protect existing vegetation from damage or disturbance.

H. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.

1.5 QUALITY ASSURANCE

A. Arborist Qualifications: If necessary, engage a qualified arborist to advise on the following work:
1. Remove branches from trees that are to remain if required.
2. Recommend procedures to compensate for loss of roots and perform initial pruning of branches and stimulation of root growth where removed to accommodate new construction.
3. Recommend procedures for excavation and grading work where adjacent to established plants.
4. Perform tree repair work for damage incurred by site demolition or new construction.
5. Replace damaged plant materials on an equal basis as determined by landscape architect and arborist.

B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

1.6 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at project site.

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:

a. Tree-service firm's personnel, and equipment needed to make progress and avoid delays.
b. Arborist's responsibilities.
c. Quality-control program.

d. Coordination of Work and equipment movement with the locations of protection zones.
e. Trenching by hand or with air spade within protection zones.
f. Field quality control.

1.7 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, and locations of protection-zone fencing and signage, showing relation of equipment-movement routes and material storage locations with protection zones.
2. Detail fabrication and assembly of protection-zone fencing and signage.
3. Indicate extent of trenching by hand or with air spade within protection zones.

C. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1. Species and size of tree.
2. Location on site plan. Include unique identifier for each.
3. Reason for pruning.
4. Description of pruning to be performed.
5. Description of maintenance following pruning.

1.8 INFORMATIONAL SUBMITTALS

A. Qualification Data: For arborist and tree service firm.

B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

D. Existing Conditions: Documentation of existing trees and plantings in areas of site demolition and new construction indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

E. Quality-control program.

1.9 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Excessive Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging, unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

D. The Contractor shall repair or replace trees and vegetation indicated to remain, which are damaged by construction, in a manner acceptable to the City.

E. No payment will be made by the City for the removal of trees damaged by the Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Backfill Soil: Stockpiled soil of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.

1. Mixture: Well-blended mix of two parts stockpiled soil to one part planting soil.
2. Planting Soil: Planting soil as specified in Section 329100 "Soil Preparation"

B. Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of the following:

1. Type: Finely shredded hardwood
2. Size Range: 3 inches (76 mm) maximum, 1/2 inch (13 mm) minimum.
3. Color: Natural.

C. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements:

1. Wood and wire snow fence, plastic construction barrier fence, or chain link fence fabric minimum 4’-0” high; in accordance with municipality standards / details.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain (or to be relocated). Tie a 1-inch (25-mm) blue vinyl tape around each tree trunk at 54 inches (1372 mm) above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.

1. Apply 2-inch (50-mm) uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches (150 mm) of tree trunks.

3.3 PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and equipment from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

B. Maintain protection zones free of weeds and trash.

C. Maintain protection-zone fencing and in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.

2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earth Moving" unless otherwise indicated.

B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

C. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

A. Roots that are affected by temporary and permanent construction. Prune roots as follows:

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots. Many plant authorities do not consider it beneficial to paint cut root ends.
2. Cut Ends: Coat cut ends of roots more than 1-1/2 inches (38 mm) in diameter with an emulsified asphalt or other coating formulated for use on damaged plant tissues and that is acceptable to arborist.
3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible according to requirements in Section 312000 "Earth Moving."

B. Root Pruning at Edge of Protection Zone: Prune tree roots 12 inches (300 mm) outside of the protection zone by cleanly cutting all roots to the depth of the required excavation.

C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as directed by arborist.

1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
3. Pruning Standards: Prune trees according to ANSI A300 (Part 1).

B. Unless otherwise directed by arborist and acceptable to Landscape Architect, do not cut tree leaders.

C. Cut branches with sharp pruning instruments; do not break or chop.

D. Do not paint or apply sealants to wounds.

E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.

3.7 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.

1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 1 inch or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Landscape Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Landscape Architect.

B. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 2-inch (50-mm) uniform thickness to remain.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

B. Burning removed trees and branches is not permitted on site.

END OF SECTION 015639

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for selecting products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. See Division 1 Section "Closeout Procedures" for submitting warranties for contract closeout.

C. See Divisions 2 through 33 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.2 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

D. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

E. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.3 SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified material or product cannot be provided.
b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time.
j. Cost information, including a proposal of change, if any, in the Contract Sum.
k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

a. Form of Acceptance: Change Order.

b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
5. Store products to allow for inspection and measurement of quantity or counting of units.
6. Store materials in a manner that will not endanger Project structure.
7. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
9. Protect stored products from damage.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.

2. Specified Form: Forms are included with the Specifications. Prepare a written document using appropriate form properly executed.
3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT OPTIONS

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.

B. Product Selection Procedures: Procedures for product selection include the following:

1. Product: Where Specification paragraphs or subparagraphs titled "Product" name a single product and manufacturer, provide the product named.

    a. Substitutions may be considered, unless otherwise indicated.

2. Manufacturer/Source: Where Specification paragraphs or subparagraphs titled "Manufacturer" or "Source" name single manufacturers or sources, provide a product by the manufacturer or from the source named that complies with requirements.

    a. Substitutions may be considered, unless otherwise indicated.

3. Products: Where Specification paragraphs or subparagraphs titled "Products" introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.

    a. Substitutions may be considered, unless otherwise indicated.

4. Manufacturers: Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.

    a. Substitutions may be considered, unless otherwise indicated.

5. Available Products: Where Specification paragraphs or subparagraphs titled "Available Products" introduce a list of names of both products and manufacturers, provide one of the products listed or another product that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

6. Available Manufacturers: Where Specification paragraphs or subparagraphs titled "Available Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed or another manufacturer that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

7. Basis-of-Design Products: Where Specification paragraphs or subparagraphs titled "Basis-of-Design Product" are included and also introduce or refer to a list of manufacturers' names, provide either the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

    a. Substitutions may be considered, unless otherwise indicated.

8. Visual Matching Specification: Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches satisfactorily.

    a. If no product available within specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents on "substitutions" for selection of a matching product.

9. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.

    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Timing: Architect will consider requests for substitution if received within 60 days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.

B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.

2.3 COMPARABLE PRODUCTS

A. Where products or manufacturers are specified by name, submit the following, in addition to other required submittals, to obtain approval of an unnamed product:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. General installation of products.
4. Progress cleaning.
5. Starting and adjusting.
6. Protection of installed construction.
7. Correction of the Work.

B. See Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.2 SUBMITTALS

A. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.3 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and

verify the existence and location of site improvements, utilities, and other construction affecting the Work.

B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

1. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
3. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 REPARATION

A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect and Owner not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's written permission.

C. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.

F. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

G. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

G. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

H. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

I. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Restore permanent facilities used during construction to their specified condition.

E. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

F. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

G. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017419-CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Specifications and general provisions of the Subcontract, including contractual Exhibits, related attachments, and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous demolition and construction waste.
   2. Recycling nonhazardous demolition and construction waste.
   3. Disposing of nonhazardous demolition and construction waste.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal, off-site, of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

A. General: Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials.

1.5 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
   1. Review and discuss waste management plan including responsibilities of waste management coordinator.
   2. Review requirements for documenting quantities of each type of waste and its disposition.
   3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
   4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
   5. Review waste management requirements for each trade.

1.6 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according the requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing, and construction waste generated by the Work.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator.
   1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
   2. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
   3. Disposed Materials: Indicate how and where materials will be disposed of. Include
   4. name, address, and telephone number of each landfill and incinerator facility.
   5. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location
   6. where materials separation will be performed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
   1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
   1. Distribute waste management plan to everyone concerned within three days of submittal return.
   2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
   2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
   3. Store items in a secure area until installation.
   4. Protect items from damage during transport and storage.
   5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to
   6. make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner's storage area off-site designated by Owner.
   5. Protect items from damage during transport and storage.

D. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

E. Plumbing Fixtures: Separate by type and size.

F. Lighting Fixtures: Separate lamps by type and protect from breakage.

G. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste off site according to approved construction waste management plan. At Contractor option provide co-mingle recyclable waste services.
   1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
      a. Inspect containers and bins for contamination and remove contaminated materials if found.
   2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
   4. Store components off the ground and protect from the weather.
   5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Project Record Documents.
3. Operation and maintenance manuals.
4. Warranties.
5. Instruction of Owner's personnel.
6. Final cleaning.

B. See Division 1 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.

C. See Divisions 2 through 33 Sections for specific closeout and special cleaning requirements for products of those Sections.

1.2 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test / adjust / balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.

12. Submit changeover information related to Owner’s occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.3 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

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

1. Organize list of spaces in sequential order.

2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

1.5 PROJECT RECORD DOCUMENTS

A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

B. Record Drawings: Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings.

1. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

   a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
   b. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
3. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
4. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.

C. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Note related Change Orders and Record Drawings, where applicable.

D. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1.6 OPERATION AND MAINTENANCE MANUALS

A. Assemble a complete set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:

1. Operation Data: Include emergency instructions and procedures, system and equipment descriptions, operating procedures, and sequence of operations.
2. Maintenance Data: Include manufacturer's information, list of spare parts, maintenance procedures, maintenance and service schedules for preventive and routine maintenance, and copies of warranties and bonds.

B. Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.

1.7 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 DEMONSTRATION AND TRAINING

A. Instruction: Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Provide instructors experienced in operation and maintenance procedures.
2. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.
4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.

B. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections. For each training module, develop a learning objective and teaching outline.
1. Include instruction for system design and operational philosophy, review of documentation, operations, adjustments, troubleshooting, maintenance, and repair.

3.2 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
   b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
   c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
   d. Remove tools, construction equipment, machinery, and surplus material from Project site.
   e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
   f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
   g. Sweep concrete floors broom-clean in unoccupied spaces.
   h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.

i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
j. Remove labels that are not permanent.
k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
l. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Replace parts subject to unusual operating conditions.
n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
q. Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 017700

SECTION 024116 - STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Demolition and removal of buildings and site improvements.
2. Removing below-grade construction.
3. Disconnecting, capping or sealing, and removing site utilities.
4. Salvaging items for reuse by Owner.

B. Related Sections:
1. Division 31 Section “Site Clearing” for site clearing and removal of above and below grade site improvements not part of building demolition.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse. Include fasteners or brackets needed for reattachment elsewhere.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 SUBMITTALS

A. Qualification Data: For qualified refrigerant recovery technician.

B. Proposed Protection Measures: Submit informational report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of Building Demolition Activities: Indicate the following:
1. Detailed sequence of demolition work, with starting and ending dates for each activity.
2. Temporary interruption of utility services.

3. Shutoff and capping or re-routing of utility services.

D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

E. Pre-demolition Photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Division 01 Section "Photographic Documentation". Submit before the Work begins.

F. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

G. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.6 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

1.7 PROJECT CONDITIONS

A. Hazardous Materials: It is not expected that hazardous materials will be encountered in the work.
1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Determine removal procedures and responsibility prior to proceeding with the work.

B. On-site storage or sale of removed items or materials is not permitted.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soils: Comply with requirements in Division 31 Section "Earth Moving."

PART 3 - EXECUTION

3.1 EXAMINIATION

A. Verify that utilities have been disconnected and capped before starting demolition operations.

B. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations. Comply with Division 01 Section "Photographic Documentation."

3.2 PREPARATION

A. Provide, erect, and maintain temporary barriers and security devices.

B. Refrigerant: Remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction before starting demolition.

C. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.
   1. Arrange to shut off indicated utilities with utility companies.
   2. Mark locations of disconnected utilities. Identify utilities and indicate capping locations on as-built drawings.

D. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
   1. Strengthen or add new supports when required during progress of demolition.

E. Salvaged Items: Comply with the following:
   1. Clean salvaged items of dirt and demolition debris.
   2. Transport items to storage area designated by Owner.
   3. Protect items from damage during transport and storage.

3.3 PROTECTION

A. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.

B. Temporary Protection: Erect temporary protection, such as fences, railings, canopies, and covered passageways, where required and as indicated. Comply with requirements in Division 01 Section "Temporary Facilities And Controls."
   1. Protect existing site improvements, appurtenances, trees, and landscaping to remain.
   2. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

C. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.4 DEMOLITION, GENERAL

A. General: Demolish indicated buildings and site improvements completely in an orderly and careful manner. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
   2. Maintain fire watch during and for at least two hours after flame cutting operations.
   3. Maintain adequate ventilation when using cutting torches.

B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner.
   2. Provide alternate routes around closed or obstructed traffic ways if required.
   3. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

C. Explosives: Use of explosives is not permitted.

3.5 DEMOLITION BY MECHANICAL MEANS

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

B. Below-Grade Construction: Demolish foundation walls and other below-grade construction.
   1. Remove below-grade construction, including basements, foundation walls, and footings, completely.

C. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.
   1. Piping: Disconnect piping at unions, flanges, valves, or fittings.
   2. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

3.6 SITE RESTORATION

A. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations according to backfill requirements in Division 32 Section "Backfilling".

B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Construction debris/materials shall be recycled or properly disposed of off site.

B. Do not burn demolished materials.

END OF SECTION 024116

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

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

B. This section includes specifications for concrete floor sealers, etc. General Contractor shall coordinate with appropriate subcontractor for finishing.

C. See Division 31 Section "Earthwork" for drainage fill under slabs-on-grade.

D. See Division 31 Section “Concrete Paving” for concrete walk, drive and approach information and concrete washout requirements.

E. See Construction Drawings for additional concrete specifications and notes.

1. Where conflicts arise between these specifications and the concrete specifications and notes that appear on Construction Drawings, those specifications and notes that appear on the drawings shall supercede these specifications.

1.2 SUBMITTALS

A. Product Data: For each manufactured material and product indicated.

B. Design Mixes: For each concrete mix indicated.

C. Shop Drawings: Include details of steel reinforcement placement including material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports.

D. Material certificates.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

B. Comply with ACI 301, "Specification for Structural Concrete," including the following, unless modified by the requirements of the Contract Documents.

1. General requirements, including submittals, quality assurance, acceptance of structure, and protection of in-place concrete.
2. Steel reinforcement and supports.
3. Concrete mixtures.
4. Handling, placing, and constructing concrete.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Reinforcement:

1. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
2. Plain-Steel Wire: ASTM A 82, as drawn.
3. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
4. Supports for Reinforcement: Bolsters , chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.

    a. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs

B. Concrete Materials:

1. Portland Cement: ASTM C 150, Type I.
2. Normal-Weight Aggregate: ASTM C 33, uniformly graded, not exceeding 1-1/2-inch nominal size.
3. Water: Potable & complying with ASTM C 94.

C. Admixtures:

1. Air-Entraining Admixture: ASTM C 260.
2. Water-Reducing Admixture: ASTM C 494, Type A.
3. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
4. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
5. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

D. Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 6 mils thick.

E. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

F. Curing Materials:

1. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
2. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf.
3. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
4. Water: Potable.

2.2 CONCRETE MIXES

A. Comply with ACI 301 requirements for concrete mixtures.

B. Prepare design mixes, proportioned according to ACI 301, for normal-weight concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Foundations & Footings:

a. Compressive Strength (28 days): 3000 psi
b. Slump: Not less than 1 inch and not more than 3 inches.

1) Slump Limit for Concrete Containing High-Range Water-Reducing Admixture: Not more than 8 inches after adding admixture to plant- or site-verified, 2- to 3-inch slump.

c. Water/Cement Ratio: 0.44 maximum (non-air-entrained), 0.35 maximum (air-entrained)

2. Interior concrete slabs & stair tread/landing fill:

a. Compressive Strength (28 days): 3500 psi
b. Slump: Not less than 1 inch and not more than 3 inches.

1) Slump Limit for Concrete Containing High-Range Water-Reducing Admixture: Not more than 8 inches after adding admixture to plant- or site-verified, 2- to 3-inch slump.

c. Water/Cement Ratio: 0.58 maximum (non-air-entrained), 0.46 maximum (air-entrained)

3. Exterior concrete slabs:

a. Compressive Strength (28 days): 4000 psi
b. Slump: Not less than 1 inch and not more than 3 inches.

1) Slump Limit for Concrete Containing High-Range Water-Reducing Admixture: Not more than 8 inches after adding admixture to plant- or site-verified, 2- to 3-inch slump.

c. Water/Cement Ratio: 0.44 maximum (non-air-entrained), 0.35 maximum (air-entrained)

C. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 6.0 percent within a tolerance of plus 1.0 or minus 1.5 percent.

1. Air content of trowel-finished interior concrete floors shall not exceed 3.0 percent.

2.3 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with ASTM C 94.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Vapor Retarder: Install, protect, and repair vapor-retarder sheets according to ASTM E 1643; place sheets in position with longest dimension parallel with direction of pour.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

B. Steel Reinforcement: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

C. Joints: Construct joints true to line with faces perpendicular to surface plane of concrete.

1. Construction Joints: Locate and install so as not to impair strength or appearance of concrete, at locations indicated or as approved by Architect.
2. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

a. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

3. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

a. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
b. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Tolerances: Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

3.2 CONCRETE PLACEMENT

A. Comply with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

B. Consolidate concrete with mechanical vibrating equipment.

3.3 FINISHING UNFORMED SURFACES

A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on the surface.

1. Do not further disturb surfaces before starting finishing operations.

C. Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.

E. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set methods. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

F. Nonslip Broom Finish: Apply a nonslip broom finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.4 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection, and follow recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions occur before and during finishing operations. Apply according to manufacturer's

written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

1. Evaporation Retarder shall NOT be applied to exposed interior concrete floors indicated as being “Sealed Concrete”.

C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.

D. Cure formed and unformed concrete for at least seven days as follows:

1. Moisture Curing: Keep surfaces continuously moist with water, continuous water-fog spray or absorptive cover, water saturated and kept continuously wet.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Contractor shall engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Tests will be performed according to ACI 301.

1. Testing Frequency: One composite sample for each day's pour of each concrete mix exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

END OF SECTION 033000

SECTION 042000 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units.
2. Decorative concrete masonry units.
3. Glazed structural clay tile masonry units
4. Sound absorbing concrete masonry units.

B. See Division 5 Section "Metal Fabrications" for furnishing steel lintels installed in unit masonry assemblies.

C. See Division 7 Section "Sheet Metal Flashing and Trim" for furnishing manufactured reglets installed in masonry joints for metal flashing.

D. See Division 7 Section “Water Repellents” for exterior split face concrete block finish.

E. See Division 7 Section “Foamed-In-Place Masonry Wall Insulation” for masonry core insulation.

F. See Construction Drawings for additional masonry specifications and notes.

1. Where conflicts arise between these specifications and the masonry specifications and notes that appear on Construction Drawings, those specifications and notes that appear on the drawings shall supersede these specifications.

1.2 SUBMITTALS

A. Product Data: For each masonry unit, accessory, and other manufactured product indicated.

B. Samples for verification purposes of the following:

1. Full size units for each different exposed masonry unit type showing full range of exposed color, texture and dimensions to be expected in completed construction.
2. All specified mortar colors.

1.3 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.

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

1.4 QUALITY ASSURANCE

A. Mockups: Build sample panels for each type of exposed unit masonry assembly to verify selections made under sample Submittals and to demonstrate aesthetic effects.
   1. Build mockups in sizes approximately 48 inches long by 48 inches high by full thickness.

B. Panel to indicate quality representation of:
   1. Color and texture range.
   2. Bonding pattern.
   3. Mortar Color
   4. Joint tooling
   5. Reinforcement / Ties
   6. Workmanship

1.5 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.

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

C. Take all precautions necessary to protect units. Damaged units will not be accepted in the wall.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph 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.

2.2 COLORS AND TEXTURES

A. Exposed Masonry Units: As indicated by manufacturer's designations.

2.3 MASONRY UNITS

A. Concrete Masonry Units: ASTM C 90.
   1. Weight Classification: Normal weight.
   2. Type: I, moisture-controlled units.
   3. Decorative Units: Split-face decorative concrete blocks as indicated on drawings.
   4. Special Shapes: Provide for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.

B. Decorative Concrete Masonry Units: ASTM C 90
   1. Weight Classification: Normal weight
   2. Integral metallic oxide pigments
   3. Integral Polymeric Water- Repellant
      a. Rheopel Plus Admixture as manufactured by Master Builders, Inc. (800)628-9990
   4. Stretcher unit dimensions:
      a. Nominal 4” high
      b. Nominal 16” long
   5. Manufacturer: BellaBrik by Consumers Concrete Corporation, Kalamazoo, MI (800)643-4235
   6. Color: Cincinnati Blend
   7. Unit Design: Modular two core units sized as indicated on the drawings. Provide special units for bond beams and Control Joints.

C. Structural Glazed Tile
   1. Pattern or Type: 8”x8” running bond
   2. Characteristics:
      a. Meet ASTM C-126 for grade (S) Select quality
      b. Meet ASTM C-84 requirements and rated zero smoke developed and zero fuel contribution. Also will not release any toxic or noxious fumes when burned at 2000 deg. F.
      c. Nominal Face stretcher dimensions standard 4W Series, Vertical Cell, 8”x8”. All dimensions are +/- allowable tolerance.
      d. Nominal Bed Depths: 2”, 4” or 6” as specified on drawings.
      e. Shapes: Furnish as shown on the plans in accordance with manufacturers current standard production. All external corners, sills and jambs shall be bullnose, unless noted otherwise. Lintels and internal corners shall be square, unless noted otherwise. The base course shall be non-recessed coved, as shown on drawings.
      f. Colors: Dove Mottle (#7400M) and Neptune Blue (#4004) as shown on the drawings.
      g. Manufacturer: Elgin Butler Company, Elgin, TX (512) 285-3356 or approved equal.

D. Sound Absorbing Concrete Masonry Units
   1. Type: Type RSC units of 12” depth with four sequential cavities and two flared slots.
   2. Pattern: 8”x16” running bond
   3. Characteristics:
      a. Shall be made of carefully prepared aggregate and shall meet the current ASTM C-90 or ASTM C-129 requirements as appropriate.
      b. Carefully controlled use of the molds shall be employed so all units have one end of the cavities tightly closed.
      c. Slots and edges shall be straight and clean.

4. Filler Insert: Poly-bagged.
5. Product: Soundblox
6. Manufacturer: Proudfoot Company, Inc. 588 Pepper St., Monroe, CT (800) 445-0034

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce required mortar color.

B. Hydrated Lime: ASTM C 207, Type S.

C. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

D. Aggregate for Grout: ASTM C 404.

E. Water: Potable.

2.5 REINFORCING

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; ASTM A 616/A 616M, including Supplement 1; or ASTM A 617/A 617M, Grade 60.

B. Masonry Joint Reinforcement: ASTM A 951; mill galvanized, carbon-steel wire for interior walls and hot-dip galvanized, carbon-steel wire for exterior walls.

1. Wire Size for Side Rods: W1.7 or 0.148-inch diameter.
2. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.
3. Single-Wythe Masonry: Use either truss or ladder type with single pair of side rods and cross rods spaced not more than 16 inches o.c.
   a. At walls with vertical reinforcing, use ladder type reinforcement.
4. Multiwythe Masonry: Use adjustable (2-piece) type with single pair of side rods and cross ties spaced not more than 16 inches o.c. and with separate adjustable veneer ties engaging the cross ties.
   a. As an alternate to the multi-wythe masonry reinforcement specified above, contractor may use specified single-wythe reinforcement in the back-up wythe and provide ties as specified below for brick veneer.

2.6 TIES AND ANCHORS

A. Materials, General: As follows, unless otherwise indicated:

1. Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating for exterior walls and Class 1 coating for interior walls.

2. Galvanized Steel Sheet: ASTM A 366/A 366M cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153, at exterior walls; and ASTM A 653/A 653M, G60, commercial-quality, steel sheet zinc coated by hot-dip process on continuous lines before fabrication at interior walls.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent minimum; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Designed to fit standard sash block and to maintain lateral stability in masonry wall. Made from styrene-butadiene-rubber compound complying with ASTM D 2000, Designation M2AA-805.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

2.8 MASONRY CLEANERS

A. Masonry Units: Light Concrete Cleaner by Prosoco, Kansas City, Missouri (800)255-4255, diluted one part cleaning solution with 4 to 6 parts water.

2.9 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, unless otherwise indicated. Do not use calcium chloride in mortar or grout.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification.
1. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
2. For masonry below grade, in contact with earth, and where indicated, use Type M.
3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls and for other applications where another type is not indicated, use Type N.

C. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 5 of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.

2.10 INSULATION

A. Foamed-In-Place Masonry Insulation: Core-Fill 500 by Tailored Chemical Products as specified in Section 7.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cut masonry units with motor-driven saws. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

C. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:
   1. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.
   2. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.

3.2 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Lay exposed masonry in bond pattern indicated; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
   1. See elevations for masonry unit patterning.

C. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

D. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

3.3 INSTALLATION OF SOUND ABSORPTION BLOCK

A. All necessary cutting on the job site shall be performed with power tools in such a manner as to provide straight and true edges. No chipped or broken blocks shall be used.

B. Acoustical masonry shall be laid in running or stack bond with the open ends of the cavities facing downward and shall be seated in a full horizontal bed of mortar. The slots shall be exposed to the area where the sound absorption is desired as indicated on the plans.

C. Care shall be taken to ensure that the slots are kept free of mortar or debris above the mortar joint.

D. Lines shall be straight and true and the workmanship shall otherwise conform to all requirements of the General Specifications for masonry work.

3.4 MORTAR BEDDING AND JOINTING

A. Lay hollow masonry units as follows:

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

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.

3.5 CAVITIES

A. Keep cavities clean of mortar droppings and other materials during construction.

3.6 MASONRY JOINT REINFORCEMENT

A. Provide continuous masonry joint reinforcement as indicated. Install with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

B. Provide continuity at corners and wall intersections by using prefabricated "L" and "T" sections.

3.7 ANCHORING MASONRY

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated.
2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.

3.8 REINFORCED UNIT MASONRY INSTALLATION

A. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

B. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.9 LINTLES

A. Provide masonry lintels where shown.

3.10 CLEANING

A. Clean unit masonry by dry brushing to remove mortar fins and smears before tooling joints, as work progresses.

B. Glazed Structural Clay Tile:
   1. It is intended that with adherence to this specification that extensive final cleaning will not be necessary. During construction, wipe glazed surface clean after tooling of joints or within 30 minutes after laying, with course rag. Keep wall clean as work progresses to avoid more difficult cleanup later. Use no metal scrapers, abrasive powders or unauthorized cleaning agents. Use wooden paddles or scrapers to clean away mortar residue or lumps. Wash with clean water. A mild detergent may be used. Rinse with clean water. Wipe with clean cloths, sponges or similar item.
   2. In the event of unexpected contaminations of SGT walls, perform any cleaning with other than a non-metallic scraper, stiff nylon or natural bristled brush or wooden paddle only after approval by Architect and necessary tests to insure against any wall damage.

C. After mortar is thoroughly set and cured, clean exposed masonry as follows:

   1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
   2. Clean brick by the bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20, using job-mixed detergent solution.
   3. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain on exposed surfaces.

3.11 FINAL SEALER

A. BellaBrik: Field applied sealer – Blok-Guard & Graffiti Control by Prosoco (800) 255-4255, as indicated on the drawings.

3.12 PROTECTION OF FINISHED WORK

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

END OF SECTION 042000

SECTION 047300 – MANUFACTURERED STONE VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes manufactured stone veneer consisting of the following:

1. Manufactured Stone Veneer.
2. Manufactured Stone Trim.

1.2 RELATED SECTIONS

A. Section 042000 Unit Masonry

1.3 SUBMITTALS

A. Product Data: Manufacturer's data sheets to be used including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

B. Samples for verification purposes of the following:

1. For each finish product specified, two complete sets of color sample, minimum size of 8 inches (203 mm) square, representing accrual product, color and texture.

C. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Performance Requirements:
1. Compressive Strength: Not less than 1800 psi (12.4 MPa) average for 5 specimens and not less than 1500 psi (10.3 MPa) for individual specimen when tested in accordance with ASTM C 39 and ASTM C 192
2. .Bond Between Manufactured Masonry Unit, Mortar and Backing: Not less than 50 psi (345 kPa) when tested in accordance with ASTM C 482 using Type S mortar.
3. Freeze/Thaw: No disintegration and less than 3 percent weight loss when tested in accordance with ASTM C 67.Unit Weight: Not more than 15 psf (73 kg/m2).
4. Surface Burning Characteristics: Not more than the following when tested in accordance with UL 723:
    A. Flamespread: 25.
    B. Smoke Development: 450.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer affiliated with MSJC and ACI with a minimum of 5 years documented experience manufacturing and marketing all Manufactured Stone products in this section.

B. Installer Qualifications: Company with documented experience in installation of manufactured masonry of the type specified including at least five projects within a 400 mile (650km) radius of the Project.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish panel of size and location designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, texture and pattern are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.6 DELIVERY AND STORAGE

A. Store products off the ground on pallets in manufacturer's unopened packaging until ready for installation.

B. Protect materials from precipitation and freezing temperatures. Product with visible frozen moisture should not be installed.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Cultured Stone® by Boral®, which is located at: 200 Mansell Court E. Suite 305 ; Roswell, GA 30076; Toll Free Tel: 800-255-1727; Tel: 866-557-8663; Email: boralstoneanswers@boral.com; Web: www.culturedstone.com

B. Substitutions: Not permitted.

2.2 MANUFACTURED STONE

A. Cultured Stone Country Ledgestone:
   1. Heights: Variable from 1-1/4 inches to 6 inches (30 mm to 150 mm).
   2. Lengths: Variable from 4 inches to 16-3/4 inches (100 mm to 420 mm).

3. Color: Bucks County

B. Architectural Trim:
1. Tuscan Lintels:
a. Color: Taupe
b. Size: 6” x 22” x 2 ½”

2.3 MORTAR AND GROUT MATERIALS

A. Pre-Mixed Mortar: ASTM C270, Type N or S. Provide natural color or white cement as required to produce required mortar color.

B. Portland Cement: ASTM C 150, Type I, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce required mortar color.

C. Hydrated Lime: ASTM C 207, Type S or SA.

D. Aggregate for Mortar: ASTM C 144; standard masonry type.

E. Water: Potable.

2.4 ADDITIONAL MATERIALS

A. Metal Flashing:
1. 0.032 inch aluminum sheet; ASTM B 209.
2. 24 gauge galvanized steel; ASTM A 653.
3. 16 oz/sq ft (5 kg/sm) copper sheet; ASTM B 370

B. Metal Lath: Diamond patterned steel mesh meeting or exceeding the requirements of ASTM C 847. Minimum 2.5 lb/sq yd (1.37 kg/sm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. General:
   1. Walls: Provide with Single Color and Texture throughout.
   2. Special Shapes: Color to match stones specified.
      a. Provide Stones manufactured specifically for installation at corners where located on the Drawings.
   3. Mortar Joints:
      a. Tool all grout joints.
   4. Caps: Install Capstones where indicated on the Drawings.

C. Keep surfaces moist while installing.

D. Poorly attached stones are considered defective work. After set-up, inspect wall for loose stones.

E. Remove and properly replace prior to project close-out.

3.4 PROTECTION

A. Protect finished work from rain and work on either side of the wall during and for 48 hours following installation.

B. Protect installed products until completion of project.

C. Clean prior to project closeout.

D. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 047300

SECTION 051200 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes structural steel.

B. See Construction Drawings for additional structural steel specifications and notes.

1. Where conflicts arise between these specifications and the structural steel specifications and notes that appear on Construction Drawings, those specifications and notes that appear on the drawings shall supercede these specifications.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer structural-steel connections required by the Contract Documents to be selected or completed by fabricator to withstand design loadings indicated.

1. Engineering Responsibility: Engage a fabricator who utilizes a qualified professional engineer to prepare calculations, Shop Drawings, and other structural data for structural-steel connections.

1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Show fabrication of structural-steel components, including connections, splices, holes, welds, and bolts.

1. Include Shop Drawings and structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Mill certificates.

D. Welding certificates.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category I, conventional steel structures.

B. Comply with applicable provisions in AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

1.5 STORAGE AND PROTECTION

A. Store steel members off ground and protect steel members and packaged materials from erosion and deterioration.

B. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural-Steel Wide Flange Beams & Columns: ASTM A 572/A 572M, Grade 50, high-strength, low-alloy columbium-vanadium steel

B. Structural-Steel Plates, and Bars: ASTM A 36/A 36M, carbon steel.

C. Cold-Formed Structural-Steel Tubing: ASTM A 500, Grade B.

D. Anchor Rods, Bolts, Nuts: ASTM A 36/A 36M, unheaded rods.

E. Nonhigh-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A; carbon-steel, hex-head bolts; carbon-steel nuts; and flat, unhardened steel washers, uncoated.

F. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers, uncoated.

G. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

H. Nonmetallic, Shrinkage-Resistant Grout: Premixed, ASTM C 1107, of consistency suitable for application.

2.2 FABRICATION

A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.

1. Comply with fabrication tolerance limits in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.
2. Shop install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.
3. Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

a. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.

4. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

B. Shop Priming: Shop prime steel, except surfaces embedded in concrete or mortar, surfaces to be field welded, surfaces to be high-strength bolted with slip-critical connections, and surfaces to receive sprayed-on fireproofing.

1. Surface Preparation: SSPC-SP 2, "Hand Tool Cleaning," or SSPC-SP 3, "Power Tool Cleaning."
2. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.3 SOURCE QUALITY CONTROL

A. Owner may engage an independent testing and inspecting agency to perform shop tests and inspections and to prepare test reports. Comply with Part 3 "Field Quality Control" Article.

PART 3 - EXECUTION

3.1 ERECTION

A. Examination: Verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.

B. Erect structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.

C. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces before setting base and bearing plates. Clean bottom surface of base and bearing plates and set on wedges, shims, or setting nuts as required.

1. Tighten anchor bolts, cut off wedges or shims flush with edge of base or bearing plate, and pack grout solidly between bearing surfaces and plates.

D. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

E. Install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.

F. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.

G. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

3.2 FIELD QUALITY CONTROL

A. Owner may engage a qualified testing and inspecting agency to perform field tests and inspections and to prepare test reports.

1. Correct deficiencies in or remove and replace structural steel that test reports and inspections indicate do not comply with specified requirements.
2. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
3. High-strength bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
4. In addition to visual inspection, welded connections will be tested and inspected according to AWS D1.1 procedures.

END OF SECTION 051200

SECTION 052100 - STEEL JOISTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Open-web, K-series steel joists.

B. See Construction Drawings for additional structural steel specifications and notes.

1. Where conflicts arise between these specifications and the structural steel specifications and notes that appear on Construction Drawings, those specifications and notes that appear on the drawings shall supercede these specifications.

1.2 SUBMITTALS

A. Product Data: For each type of joist, accessory, and product indicated.

B. Shop Drawings: Showing layout, mark, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, accessories; splice and connection locations and details; and attachments to other construction.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing joists similar to those indicated for this Project and with a record of successful in-service performance.

1. Manufacturer must be certified by SJI to manufacture joists complying with SJI standard specifications and load tables.

B. SJI Specifications: Comply with SJI's "Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders" (hereafter, "Specifications"), applicable to types of joists indicated.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: Comply with SJI's "Specifications" for chord and web members.

2.2 PRIMERS

A. Primer: SSPC-Paint 15, Type I, red oxide; FS TT-P-636, red oxide; or manufacturer's standard shop primer complying with performance requirements of either of these red-oxide primers.

2.3 STEEL JOISTS

A. Manufacture steel joists according to SJI's "Specifications," with steel-angle top- and bottom-chord members, and as follows:

1. Manufacture K-series steel joists according to "Standard Specifications for Open Web Steel Joists, K-Series," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

2.4 JOIST ACCESSORIES

A. Bridging: Schematically indicated. Detail and fabricate according to SJI's "Specifications."

B. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.5 SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Apply 1 shop coat of primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.

C. Field weld joists to supporting steel bearing plates. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

END OF SECTION 052100

SECTION 053100 - STEEL DECK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Roof deck
2. Bearing plates and angles
3. Supplementary framing for openings up to and including 18 inches.

B. See Construction Drawings for additional structural steel specifications and notes.

1. Where conflicts arise between these specifications and the structural steel specifications and notes that appear on Construction Drawings, those specifications and notes that appear on the drawings shall supercede these specifications.

1.2 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Include layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.

1.3 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

B. AISI Specifications: Calculate structural characteristics of steel deck according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Steel Deck:
1. United Steel Deck, Inc.: www.njb-united.com
2. Vulcraft/Nucor Corporation: www.vulcraft.com
3. Wheeling Corrugating Co.: www.wheelingcorrugating.com
4. Substitutions: See Section 01600 “Product Requirements”

2.2 STEEL DECK

A. Roof Deck: Non-composite type, fluted steel sheet.
   1. Galvanized Steel Sheet: ASTM A924 G-60 or G-90 or to Federal Specifications QQ- S-775
   2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and pretreated substrate.
   3. Structural Properties:
      a. Span Design: Multiple.
   4. Minimum Steel Thickness, Excluding Finish: 20 Gage (0.9 mm)
   5. Nominal Height: 1-1/2 inch (38mm)
   6. Profile: Fluted
   7. Formed Steel Width: 36 inches
   8. Side Joints: Lapped, mechanically fastened
   9. End Joints: Lapped, welded.

2.3 ACCESSORIES

A. Accessories: Steel deck manufacturer's standard accessory materials, including mechanical fasteners, closure strips, pour stops, and closures for deck.

B. Bearing Plates and Angles: ASTM A 36/A 36M steel, unfinished.

C. Welding Materials: AWS D1.1.

D. Fasteners: Galvanized hardened steel, self tapping.

E. Weld Washers: Mild steel, uncoated 3/4 inch (19 mm) ouside diameter, 1/8 inch (3 mm) thick.

F. Galvanizing Repair Paint: ASTM A 780.

G. Repair Paint: Lead- and chromate-free rust-inhibitive primer.

H. Fluted Closures: Closed Cell foam rubber, 1 inch (25 mm) thick; profiled to fit tight to the deck.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 29, manufacturer's written instructions, and requirements in this Section.

B. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

C. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

D. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to decking.

E. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.

F. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

G. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

H. Repairs and Protection:

1. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
2. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior non-load-bearing wall framing.
2. Interior non-load-bearing wall framing.
3. Ceiling framing.
4. Roof framing.

B. See Construction Drawings for additional structural steel specifications and notes.

1. Where conflicts arise between these specifications and the structural steel specifications and notes that appear on Construction Drawings, those specifications and notes that appear on the drawings shall supercede these specifications.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads without deflections greater than the following:

1. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height.

1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Include layout, spacings, sizes, thicknesses, and types of cold-formed metal framing, fabrication, and fastening and anchorage details, including mechanical fasteners.

1.4 QUALITY ASSURANCE

A. Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members" for calculating structural characteristics of cold-formed metal framing.

B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

C. Fire-Test-Response Characteristics: Where metal framing is part of a fire-resistance-rated assembly, provide framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by GA File Numbers in GA-600, "Fire Resistance Design Manual," or by design designations from UL's "Fire Resistance Directory" or from the listings of another testing agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:
1. Clark Dietrich: www.clarkdietrich.com
2. Marino-Ware: www.marinoware.com
3. SCAFCO: www.scafco.com

2.2 MATERIALS

A. Wall Framing: Manufacturer's standard steel studs, of web depths indicated, with stiffened flanges, complying with ASTM C 955, and as follows:
1. Minimum Uncoated-Steel Thickness:
a. Exterior Non-Bearing: 16 gage
b. Interior Non-Bearing: 25 gage
2. Track: Manufacturer's standard U-shaped steel track, unpunched, with straight flanges, complying with ASTM C 955, manufacturer's standard flange width, and minimum uncoated-steel thickness matching steel studs.

2.3 ACCESSORIES AND MISCELLANEOUS MATERIALS

A. Fabricate steel-framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33,000 psi, of manufacturer's standard thickness and configuration, unless otherwise indicated.

B. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: Corrosion-resistant-coated, self-drilling, self-threading steel drill screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Preparation: Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction.

B. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to ASTM C 1007, manufacturer's written recommendations, and requirements in this Section.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
3. Install framing members in one-piece lengths.
4. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed.
5. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
6. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

C. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Install miscellaneous framing and connections, including supplementary framing, blocking, bracing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

D. Non-Load-Bearing, Curtain-Wall Installation: Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure. Space studs as indicated; set plumb, align, and fasten both flanges of studs to track, unless otherwise indicated.

1. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
2. Install horizontal bridging in curtain-wall studs, spaced in rows indicated on Shop Drawings but not more than 54 inches apart. Fasten at each stud intersection.
3. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtain-wall-framing system.

E. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

3.2 FIELD QUALITY CONTROL

A. Testing: Owner may engage a qualified independent testing agency to perform field quality-control testing.

1. Field and shop welds will be subject to testing and inspection.
2. Remove and replace Work that does not comply with specified requirements.
3. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Loose bearing and leveling plates.
   2. Loose steel lintels.
   3. Miscellaneous steel framing and supports.
   4. Pipe bollards.

B. See Division 5 Section "Pipe and Tube Railings" for metal pipe and tube handrails and railings.

C. See Division 9 Section “Paints and Coatings” for paint finish.

D. See Construction Drawings for additional structural steel specifications and notes.

   1. Where conflicts arise between these specifications and the structural steel specifications and notes that appear on Construction Drawings, those specifications and notes that appear on the drawings shall supercede these specifications.

1.2 SUBMITTALS

A. Shop Drawings: Include plans, elevations, sections, details of installation, and attachments to other Work.

B. Templates: For anchor bolts.

PART 2 - PRODUCTS

2.1 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

B. Ferrous Metals:

   1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
   2. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

2.2 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664 and compatible with finish paint systems indicated.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners: Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls, of type, grade, and class required by application indicated.

B. Nonshrink, Nonmetallic Grout: ASTM C 1107, factory-packaged, nonstaining, noncorrosive, nongaseous grout.

C. Concrete Fill: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.4 FABRICATION

A. Connections, General: Use connections that maintain structural value of joined pieces.

1. Shear and punch metals cleanly and accurately. Remove burrs.
2. Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish exposed welds smooth and blended.
3. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes.
4. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

B. Loose Bearing and Leveling Plates: Fabricate loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

C. Loose Steel Lintels: Fabricate loose structural-steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

D. Miscellaneous Framing and Supports: Fabricate steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work from structural steel of welded construction. Cut, drill, and tap units to receive hardware, hangers, and similar items.

E. Miscellaneous Steel Trim: Fabricate units with continuously welded joints and smooth exposed edges. Miter corners and use concealed splices where possible. Fabricate cutouts, fittings, and anchorages; coordinate assembly and installation with other work.

F. Pipe Bollards: Fabricate from Schedule 40 steel pipe.

2.5 FINISHES

A. Finish metal fabrications after assembly. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Shop prime ferrous-metal items not indicated to be galvanized.

1. Hot-dip galvanize items indicated to be galvanized to comply with ASTM A 123 or ASTM A 153/A 153M as applicable.
2. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
3. Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Provide anchorage devices and fasteners for securing metal fabrications to in-place construction. Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, with edges and surfaces level, plumb, and true.

1. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
2. Fit exposed connections accurately together. Weld connections, unless otherwise indicated. Do not weld, cut, or abrade galvanized surfaces.

B. Set bearing and leveling plates on cleaned surfaces using wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts and pack with nonshrink, nonmetallic grout.

C. Bollards:

1. Anchor in place with concrete footings. Support and brace bollards in position in footing excavations until concrete has been placed and cured.
2. Fill bollards solidly with concrete, mounding top surface.

D. Touch up surfaces and finishes after erection.

1. Painted Surfaces: Clean field welds, bolted connections, and abraded areas and touch up paint with the same material as used for shop painting.
2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 055150 - LADDERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Aluminum ship's ladder.

B. See Division 5 Section "Metal Fabrications" for fasteners and installation requirements used to attach ladders to structure.

C. See Division 7 Section "Roof Hatches" for hatch at roof.

1.2 REFERENCES

A. AA – Aluminum Association.

B. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

D. OSHA 1910.27 – Fixed Ladders.

1.3 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product.

C. Shop Drawings:
   1. Detail fabrication and erection of each ladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.
   2. Provide templates for anchors and bolts specified for installation under other Sections.
   3. Provide reaction loads for each hanger and bracket.

D. Qualification Data:
   1. Refer to Quality Assurance provisions for submittal requirements evidencing experience, certifications and resources.

E. Selection Samples: For each finish specified, two complete sets of color chips representing manufacturer's full range of available colors.

F. Verification Samples: For each finish specified, two samples, minimum size 6 inches (150 mm) square, represent actual product color.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in producing aluminum metal ladders similar to those indicated for this Project.
   1. Record of successful in-service performance.
   2. Sufficient production capacity to produce required units.
   3. Professional engineering competent in design and structural analysis to fabricate ladders in compliance with industry standards and local codes.

B. Installer Qualifications: Competent and experienced firm capable of selecting fasteners and installing ladders to attain designed operational and structural performance.

C. Product Qualification: Product design shall comply with OSHA 1910.27 minimum standards for ladders.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Install ladder in area designated by Architect.
   2. Do not proceed with remaining work until workmanship and installation are approved by Architect.
   3. Rework mock-up as required to produce acceptable work.

1.5 DELIVERY, STORAGE AND HANDELING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurement before fabrication.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, indicate established dimensions on shop drawing submittal and proceed with fabrication.

1.7 WARRANTY

A. Manufacturer has responsibility for an extended Corrective Period for work of this Section for a period of 5 years commencing on the shipment date of the product against all the conditions indicated below, and when notified in writing from Owner, manufacturer shall promptly and without inconvenience and cost to Owner correct said deficiencies.
   1. Defects in materials and workmanship.
   2. Deterioration of material and surface performance below minimum OSHA standards as certified by independent third party testing laboratory. Ordinary wear and tear, unusual abuse or neglect excepted.
   3. Within the warranty period, the manufacturer shall, at its option, repair, replace, or refund the purchase price of defective ladder.

B. Manufacturer shall be notified immediately of defective products, and be given a reasonable opportunity to inspect the goods prior to return. Manufacturer will not assume responsibility, or compensation, for unauthorized repairs or labor. Manufacturer makes no other warranty, expressed or implied, to the merchantability, fitness for a particular purpose, design, sale, installation, or use, of the ladder; and shall not be liable for incidental or consequential damages, losses of or expenses, resulting from the use of ladder products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: O'Keeffe's, Inc.; 100 N Hill Drive, Suite 12, Brisbane, CA 94005. Toll Free Tel: (888) 653-3333. Tel: (415) 824-4900. Fax: (415) 824-5900. Email: info@okeeffes.com. Web: http://www.okeeffes.com.

B. Substitutions: As approved by Architect.

C. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 APPLICATION

A. Ship Ladder with access to roof hatch.
   1. Model 523 as manufactured by O'Keeffe's Inc.
      a. 60 degree

2.3 FINISHES

A. Mill finish. As extruded.

2.4 MATERIALS

A. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.

B. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.

2.5 FABRICAITON

A. Rungs: Not less than 1-1/4 inches (32 mm) in section and 18–3/8 inches (467mm) long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides.
   1. Rungs shall withstand a 1,500 pound (454 kg) load without deformation or failure.

B. Channel Side Rails: Not less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide.

C. Heavy Duty Tubular Side Rails: Assembled from two interlocking aluminum extrusions no less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide. Construction shall be self-

locking stainless steel fasteners, full penetration TIG welds and clean, smooth and burr-free surfaces.

D. Ship Ladders: Not less than 1-1/4 inches (32mm) high, 4-1/8 inch (105 mm) deep and 2 feet (610 mm) wide; tread spacing shall be 1 foot (305 mm) on center. Handrails shall be aluminum pipe, not less than 1-1/2 inches (38 mm) in diameter with hemispheric end caps.

PART 3 - EXECUTION

3.1 EXAMINIATION

A. Coordinate anchorages. Furnish setting drawings, templates, and anchorage structural loads for fastener resistance.

B. Do not begin installation until supporting structure is complete and ladder installation will not interfere with supporting structure work.

C. If supporting structure is the responsibility of another installer, notify Architect of unsatisfactory supporting work before proceeding.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 055150

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes pipe and tube handrails and railings made of the following:

1. Steel.

B. See Section 9 “Paints and Coatings” for paint finish.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance of Handrails and Railings:
1. Capable of withstanding the following structural loads without exceeding the allowable design working stress of materials involved:

a. Top Rail of Guards: Concentrated load of 200 lbf applied at any point and in any direction, and a uniform load of 50 lbf/ft. applied horizontally and concurrently with uniform load of 100 lbf/ft. applied vertically downward. Concentrated and uniform loads need not be assumed to act concurrently.
b. Handrails Not Serving as Top Rails: Concentrated load of 200 lbf applied at any point and in any direction, and a uniform load of 50 lbf/ft. applied in any direction. Concentrated and uniform loads need not be assumed to act concurrently.
c. Infill Area of Guards: Horizontal concentrated load of 200 lbf applied to 1 sq. ft. at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area. Load on infill area need not be assumed to act concurrently with loads on top rails.

1.3 SUBMITTALS

A. Product Data: For mechanically connected handrails and railings, grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details of installation, attachments to other Work.

PART 2 - PRODUCTS

2.1 METALS

A. Steel and Iron:

1. Steel Tubing: Cold-formed steel tubing, ASTM A 500, Grade A, unless another grade is required by structural loads.
2. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.2 MISCELLANEOUS MATERIALS

A. Welding Electrodes and Filler Metal: Provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Fasteners: Same basic metal as fastened metal; concealed, unless otherwise indicated or unavoidable, and standard with systems indicated.

C. Anchors: Fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined per ASTM E 488.

D. Shop Primers: Provide primers to comply with applicable requirements in Division 9 Section "Painting."

E. Grout and Anchoring Cement: Premixed, nonshrink, nonmetallic grout complying with ASTM C 1107 or erosion-resistant, nonshrink, anchoring cement; recommended by manufacturer for use indicated.

2.3 FABRICATION

A. General: Fabricate to design, dimensions, and details indicated, but not less than that required to support structural loads.

1. Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

B. Form changes in direction of railing members by bending.

C. Form curves by bending in jigs to produce uniform curvature without buckling, twisting, cracking, or otherwise deforming exposed surfaces.

D. Welded Connections: Connect handrail and railing members by welding. Cope and weld or use welded-in fittings. Weld connections continuously.

E. Brackets, Flanges, Fittings, and Anchors: Fabricate wall brackets, flanges, miscellaneous fittings, and anchors to connect handrails and railings to other work.

1. Cast or form metal of same material and finish as rails.

F. Close exposed ends of handrail and railing members with prefabricated end fittings.

G. Provide wall returns at ends of wall-mounted handrails.

2.4 FINISHES

A. Steel:
1. Shop-Primed Steel Finish: Prepare to comply with SSPC-SP 7, "Brush-off Blast Cleaning" and apply primer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Perform cutting, drilling, and fitting required to install handrails and railings. Set units accurately in location, alignment, and elevation.

1. Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Weld posts directly to metal surfaces.

C. Anchor railing ends into concrete and masonry with round flanges connected with post installed anchors and bolts.

D. Attach handrails to wall with wall brackets.

1. For wood stud partitions, use hanger or lag bolts set into wood backing between studs.
2. For steel-framed gypsum board assemblies, use hanger or lag bolts set into wood backing between studs or fasten to steel framing or concealed reinforcements using self-tapping screws of size and type required to support structural loads.

E. Touch up surfaces and finishes after erection.

1. Painted Surfaces: Clean field welds, bolted connections, and abraded areas and touch up paint with the same material as used for shop painting.

END OF SECTION 055213

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Wood framing.
   2. Wood blocking
   3. Wood cants.
   4. Wood nailers.
   5. Wood furring.
   6. Plywood backing panels.

1.2 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product indicated.

   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that materials comply with requirements.

B. Research/Evaluation Reports: For the following:

   1. Treated wood.
   2. Power-driven fasteners.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. Provide dressed lumber, S4S, unless otherwise indicated.
   3. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2 (lumber) and AWPA C9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

B. Kiln-dry material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.

C. Mark each treated item with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

2.3 DIMENSION LUMBER

A. General: Of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

B. Non-Load-Bearing Interior Partitions: Construction, Stud, or No. 2 grade and the following species:

1. Mixed southern pine; SPIB.

C. Framing Other Than Non-Load-Bearing Partitions: Any species and #2 or better grade with a modulus of elasticity of at least 1,200,000 psi and an extreme fiber stress in bending of at least 850 psi for 2-inch nominal thickness and 12-inch nominal width for single-member use.

2.4 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber for support or attachment of other construction, including the following:

1. Rooftop equipment bases and support curbs.
2. Blocking.
3. Cants.
4. Nailers.
5. Furring.
6. Grounds.

B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 19 percent maximum moisture content of any species.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and the following species and grades:

1. Mixed southern pine, No. 2 grade; SPIB.

2.5 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch thick.

2.6 MISCELLANEOUS MATERIALS

A. Fasteners:

1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
2. Power-Driven Fasteners: CABO NER-272.
3. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

C. Use finishing nails for exposed work, unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. CABO NER-272 for power-driven fasteners.
2. Table 2305.2, "Fastening Schedule," in the BOCA National Building Code.

E. Framing Standard: Comply with AFPA's "Manual for Wood Frame Construction," unless otherwise indicated.

F. Fastening Methods:
1. Plywood Backing Panels: Nail or screw to supports.

END OF SECTION 061000

SECTION 061600 – SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Wall sheathing.
   2. Roof sheathing.
   3. Underlayment.
   4. Flexible flashing at openings in sheathing.

B. See Division 6 Section "Rough Carpentry" for supplementary framing and permanent bracing.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads indicated without exceeding TPI 1 deflection limits.

   1. See structural drawings for wood truss loading requirements.

1.3 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Capable of demonstrating that all wood procurement operations are conducted in accordance with procedures and policies of the Sustainable Forestry Initiative (SFI) Program.

1.5 DELIVERY AND STORAGE

A. Outdoor Storage: Comply with manufacturer's recommendations.

   1. Set panel bundles on supports to keep off the ground.
   2. Cover panels loosely with waterproof protective material.
   3. Anchor covers on top of stack, but keep away from sides and bottom to assure adequate air circulation.
   4. When high moisture conditions exist, cut banding on panel stack to prevent edge damage.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS, GENERAL

A. Oriented Strand Board: DOC PS 2.

B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

C. Factory mark panels to indicate compliance with applicable standard.

2.2 FASTNERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: Hardened, ASME B18.6.1.

2.3 WEATHER RESISTANT SHEATHING PAPER

A. Building Paper: ASTM D 226, Type 1 (No. 30 asphalt-saturated organic felt), unperforated.

B. Building Wrap: Weather Barrier – spunbonded polyolefin, non-woven, non-perforated, weather barrier.

   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

      a. DuPont Tyvek Commercial Wrap

C. Building Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.4 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Pressure-sensitive, self-adhering, cold-applied, proprietary seam tape consisting of polyolefin film with acrylic adhesive, designed for use around wood, steel, and vinyl-framed flanged windows, frames, door frames and wall penetrations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WEATHER BARRIER INSTALLATION

A. General: Cover sheathing with weather-resistant sheathing paper as follows:
   1. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.
   2. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap, unless otherwise indicated.

B. Building Paper: Apply horizontally with a 2-inch (50-mm) overlap and a 6-inch (150-mm) end lap; fasten to sheathing with galvanized staples or roofing nails.

C. Building Wrap: Comply with manufacturer's written instructions.
   1. Seal seams, edges, fasteners, and penetrations with tape.
   2. Extend into jambs of openings and seal corners with tape.

3.3 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturers written instructions.
   1. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION 061600

SECTION 061753 – SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Wood roof trusses.
2. Wood girder trusses.
3. Truss accessories.

B. See Division 6 Section "Rough Carpentry" for supplementary framing and permanent bracing.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads indicated without exceeding TPI 1 deflection limits.

1. See structural drawings for wood truss loading requirements.

1.3 SUBMITTALS

A. Shop Drawings: Show location, pitch, span, camber, configuration, and spacing for each type of truss required; species, sizes, and stress grades of lumber; splice details; type, size, material, finish, design values, orientation, and location of metal connector plates; and bearing details.

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with TPI quality-control procedures for manufacture of connector plates published in TPI 1.

1. Manufacturer's responsibilities include preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that involves inspection by SPIB, Timber Products Inspection, TPI, or other independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.

C. Comply with TP1 1, "National Design Standard for Metal Plate Connected Wood Truss Construction," and TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."

D. Wood Structural Design Standard: Comply with applicable requirements in AFPA's "National Design Specifications for Wood Construction" and its "Supplement."

PART 2 - PRODUCTS

2.1 DIMENSION LUMBER

A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.

B. Grade and Species: Any species for truss chord and web members, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AFPA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 METAL PRODUCTS

A. Metal Connector Plates: Fabricate connector plates to comply with TPI 1 from hot-dip galvanized steel sheet complying with ASTM A 653/A 653M, G60 coating designation; Designation SS, Grade 33, and not less than 0.036 inch thick.

1. Manufacturers: Subject to compliance with requirements, provide products by a qualified manufacturer.

B. Fasteners: Where trusses are exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

1. Nails, Wire, Brads, and Staples: FS FF-N-105.
2. Power-Driven Fasteners: CABO NER-272.
3. Wood Screws: ASME B18.6.1.
4. Lag Bolts: ASME B18.2.1..
5. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

C. Metal Framing Anchors: Provide framing anchors made from hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

1. Manufacturers: Subject to compliance with requirements, provide products by a qualified manufacturer.
2. Allowable Design Loads: Meet or exceed those indicated per manufacturer's published values determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.3 FABRICATION

A. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and brace trusses according to TPI recommendations and as indicated. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

B. Anchor trusses securely at bearing points; use metal framing anchors. Install fasteners through each fastener hole in metal framing anchor according to manufacturer's fastening schedules and written instructions.

C. Securely connect each truss ply required for forming built-up girder trusses. Anchor trusses to girder trusses as indicated.

D. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.

E. Install wood trusses within installation tolerances in TPI 1.

F. Do not cut or remove truss members.

G. Return wood trusses that are damaged or do not meet requirements to fabricator and replace with trusses that do meet requirements.

END OF SECTION 061753

SECTION 064116 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes interior woodwork for the following applications:

1. Plastic-laminate cabinets.

B. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips, unless concealed within other construction before woodwork installation.

1.2 SUBMITTALS

A. Product Data: For the following:

1. Cabinet hardware and accessories.

B. Shop Drawings: Include location of each item, plans and elevations, large-scale details, attachment devices, and other components.

C. Samples:

1. Plastic-laminate-clad panel products, for each type, color, pattern, and surface finish.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of woodwork.

B. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.

1. Provide AWI certification labels or compliance certificate indicating that woodwork complies with requirements of grades specified.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wood Products:

1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2, Grade MD.
3. Particleboard: ANSI A208.1, Grade M-2 .
4. Softwood Plywood: DOC PS 1, Medium Density Overlay.
5. Hardwood Plywood and Face Veneers: HPVA HP-1.

B. High-Pressure Decorative Laminate: NEMA LD 3.

1. **PLM-1**:

a. Manufacturer: Pionite
b. Color: Pralines & Cream WWW160-N

2.2 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials for a complete installation of architectural woodwork, except for items specified in Division 8 Section "Door Hardware."

B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.

C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, self-closing.

D. Wire Pulls: Back mounted, 4 inches long, 5/16 inches in diameter.

E. Catches: Magnetic, BHMA A156.9, B03141.

F. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

G. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091, and rated for the following loads:

1. Box Drawer Slides: 100 lbf.
2. File Drawer Slides: 200 lbf.
3. Pencil Drawer Slides: 45 lbf.

H. Door Locks: BHMA A156.11, E07121.

I. Drawer Locks: BHMA A156.11, E07041.

J. Exposed Hardware Finishes: Complying with BHMA A156.18 for BHMA finish number indicated.

1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

2.3 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

2.4 FABRICATION

A. General: Complete fabrication to maximum extent possible before shipment to Project site. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.

1. Interior Woodwork Grade: Premium complying with the referenced quality standard.
2. Shop cut openings to maximum extent possible. Sand edges of cutouts to remove splinters and burrs.
3. For trim items wider than available lumber, use veneered construction. Do not glue for width.
4. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

B. Plastic-Laminate Cabinets:

1. AWI Type of Cabinet Construction: Flush overlay.
2. Laminate Cladding for Exposed Surfaces: High-pressure decorative of grade indicated.

    a. Horizontal Surfaces Other Than Tops: HGS.
    b. Postformed Surfaces: HGP.
    c. Vertical Surfaces: HGS.
    d. Edges: HGS.

3. Materials for Semi-exposed Surfaces Other Than Drawer Bodies: Thermoset decorative overlay.

    a. Drawer Sides and Backs: Thermoset decorative overlay.
    b. Drawer Bottoms: Thermoset decorative overlay.

4. Colors, Patterns, and Finishes: As indicated in “Materials” section of this specification.
5. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Condition woodwork to average prevailing humidity conditions in installation areas and examine and complete work as required, including removal of packing and backpriming before installation.

B. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in this Section for type of woodwork involved.

C. Install woodwork level, plumb, true, and straight to a tolerance of 1/8 inch in 96 inches. Shim as required with concealed shims.

D. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.

1. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.

END OF SECTION 064116

City of Sterling Heights - Dodge Park

PROJECT NUMBER 170402

SECTION 066500

SOLID POLYMER FABRICATION

1 GENERAL

1.1 SECTION INCLUDES

A. Counter tops

B. One piece vanity tops and bowls

1.2 RELATED SECTIONS

A. Section 064000: Architectural Woodwork

B. Section 223000: Plumbing

1.3 SUBMITTALS

A. Product Data: Not required.

B. Shop Drawings: Required.

C. Samples: Not required.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Conform to applicable code for flame/smoke rating and ADA/Mich. Barrier Free requirements.

B. Installer Qualifications: Installation shall be by a firm that is authorized by the manufacturer to fabricate and install specified surfaces, and that can demonstrate successful experience in installing finished carpentry items similar in type and quality to those required for this project.

C. Submit maintenance data and recommended cleaning and stain removal methods.

1.5 DELIVERY, STORAGE AND HANDLING

A. Transport and handle sheets and fabricated items by methods that will prevent damage and defacing.

B. Storage: If units are not installed immediately upon delivery to site, store in covered location, off the ground or floor, and cover with moisture and stain-resistant paper or plastic.

1.6 ENVIRONMENTAL CONDITIONS

A. Obtain and comply with Corian Surfaces advice for optimum temperature and humidity conditions to Corian Surfaces during its storage and installation.

1.7 WARRANTY

A. Furnish the manufacturer's ten year warranty against defective materials and workmanship.

2 PRODUCTS

2.1 MANUFACTURERS/PRODUCTS

A. SS-1 Acrylic resin composite solid surfacing.
   1. Source: HJ Oldenkamp
   2. Product: Corian
   3. Color: Sonora
   4. Thickness: ½"
   5. Backsplash Height: 4"
   6. Rep: Sabrina Mansour, smansour@oldenkamp.com
   7. Sink: Integral Corian bowl #801 color Bone.

2.2 ACCESSORIES

A. Adhesive: For joints or seams use DuPont Joint Adhesive for Corian.

B. Sealant: Use DuPont Sealant for Corian. Use manufacturer's recommended mildew resistant sealant in color matching formulation.

2.3 FABRICATION

A. For warranty coverage, fabricator/installer shall be approved by solid polymer manufacturer.

B. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and solid polymer manufacturer requirements.

C. Form joints between components using manufacturer's standard joint adhesive. Joints shall be inconspicuous in appearance, nonporous and without voids. Attach 2 inch wide reinforcing strip of solid polymer material under each joint.

D. Adhere integral sinks to countertop per manufacturers instructions.

E. Provide holes and cutouts for plumbing and bath accessories as indicated on the drawings.

F. Rout and finish component edges to a smooth, uniform finish. Rout all cutouts, and then sand all edges smooth. Repair or reject defective or inaccurate work.

3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Beginning of installation means installer accepts existing site conditions and dimensions.

3.2 INSTALLATION

A. Install per manufacturers instructions.

B. Install components plumb and level, in accordance with approved shop drawings and product installation details.

C. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.

D. Provide backsplashes and endsplashes as indicated on the drawings. Adhere to countertops using manufacturer's standard color-matched silicone sealant.

E. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Components shall be clean on Date of Substantial Completion.

F. Make plumbing connections to sinks in accordance with Division 15 and good practice.

G. Protect surfaces from damage until Date of Substantial Completion. Repair or replace damaged work that cannot be repaired to Designer's satisfaction.

H. Fabricator/Installer is to review maintenance procedures and warranty details with the director of maintenance upon completion of work.

3.3 SCHEDULES

A. See Drawings.

END OF OUTLINE

Date:

SECTION 072100 - BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Perimeter insulation at slabs-on-grade.
2. Concealed building insulation.
3. Open-celled spray foam insulation
4. Masonry core insulation

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Product test reports.

C. Research/evaluation reports.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84 for surface-burning characteristics, by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

B. Manufacturing Standards: Provide insulation produced by a single and approved manufacturer. The product must come from the manufacturer pre-mixed to ensure consistency.

C. Installer Qualifications: Engage an experienced dealer/applicator who has been trained and licensed by the product manufacturer and which has not less than three years direct experience in the installation of the product used.

PART 2 - PRODUCTS

2.1 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards for preformed units, in sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths, and lengths.

B. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.60 lb/cu. ft., with maximum flame-spread and smoke-developed indices of 75 and 450, respectively.

C. Open-celled Spray Foam Insulation: Low-density, water-blown, conforming to the following:
1. Thermal Resistance (R-Value/inch @75 deg F): ASTM C 518; 3.7 hr/sq ft/degree F/BTU
2. Air Permeance (for 3 inches of material): ASTM E 2178; < 0.014 L/s.m^2 @ 75 Pa
3. Water Vapor Transmission (for 5.5 inches of material): ASTM E 96; 11 perms [627 ng /(Pa.s.m^2)]
4. Flame Spread and Smoke Developed Rating: ASTM E 84
   a. Flame Spread: Less than 20
   b. Smoke Development: Less than 400
5. Bacterial and Fungal Growth and Food Value: ASTM C 1338: no growth
6. Icynene Classic (LD-C-50) by Icynene, Inc. www.Icynene.com, or equal.

D. Foamed-in-Place Masonry Wall Insulation: Two component thermal insulation produced by combining a plastic resin and catalyst foaming agent surfactant which, when properly ratioed and mixed, together with compressed air produce a cold-setting foam insulation in the hollow cores of hollow unit masonry walls.
1. Surface Burning Characteristics: Maximum flame spread, smoke developed and fuel contributed of 0, 5 and 0 respectively.
2. Combustion Characteristics: Must be noncombustible, Class A building material.
3. Thermal Values: "R" Value of 4.91/inch @ 32 degrees F mean; ASTM C-177
4. "Core-Fill 500TM"; Tailored Chemical Products, P.O. Box 4186, Hickory, N.C. 28603, (800) 627-1687, or equal.

2.2 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

B. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install insulation to comply with insulation manufacturer's written instructions applicable to products and application indicated. 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.

B. Open-celled spray foam insulation:

1. Site mix liquid components.
2. Apply insulation to substrates in compliance with manufacturer's written instructions.
3. Apply insulation to produce thickness required for indicated R Value.
4. Extend insulation in thickness indicated to envelop entire area to be insulated.
5. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

C. Foamed-in-Place Core Insulation:
   1. Fill all open cells and voids in hollow concrete masonry walls where shown on drawings.
      a. Existing masonry walls: The foam insulation shall be pressure injected through a series of 5/8" to 7/8" holes drilled into every vertical column of block cells (every 8" on center) beginning at an approximate height of four (4) feet from finished floor level. Repeat this procedure at an approximate height of ten (10) feet above the first horizontal row of holes (or as needed) until the void is completely filled. Patch holes with mortar and score to resemble existing surface.
      b. New masonry walls: The foam insulation shall be pumped into the masonry cells from the top of the uncapped wall.

D. Installation of General Building Insulation: 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.

   1. 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.
   2. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.

      a. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
      b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to produce airtight installation after concealing finish material is in place.

END OF SECTION 072100

SECTION 074600-SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Fiber Cement horizontal siding
   2. Fiber Cement soffit panels

1.2 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations
   3. Installation methods

B. Verification Samples: For each finish product specified, two samples, representing actual product and color.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Installer shall be licensed, registered or otherwise acceptable to authorities having jurisdiction to install exterior building products.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Inspect the materials upon delivery to assure specified products have been received. Store products in a safe area, away from construction traffic. Store under cover and off the ground, protected from moisture.

1.5 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.6 WARRANTY

A. Material Warranty: Provide manufacturer's standard warranty with 15 year warranty on the coating when factory applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fiber Cement Siding:
1. Acceptable Manufacturer: Woodtone, which is located at: 8007 Aitken Rd.; Chilliwack, BC; Canada V2R 4H5; Toll Free Tel: 800-663-9844; Fax: 604-792-3976; Email: request info (info@woodtone.com); Web: www.woodtone.com

B. Fiber Cement Soffit:
1. Allura, which is located at: 15055 Woodham Drive, Houston, TX 77073 (844) 425-5872 www.allurausa.com
2. Or approve equal.

2.2 SIDING

A. Fiber Cement Siding; Allura products as coated by Woodtone.
1. Type: Horizontal Fiber Cement Siding: WeatherBoards as coated by Woodtone.
   a. Style: Lap siding; 8-1/4 inches (210 mm) wide. .
   b. Texture: Cedar.
   c. Thickness: 5/16 inch (7.9 mm).
   d. Length: 12 feet (3657 mm).
2. Finish: Factory Finish Top Coating by Woodtone.
   a. Procedure: 2 coats, coated all 6 sides.
   b. Color: Rustic Series Winchester Brown

B. Fiber Cement Soffit: Allura Fiber Cement panel
1. Type 1: Cedar, 8” grooved
   a. Thickness: 5/16 inch (7.9 mm)
   b. Panel size: as required from manufacturer’s standard sizes
   c. Texture: Traditional Cedar
   d. Finish: Factory Finish
   e. Color: To be selected from Manufacturer’s stand colors
2. Type 2: Smooth Panel
   a. Thickness: 5/16” (7.9mm)
   b. Panel size: as required from manufacturer’s standard sizes
   c. Texture: Smooth
   d. Finish: Field Painted

2.3 FINISH COATING SYSTEM

A. Horizontal siding:
1. Primer: Ultra low VOC Hybrid Alkyd Emulsion™ primer. Tinted where scheduled or required.
2. Finish Coating: Hybrid Alkyd Emulsion™ (HAE™). Polymer technology of alkyd-oil coating in a water emulsion providing environmental benefits. Borax for mold resistance and greater long-term appearance.

3. System: Coated on all 6 six sides.
4. Wood Appearance Proprietary Two Coat System (RusticSeries Coatings).

2.4 FASTNERS

A. Nails for Fiber Cement Siding and Engineered Wood Siding with Woodtone RusticSeries Coating: As recommended by fiber cement siding manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions including the following:
1. Coordinate work with related trades; scribe and cope siding boards for accurate fit. Allow for installation of related work to avoid cutting and patching.
2. Select siding boards of longest practical lengths. Discard boards that are warped, twisted, bowed, crooked or otherwise defective.
3. Comply with siding manufacturer's and substrate manufacturer's installation instructions. Comply with local building codes and regulations.
4. Apply touch up coating on surfaces and ends cut during installation.
5. As work proceeds, maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris related to this work.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 074600

SECTION 075323-MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Thermoplastic roofing membrane, mechanically fastened to substrate.
2. Roof Insulation
3. Prefabricated flashings, corners, parapets, stacks, vents, and related details.
4. Fasteners, adhesives, and other accessories required for a compete roofing installation.
5. Walking pads for access to rooftop systems.

1.2 SUBMITTALS

A. Manufacturers Product Data including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations
3. Installation requirements.

B. Verification Samples: Three samples, minimum size 6 inches square, representing actual product.

C. Shop Drawings: Indicate insulation pattern, overall membrane layout, field seam locations, joint or termination detail conditions, and locations of fasteners.

1.3 QUALITY ASSURANCE

A. Perform work in accordance with NRCA ML 104 and manufacturer’s installation instructions.

B. Installer Qualifications: Company specializing in installation of roofing system similar to those specified in this project and approved by the roofing system manufacturer.

1.4 DELIVERY, STORAGE AND HANDLING

A. Roofing system and related materials to be delivered to the location designated by the contractor in the original packaging and with shipping labels intact. Containers will be labeled with manufacturers/supplier’s name, product name, and identification. Each shipment should be checked for damages and/or shortages at the time of delivery. The freight agent must note damaged materials and/or shortages on the freight bill. Concealed damage must be reported to

the freight agent immediately. Materials damaged in shipping, handling, or storage cannot be used.

B. Materials should be kept clean and dry. Materials should be stored on pallets and covered with tarps. Care should be taken to place materials away from areas where water may pond or areas that water falls onto from higher elevations. All sealants must be stored at temperatures above 40 deg. F. Keep combustible materials away from heat, sparks, and open flames. Follow precautions outlined on the containers or supplied by the material manufacturer.

1.5 PROJECT CONDITIONS

A. Do not apply roofing membrane during inclement weather, or when ambient temperature is below 40 deg. F.

B. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is anticipated.

C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed in the same day.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Duro-Last Roofing, Inc. Saginaw, MI 48601 (800) 248-0280

B. Provide all roofing system components by a single manufacturer, or as approved by membrane manufacturer.

C. Substitutions: Not Permitted.

2.2 MEMBRANE DESCRIPTION

A. The Duro-Last membrane is a polyvinylchloride polymer blend, which is reinforced with a high-strength weft- inserted polyester scrim that has a thread pattern of 18 x 14 threads per square inch. Refer to the Product Data Sheets for a listing of all of the test results and physical properties of the membrane.
   1. The 40-mil thick membrane has a system weight of approximately 0.25 lb/ft2. The prefabricated roof cover is supplied in sections that are either folded or rolled. Individual sections may be as large as 2,500 ft2, with no single dimension exceeding 100 ft. Deck sheets can be fabricated up to 3,000 ft2 when using 10-ft. laps, 30’-6” wide with a full reverse, not to exceed 100 ft. long.

B. Minimum Performance and Physical Specification requirements for Membrane:

Physical Property	Test Method Used	Specification Requirements
Thickness Min.	ASTM D-751	.040 inch thick (40 mils)
Tear Strength, Toung Method 8" x 8" sample	ASTM D-751	130 x 110 lbf .
Breaking Strength	ASTM D-751	435 x 350 lbf.
EMMAQUA Exposure	ASTM E938, Desert Sun	>6.9 million Langleys
Elongation	ASTM D-751	35%
Dimensional Stability	ASTM D-1204	<.0.1%
Low Temperature Flexibility	ASTM D-2136, 1/8" mandrel	no cracks, -40 degrees F
Dynamic Impact (Puncturing)	Fed. Std. 1013, Method B	350 lbs.
Water Vapor Transmission	ASTM E96 WVT, Procedure B, Method A	>..25 US Perms, 0.086 g/hr//sqm
Accelerated Weathering	Carbon Arc, 6000 Hours	No cracks, crazing, or blistering
Accelerated weathering UVB-313 Lamp @ 80 degrees C	ASTM G-5388, 2000 Hrs.	No cracks, crazing, or blistering
Factory Mutual Research	ASTM E-108	Class 1 I-60 & I-90
Underwriter's Laboratory	UL-790	Class A, B, or C
Scrim: Weft Inserted Polyester		18 x 14, 1000 denier

2.3 MEMBRANE RELATED MATERIALS

A. Membrane-Related Materials

1. All membrane components, including pipe and curb flashings must be factory prefabricated from the same fabric reinforced material used for the deck membrane.
2. Termination Sealant: Compatible with materials to which membrane is to be bonded, conforming to Federal Specifications TT-598 and TT-S-00230C as furnished by Duro-Last Roofing, Inc.
3. Distribution Plates: Factory Mutual approved stress distribution plates formed from a minimum 24 gauge G-90 C.Q. steel with a galvalume coating for insulation attachment, or 20 gauge G-90-C.Q. steel with galvalume coating or high strength polyblend for membrane attachment.
4. Water Cut-Off Mastic: Compatible with materials with which it is used and furnished by the membrane manufacturer.
5. Pitch Pocket Sealant: Shall be a single component, self-leveling silicone sealant furnished by Duro-Last Roofing, Inc.
6. Fasteners: Compatible with roof deck as furnished by the membrane manufacturer. Fasteners shall be furnished by Duro-Last Roofing, Inc. and be Duro-Guard coated #14 and must pass 30 cycles in the Kesternich Cabinet, DIN #50018-2 Liter. The FM approved fastener is inserted through the hole in the distribution plate and properly secured to the roof deck.
7. Breather Vents: Two-way vents with factory-attached skirt shall be installed at a density of one per 1000 square feet of roof deck area and in accordance with Duro-Last Roofing, Inc.’s specifications. Vents shall be furnished by Duro-Last Roofing, Inc.

8. Terminations/Edge Details: Shall be manufactured from rigid exterior vinyl with slotted holes for securement and furnished by membrane manufacturer. All other terminations/edge details must be approved and warranted by Duro-Last Roofing, Inc.
9. Walkway Pads: Provide Duro-Last Roofing, Inc.'s walkway pads made from the roofing membrane material installed in strict compliance with manufacturer's recommendations. Pads shall be non-skid, maintenance free, and restrained to remain in position. Pad installation minimum configuration is shown on the drawings. Walkway pads shall be a contrasting color to the roof membrane. Owner and/or Owner's representative shall choose from Duro-Last Roofing, Inc.'s samples.

B. Insulation
1. Board insulation shall be a minimum of 3 inch thick polyisocyanurate.

C. Tapered Crickets (where required)
Crickets shall be formed of tapered material having the same requirements and characteristics as listed in the preceding paragraph.

D. Roofing Nails
Nails shall be galvanized "Stronghold" type: (for use on parapet walls, wood nailers)

E. Nailers & Blocking
1. Where required, nailers and wood blocking shall be S4S 1500 fc construction grade Douglas fir conforming to standard 15 grading and dressing rules of the West Coast Lumber Inspection Bureau, or other species of wood of equal strength. All lumber shall be grade marked at the mill.
2. All lumber shall be pressure treated by a method approved by the roofing membrane manufacturer: "Wolmanized" or "Osmose K-33" are acceptable.
3. Nailers shall be securely anchored to the deck to resist the minimum force required in Loss Prevention Data Sheet I-49, "Perimeter Flashing," Factory Mutual Systems, June, 1985. The thickness of the nailer shall be such that the top of the nailer is flush with the surface to which the membrane is to be applied.

F. Accessories
Primary accessories shall be factory prefabricated or manufactured by or under the direction of Duro-Last Roofing, Inc. All other shall be furnished and approved by the Duro-Last Roofing, Inc.

PART 3 - EXECUTION

3.1 PREPARATION

A. Substrate Inspection
1. Inspect all surfaces to receive roofing for any condition that will adversely affect execution, performance, or quality of work.
2. All roof surfaces and all sloped surfaces to drains and outlets shall be checked and approved by the roofing contractor prior to the start of the roofing work.

3. Install roofing material only under satisfactory conditions as specified by Duro-Last Roofing, Inc.
4. Scheduling: Schedule the roofing work in areas and sections in such a manner as to keep the new and existing insulation, roofing materials, and building absolutely dry and watertight during new roofing work.
5. Any damage sustained to the facility or contents as a result of improper scheduling of roofing work shall be the contractor's responsibility.

B. Surface Preparation: Contractor's proposal shall include all costs for the removal of wet or damaged existing roofing insulation and replacement as required, repair of blisters, existing flashings, expansion and control joint covers, and repair or replacement of required treated wood nailers or blocking.
1. The total extent of preparation shall include the above and comply with the Duro-Last Roofing, Inc.'s recommendations.
2. Mechanically secure separation material units to roofing deck independent of membrane attachment and cover immediately with membrane. Butt units tightly together, limiting joint separation to 1/8 inch, maximum. Meet attachment pattern requirements of Duro-Last Roofing, Inc.

3.2 GENERAL REQUIRMENTS

A. Precautions:
1. Do not lay out or expose any insulation on the deck that cannot be covered by membrane on the same day.
2. In making all field heat welds, make sure all edges are clean and free of tar, mastic or other foreign items.
3. Do not expose membrane and accessories to a constant temperature in excess of 110 degrees Fahrenheit.
4. Sealants and adhesives should be applied according to the manufacturer's specifications and all containers shall be disposed of properly.
5. Start securing the membrane at the highest point and work towards the drains.

B. Protection of Roofing Surfaces
1. Storing, wheeling, or trucking directly on roof insulation or membrane surface is not recommended. Smooth, clean plywood or plank walkways, runways and platforms shall be provided as necessary.

3.3 INSULATION INSTALLATION

A. General:
1. The roof insulation shall be installed with approved fasteners and distribution plates placed according to specification. Insulation board having maximum of dimensions of 2 x 4 feet shall require a minimum of 2 fasteners. Insulation boards having maximum of dimensions of 4 x 4 feet shall require a minimum of 4 fasteners. Insulation boards having maximum of dimensions of 4 x 8 feet shall require a minimum of 6 fasteners. Install the fasteners flush with the top surface of the insulation board. The ends of the insulation boards shall be staggered 50% from row to row. Butt each insulation board firmly to the adjacent board. Do not jam insulation boards or allow cracks between insulation boards.

Cut boards to allow a maximum 1/4 inch gap away from vertical surfaces. The following FM approved insulation's are approved for use with the membrane cover, fiberglass, urethane/OSB composite, polyisocyanurate or others approved by Duro-Last Roofing, Inc. Contact Duro-Last Roofing, Inc. for specific applications.

3.4 MEMBRANE INSTALLATION

A. Lay-out:
1. Select the proper factory marked rolled sheet of roofing membrane for an outside corner or high point. Orient the roofing membrane so that the 3 inch wide fastening tabs are perpendicular to the ribs or corrugations of a steel deck or perpendicular to the width of the pre-stressed concrete "T" slabs, etc. When laying out each tab, pull the membrane tight.

B. Roof Sections:
1. Unfold first sheet along edge of roof or parapet wall. Position and fasten first tab with plates and screws according to membrane manufacturer specifications. Unfold roofing sheet to the second 3-1/4 inch wide fastening tab. Pull tab tight and secure to deck as herein described, maintaining proper plate and screw frequency, squarely placed. Continue unfolding and fastening roofing membrane until entire sheet is in place. Install the adjacent roofing membrane sheets using the fastening procedure described. Proceed until all sheets are in place, thus forming a monolithic roof cover. Make sure all edges of each sheet of roofing are fastened with the same fastener spacing as tabs or are welded to another sheet that is fastened in this manner.

C. Field Welding
1. All field heat seams of the roofing materials shall be 1-1/2 inch wide minimum and be made with a hot air welder. The hot air welder shall be in such a position so that the outside edge and both pieces of material will receive an equal amount of heat and all of which will be closely followed by a 1-5/8 inch wide roller specially designed for this purpose. Make a hands and knees inspection of all field welds with a probe.

D. Perimeter Nailing
1. The membrane shall be mechanically fastened at all roof perimeters, parapets, curbs, wall, penetrations, etc. in strict accordance with the Contract Documents and Duro-Last Roofing, Inc.'s specifications and details.

E. Cut-outs
1. Make cut-outs in roofing membrane for protrusions through the roof. Some situations might require that the deck membrane be slit to the section edge for fitting around protrusions. Fasten around cut-outs with approved fasteners, 12 inches on center or a minimum of one per side. The skirts on factory prefabricated accessories when welded to deck will cover these.

F. Stacks
1. After membrane has been attached, select proper size of pre-manufactured round stack for roof vents and pipes. Drop stack flashing over the pipe, lay flat to the roof, and heat weld the skirt to the deck membrane. Using appropriate hand tool, tighten stainless steel band (or stainless steel screw clamp) around top of stack flashing to prevent water

penetration, and cut off excess. Using factory approved sealant, liberally seal the top of the stack flashing and steel band.

G. Custom Curbs/Pitch Pockets
1. After securing cut-out as stated, heat weld the bottom of the skirt to the deck membrane. If the square or rectangle penetration has a removable top, i.e. roof hatch, skylight, etc., remove the unit and fold the custom curb flashing over the top, secure, then replace unit. If top is not removable, secure the top of the custom curb flashing with termination bar and seal with factory approved sealant. Use this same procedure on existing or new pitch pockets.

H. Breather Vents
1. Install a two-way breather vent for every 1,000 square feet of deck area. Factory prefabricated vents with a skirt made from roofing membrane shall be used. For new construction or reroof after tear-off, a 2-1/2 inch diameter hole cut down through the roofing membrane and insulation facer is required. For recover/non-tear-off application a 2-1/2 inch diameter hole is to be cut through the roofing membrane and the facer down to the facer on the existing insulation. Heat weld skirt to the deck membrane so as to position two-way vent directly over the hole. Careful placement of the breather vents must be observed. DO NOT locate in valleys, next to roof penetrations, scuppers, roof drains, etc. Equally space the vents throughout the roof area. Do not fasten the vent or the skirt to the roof deck. This two-way breather vent is designed to vent the roofing system only and not the building to which it is installed.

I. Parapet Walls
1. Fasten bottom tab of prefabricated parapet wall flashing 12 inches on center with approved fasteners. This fastening sequence will secure both bottom of parapet and edge of deck membrane. Base skirt should extend approximately 6 inches onto the roof. This allows for a 1-1/2 inch wide weld and covering of the fasteners and plates. Heat weld skirt to deck membrane. On all termination bar applications, start fastening at one end and proceed to the other. This will eliminate buckling of the termination bar. Seal behind the parapet wall material and on top of termination bar with factory approved sealant. If parapet wall coping is to be covered, extend covering down 2 inches on exterior face of coping and terminate accordingly.

J. Roof Drains
1. Secure cut-out made in deck membrane with four (4) equally spaced fasteners and distribution plates. If drain is flush with deck, use a prefabricated drain boot. Apply factory-approved sealant all around drain approximately 12 inches under deck membrane and install the expanding snap rings.
2. If the roof drain has a secure clamping ring and strainer, unbolt and remove. Clean and apply factory-approved sealant under deck membrane around drain for use as a water block seal after cutting properly sized hole. Secure clamping ring and strainer to drain base over deck membrane. Seal with factory approved sealant between clamping ring and roofing membrane.

K. Expansion Joints/Valley
1. Whenever encompassing an elevated mid-roof expansion joint, must use a prefabricated expansion joint section. This section shall allow loose layment over the joint and

approved fastening on either side. A 6 inch skirt on both sides will provide coverage of fasteners and still allow approximately 1-1/2 inch for a heat weld to deck membrane.

2. Valleys are worked in the same manner. Fasten according to specifications, 12 inches on center, and lap deck membrane over fasteners. Heat weld deck membrane to valley section.

3.5 CLEAN-UP

A. Upon completion of the membrane installation, the contractor shall remove all foreign matter, rubbish and scrap material from the roof. The membrane surface shall be cleaned using cleaners recommended by the membrane manufacturer.

3.6 INSPECTION AND WARRANTY

A. Inspection: Duro-Last Roofing, Inc.'s Quality Assurance Technician, architect and roofing contractor shall conduct all required inspections. Submit all required drawings, details, and completed questionnaires to the roofing manufacturer before obtaining the specified warranty. After an authorized Quality Assurance Technician has inspected the roof for determining acceptability for warranty issuance, any deficiencies on the final inspection report shall be corrected by the contractor/applicator and made ready for reinspection within five (5) working days.

B. Warranty: Upon receipt of required materials, certifying inspection, and acceptance of the roofing system by Duro-Last Roofing, Inc., the warranty shall be duly executed and issued to the Owner.

3.7 REPAIRS

A. Future repairs or additions to the roofing system shall be made using the heat welding process. Adhesive bonded or butyl tape repairs shall not be allowed for the life of the roof. Provide repair procedures to the Owner and/or Owner's representative.

3.8 CONSTRUCTION DAMAGE

A. Upon completion of work, repair or replace as required, all building materials damaged as a result of the roofing operations. Match existing materials as close as possible. Owner and/or Owner's representative will be involved in the selection of matching materials.

END OF SECTION 075323

SECTION 076100-PREFORMED METAL ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Preformed, prefinished metal roofing and flashing
   2. Miscellaneous trim, flashing, closures, drip flashing, and accessories
   3. Sealant
   4. Fastening Devices

1.2 REFERENCES

A. American Iron & Steel Institute (AISI) Specification for the Design of Cold formed Steel Structural Members.

B. ASTM A-653-09 Steel Sheet, Zinc-Coated (Galvanized)

C. ASTM 792-86 AZ-50 Aluminum Zinc Alloy Coated Steel (Galvalume Sheet Metal

D. ASTM E-1680

E. ASTM E-1646

F. ASTM E-1592

G. Spec Data Sheet - Aluminum Zinc Alloy Coated Steel (Galvalume) Sheet Metal by Bethlehem Corp.

H. SMACNA - Architectural Sheet Metal Manual.

I. Building Materials Directory - Underwriter’s Laboratories, Test Procedure 580 - UL-90.

1.3 SUBMITTALS

A. Submit detailed shop drawings showing layout of panels, anchoring details, joint details, trim, flashing, and accessories. Show details of weatherproofing, terminations, and penetrations of metal work at 0’-3”= 1’-0” scale.

B. Submit a sample of each type of roof panel, complete with factory finish.

C. Submit results indicating compliance with minimum requirements of the following performance tests:

D. Air Infiltration - ASTM E 1680

E. Water Infiltration - ASTM E 1646

F. Wind Uplift - UL 90

G. Submit calculations with registered engineer seal, verifying roof panel and attachment method resist wind pressures imposed on it pursuant to applicable building codes.

1.4 QUALITY ASSURANCE

A. Manufacturer: Company specializing in Architectural Sheet Metal Products with ten (10) years minimum experience.

B. No product substitutions shall be permitted without meeting specifications.

1.5 DELIVERY, STORAGE AND HANDLING

A. Upon receipt of panels and other materials, installer shall examine the shipment for damage and completeness.

B. Panels should be stored in a clean, dry place. One end should be elevated allowing moisture to run off.

C. Panels with strippable film must not be stored in the open, exposed to the sun.

D. Stack all materials to prevent damage and to allow adequate ventilation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Berridge Manufacturing Co.
2. Morin Corporation.
3. Petersen Aluminum Corp.

2.2 SHEET MATERIALS

A. Prefinished metal shall be Aluminum-Zinc Alloy Coated (AZ-50 Galvalume) Steel Sheet, 24-Gauge or 22-Gauge, ASTM 792-08, Grade 40, yield strength 40 ksi min.

B. Finish shall be full strength Kynar 500 or Hylar 5000 fluoropolymer coating applied by the manufacturer on a continuous coil coating line, with a top side dry film thickness of 0.75 ± 0.05 mil over 0.20 ± 0.05 mil prime coat, to provide a total top side dry film thickness of 0.95 ± 0.10 mil. Bottom side shall be coated with a primer (non-metallics only) and beige urethane coating

with a total dry film thickness of 0.35 ± 0.05 mil. Finish shall conform to all tests for adhesion, flexibility, and longevity as specified by the Kynar 500 or Hylar 5000 finish supplier.

C. Strippable film shall be applied to the top side of all prefinished metal to protect the finish during fabrication, shipping and field handling. This strippable film MUST be removed immediately before installation.

D. Unpainted metal shall be Aluminum-Zinc Alloy Coated (AZ-55 Acrylic Coated Galvalume) Steel Sheet, 24-Gauge or 22-Gauge, ASTM 792-08, Grade 40, yield strength 40 ksi min., with clear acrylic coating on both sides of material.

E. Field protection must be provided by the contractor at the job site so stacked or coiled material is not exposed to weather and moisture.

F. Flashing maybe factory fabricated or field fabricated. Unless otherwise specified all exposed adjacent flashing shall be of the same material and finish as panel system.

2.3 ACCESSORY MATERIALS

A. Fasteners: Stainless Steel with washers at exposed fasteners where approved by architect.

B. Sealant: Sealant shall be an ultra low modulus, high performance, one-part, moisture curing silicone joint sealant. Tremco Spectrum One, Dow 790 or equal (Do not use a clear sealant or sealants which release a solvent or acid during curing).

C. Sealant must be resistant to environmental conditions such as wind loading, wind driven rain, snow, sleet, acid rain, ozone, ultraviolet light and extreme temperature variations.

D. Features must include joint movement capabilities of +100% & -50% ASTM C-719, capable of taking expansion, compression, transverse and longitudinal movement, service temperature range -65ºF to 300ºF (-54ºC to 149ºC), Flow, sag or slump: ASTM C-639; Nil, Hardness (Shore A): ASTM C-661; 15, Tensile strength at maximum elongation: ASTM D-412; 200 psi, Tensile strength at 100% elongation: ASTM D-412; 35 psi, Tear strength, (die “C”); ASTM D-624; 40 pli, Peel strength (Aluminum, Glass, Concrete): ASTM C-794; 30 pli

E. Vinyl Weatherseal Insert.

2.4 FABRICATION

A. All exposed adjacent flashing shall be of the same material and finish as the roof panels.

B. Hem all exposed edges of flashing on underside, ½ inch.

2.5 STANDING SEAM PANELS

A. Snap Lock panels for installation over solid substrate:

1. Panels shall have 1 ½" high vertical legs, spaced 16 ½" on center and shall have no exposed fasteners.
2. Standing seam to be of an interlocking, "snap-lock" design.
3. Panels shall be site-formed in continuous lengths from ridge to eave or factory-formed to maximum 40'.
4. Continuous Rib to be 2 1/8" wide and 1 3/8" in height. Rib shall be connected to substrate with two #12-14 x 1" self-drilling/tapping fasteners or clips at 3'-0" max.
5. Certification shall be submitted, based on independent testing laboratory, indicating no measurable water penetration or air leakage through the system when tested in accordance with ASTM E-1680 and E-1646.

2.6 UNDERLAYMENT MATERIALS

A. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felts.

B. Ensure felt installed horizontally, starting at eave to ridge with a 6" minimum overlap and 18" endlaps.

C. Ensure that all nail heads and felt caps are totally flush with the substrate. Fasteners shall be galvanized roofing nails or zinc-coated fasteners with Coated Felt Caps.

2.7 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.

1. Exterior Fasteners: Stainless steel.
2. Interior Fasteners: Galvanized steel.
3. Exposed Fasteners: With heads matching color of panel by means of plastic caps or factory-applied coating.

    a. Provide metal-backed neoprene washers under heads of exposed fasteners bearing on weather side of panels.
    b. Locate and space exposed fasteners in true vertical and horizontal alignment. Obtain controlled uniform compression for positive seal without rupture of neoprene washer.

B. Snow Guards: Solid, pre-finished, cast aluminum snow guards for mid-panel adhesive application on standing seam metal roof.

1. Manufacturer/Product: "BRONZE GUARD #640" as manufactured by M. J. Mullane Company, Inc., (978) 568-0597.
2. Color: Pre-finished by Manufacturer to match specified roof color.
3. Accessories: Manufacturer's standard high-strength adhesive as required for installation.

C. Accessories: Components required for complete roof panel assembly including trim, copings, fasciae, mullions, sills, corner units, ridge closures, clips, seam covers, battens, flashings,

gutters, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of panels.

1. Closure Strips: Closed-cell, self-extinguishing, expanded, cellular, rubber or crosslinked, polyolefin-foam flexible closure strips. Cut or premold to match configuration of panels. Provide closure strips necessary to ensure weathertight construction.
2. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound with release paper backing; permanently elastic, nonsag, nontoxic, and nonstaining.
3. Elastomeric Joint Sealant: ASTM C 920, of base polymer, type, grade, class, and use classifications required to seal joints in panel roofing and remain weathertight and recommended by panel manufacturer.

2.8 FABRICATION

A. General: Fabricate and finish panels and accessories at the factory to greatest extent possible.

B. All exposed adjacent flashing shall be of the same material and finish as the roof panels.

C. Hem all exposed edges of flashing on underside, ½ inch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Coordinate metal panel roofing with rain drainage work; flashing; trim; and construction of decks, parapets, walls, and other adjoining work to provide leakproof, secure, and noncorrosive installation.

B. Panel Installation: Anchor securely in place with provisions for thermal and structural movement.
1. Comply with manufacturers standard instructions and conform to standards set forth in the Architectural Sheet Metal Manual published by SMACNA, in order to achieve a watertight installation.
2. Install panels in such a manner that horizontal lines are true and level and vertical lines are plumb.
3. Install starter and edge trim before installing roof panels.
4. Remove protective strippable film prior to installation of roof panels.
5. Attach panels using manufacturer’s standard clips and fasteners, spaced in accordance with approved shop drawings.
6. Install sealants for preformed roofing panels as approved on shop drawings.
7. Do not allow panels or trim to come into contact with dissimilar materials.
8. Do not allow traffic on completed roof. If required, provide cushioned walk boards.
9. Protect installed roof panels and trim from damage caused by adjacent construction until completion of installation.
10. Remove and replace any panels or components which are damaged beyond successful repair.

C. Snow Guard Installation: Snow guards shall be installed by means of Manufacturer's recommended adhesive and per Manufacturer's printed installation instructions.

D. Accessories: Install components required for complete roof panel assembly.

1. Separate dissimilar metals by painting each metal surface in area of contact with a bituminous coating, by applying rubberized-asphalt underlayment to each metal surface, or by other permanent separation as recommended by manufacturers of dissimilar metals.

E. Joint Sealers: Install gaskets, joint fillers, and sealants as required for weatherproof performance of panel assemblies.

1. Install weatherseal under ridge cap. Flash and seal panels at eave and rake with rubber, neoprene, or other closures to exclude weather.
2. Seal panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by panel manufacturer.
3. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

F. Cleaning: Remove temporary protective coverings and strippable films, if any, as soon as each panel is installed. After completing panel installation, clean finished surfaces as recommended by panel manufacturer and maintain in clean condition during construction.

END OF SECTION 076100

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes sheet metal flashing and trim for the following:

1. Roof-drainage systems (downspouts & built-in gutters).
2. Metal flashing.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.

C. Samples: For each exposed finish.

PART 2 - PRODUCTS

2.1 METALS

A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability of alloy and temper indicated.

1. Anodized Aluminum Sheet: ASTM B 209, alloy 5005-H14, with a minimum thickness of 0.040 inch.
2. Factory-Painted Aluminum Sheet: ASTM B 209, alloy 3003-H14, with a minimum thickness of 0.040 inch.

B. Galvanized Steel Sheet: ASTM A 526/A 526M, G 90, commercial steel, or ASTM A 527/A 527M, G 90, lock-forming quality, hot-dip galvanized steel sheet with 0.20 percent copper, mill phosphatized where indicated for painting; not less than 0.0396 inch thick.

C. Coil-Coated Galvanized Steel Sheet: Zinc-coated, commercial-quality steel sheet complying with ASTM A 755/A 755M, G 90 coating designation, coil coated with high-performance fluoropolymer coating; not less than 0.0396 inch thick.

1. High-Performance Organic Coating: Fluoropolymer two-coat system with fluoropolymer coat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2.

a. Color and Gloss: As selected from manufacturer's full range.

2.2 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Solder: ASTM B 32, Grade Sn50, used with rosin flux.

B. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.

C. Asphalt Mastic: SSPC-Paint 12, solvent-type, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil dry film thickness per coat.

D. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

E. Elastomeric Sealant: As recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements specified in Division 7 Section "Joint Sealants ."

F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior and interior nonmoving joints, including riveted joints.

G. Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.

H. Paper Slip Sheet: 5-lb/square red rosin, sized building paper, FS UU-B-790, Type I, Style 1b.

I. Polyethylene Underlayment: ASTM D 4397, minimum 6-mil- thick black polyethylene film, resistant to decay when tested according to ASTM E 154.

J. Metal Accessories: Sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

K. Roofing Cement: ASTM D 4586, Type I, asbestos free, asphalt based.

2.3 FABRICATION, GENERAL

A. Sheet Metal Fabrication Standard: Fabricate units to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, material, metal thickness, and other characteristics of item indicated.

B. Fabricate units that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Form exposed sheet metal without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.

D. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.

E. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

F. Expansion Provisions: Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

G. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

H. Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.

I. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.

J. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.

1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but not less than thickness of metal being secured.

K. Aluminum Extrusion Units: Fabricate with formed or extruded-aluminum joint covers for installation behind main members where possible. Fabricate mitered and welded corner units.

2.4 ALUMINUM FINISHES

A. Class I, Clear Anodic Finish: Comply with AAMA 607.1.

B. Class I, Color Anodic Finish: Comply with AAMA 606.1 or AAMA 608.1.

1. Color: As selected from full range of industry colors and densities.

C. High-Performance Organic Coating Finish: Fluoropolymer two-coat system with fluoropolymer coat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2.

1. Color and Gloss: As selected from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual."
2. Anchor units of Work securely in place, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Install exposed units 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.

C. Install units to fit substrates and to result in waterproof and weather-resistant performance.

D. Expansion Provisions: Accommodate thermal expansion of exposed sheet metal. Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

E. 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, except where pretinned surface would show in finished Work.

1. Do not solder aluminum and coil-coated galvanized steel sheet.
2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

F. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant.

1. Use joint adhesive for nonmoving joints specified not to be soldered.

G. Seams: Install flat-lock seams at nonmoving seams. Tin edges to be seamed, form seams, and solder.

H. Seams: Install flat-lock seams at nonmoving seams in aluminum. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

I. Separations: Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.

1. Underlayment: Where installing stainless steel or aluminum directly on cementitious or wood substrates, install slip sheet of red-rosin paper and course of polyethylene underlayment.
2. Bed flanges of Work in thick coat of roofing cement where required for waterproof performance.

J. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a

waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of 2 inches and bed with sealant.

K. Equipment Support Flashing: Coordinate equipment support flashing installation with roofing and equipment installation. Weld or seal flashing to equipment support member.

L. Roof-Penetration Flashing: Coordinate roof-penetration flashing installation with roofing and installation of items penetrating roof. Install flashing as follows:

1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
2. Seal and clamp flashing to pipes penetrating roof, other than lead flashing on vent piping.

M. Splash Pans: Install where downspouts discharge on low-sloped roofs, unless otherwise indicated. Set in roof cement or sealant compatible with roofing membrane.

N. Immediately after installation, clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

END OF SECTION 076200

SECTION 077100 - MANUFACTURED ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Copings.
2. Reglets and counterflashing.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.

C. Samples: For each exposed finish.

PART 2 - PRODUCTS

2.1 METALS

A. Aluminum: Alloy and temper as recommended by manufacturer for intended use and finish indicated with not less than the strength and durability characteristics of alloy and temper indicated.

1. Extrusions: ASTM B 221, 6063-T5 alloy and temper.
2. Sheet: ASTM B 209.

a. Coated-Finish Sheet: Alloy 5005-H14, with minimum thickness of 0.050 inch, unless otherwise indicated.
b. Clear Anodic Finish: Class I coating complying with AAMA 607.1.
c. Color Anodic Finish: Class I coating complying with AAMA 606.1 or AAMA 608.1.

1) Color: As selected from full range of industry colors and densities.

d. High-Performance Organic Coating Finish: Fluoropolymer two-coat system with fluoropolymer coats containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 1402, Test Method 7.

1) Color and Gloss: As selected from manufacturer's full range.

B. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 commercial steel; minimum 0.034 inch thick, unless otherwise indicated.

1. Factory Priming for Field-Painted Finish: Prime with SSPC-Paint 20 zinc-rich primer.
2. Baked-Enamel Finish: Manufacturer's standard two-coat, thermocured finish.

    a. Color and Gloss: As selected from manufacturer's full range.

2.2 COPINGS

A. General: Of metal and in shapes and sizes indicated, with shop-fabricated corners. Include anchor plates formed from at least 0.028-inch- thick, galvanized steel sheet; cleats or other attachment devices; concealed splice plates; and trim and other accessories indicated or required for complete installation, with no exposed fasteners.

B. Formed-Aluminum Copings: Minimum 0.063 inch thick, unless otherwise 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. Architectural Products Co.
    b. Cheney Flashing Company.
    c. Hickman, W. P. Co.
    d. MM Systems Corp.
    e. Petersen Aluminum Corp.

2.3 REGLETS AND COUNTERFLASHING

A. General: Of type, metal, and profile indicated, compatible with flashing. Form to securely interlock with counterflashing.

B. Masonry Type: With offset top flange for embedment in masonry mortar joint.

C. Counterflashing: Fabricated from same metal as reglets and compatible with reglet system installed.

D. Galvanized Steel Reglets: 0.022 inch thick.

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. Cheney Flashing Company.
    b. Fry Reglet Corporation.
    c. Hickman, W. P. Co.

2.4 ACCESSORIES

A. Exposed Fasteners: Stainless steel, nonmagnetic, of manufacturer's standard type and size for product and application indicated. Match finish of exposed heads with material being fastened.

B. Concealed Fasteners: Same metal as item fastened or other noncorrosive metal as recommended by manufacturer.

C. Galvanizing Repair Paint: SSPC-Paint 20, high-zinc-dust-content paint for regalvanizing welds in steel.

D. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil dry film thickness per coat.

E. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

F. Foam-Rubber Seal: Manufacturer's standard foam.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate installation of products with installation of roof deck and other substrates, vapor retarders, roofing insulation, roofing membrane, flashing, and wall construction, as required to ensure that combined elements are waterproof and weathertight. Anchor products securely to structural substrates to withstand lateral and thermal stresses and inward and outward loading pressures.

B. Isolation: Where metal surfaces of units contact dissimilar metal or corrosive substrates, including wood, apply bituminous coating on concealed metal surfaces or provide other permanent separation as recommended in writing by manufacturer.

C. Expansion Provisions: Install running lengths to allow controlled expansion for movement of metal components in relation not only to one another but also to adjoining dissimilar materials, including flashing and roofing membrane materials, in a manner sufficient to prevent water leakage, deformation, or damage.

D. Immediately after installation, clean exposed metal surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

END OF SECTION 077100

SECTION 077233 – ROOF HATCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide factory-fabricated roof hatches for ladder access.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product data.

B. Shop Drawings: Submit shop drawings including profiles, accessories, location, adjacent construction interface, and dimensions.

C. Warranty: Submit executed copy of manufacturer's standard warranty.

1.3 QUALITY ASSURANCE

A. Manufacturer: A minimum of 5 years experience manufacturing similar products.

B. Installer: A minimum of 2 years experience installing similar products.

C. Manufacturer's Quality System: Registered to ISO 9001:2008 Quality Standards including in-house engineering for product design activities.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

1.5 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard warranty. Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design Manufacturer: Type L Roof Hatch by The Bilco Company, P.O. Box 1203, New Haven, CT 06505, 1-800-366-6530, Fax: 1-203-933-8478, Web: www.bilco.com.

2.2 ROOF HATCH

A. Furnish and install where indicated on plans metal roof hatch Type NB, size width: 30" (762mm) x length: 54" (1372mm). Length denotes hinge side. The roof hatch shall be single leaf. The roof hatch shall be pre-assembled from the manufacturer.

B. Performance characteristics:
1. Cover shall be reinforced to support a minimum live load of 40 psf (195 kg/m^2) with a maximum deflection of 1/150th of the span or 20 psf (97 kg/m^2) wind uplift.
2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
3. Operation of the cover shall not be affected by temperature.
4. Entire hatch shall be weathertight with fully welded corner joints on cover and curb.

C. Cover: Shall be 14 gauge (1.9mm) paint bond G-90 galvanized steel with a 3" (76mm) beaded flange with formed reinforcing members. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.

D. Cover insulation: Shall be fiberglass of 1" (25mm) thickness, fully covered and protected by a metal liner 22 gauge (.8mm) paint bond G-90 galvanized steel.

E. Curb: Shall be 12" (305mm) in height and of 14 gauge (1.9mm) paint bond G-90 galvanized steel. The curb shall be formed with a 3-1/2" (89mm) flange with 7/16" (11mm) holes provided for securing to the roof deck. The curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, fully welded at the corners, that features the Bil-Clip® flashing system, including stamped tabs, 6" (153mm) on center, to be bent inward to hold single ply roofing membrane securely in place.

F. Curb insulation: Shall be rigid, high-density fiberboard of 1" (25mm) thickness on outside of curb.

G. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe through bolted to the curb assembly.

H. Hardware
1. Heavy pintle hinges shall be provided
2. Cover shall be equipped with an enclosed two point spring latch with interior and exterior turn handles
3. Roof hatch shall be equipped with interior and exterior padlock hasps.
4. The latch strike shall be a stamped component bolted to the curb assembly.
5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1" (25mm) diameter red vinyl grip handle to permit easy release for closing.

6. Compression spring tubes shall be an anti-corrosive composite material and all other hardware shall be zinc plated and chromate sealed. [For installation in highly corrosive environments or when prolonged exposure to hot water or steam is anticipated, specify Type 316 stainless steel hardware].
7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.
8. Finishes: Factory finish shall be alkyd based red oxide primed steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work.
   1. Test units for proper function and adjust until proper operation is achieved.
   2. Repair finishes damaged during installation.
   3. Restore finishes so no evidence remains of corrective work.

3.3 ADJUSTING AND CLEANING

A. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

END OF SECTION 077233

SECTION 079200-JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes joint sealants for the applications indicated:

1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:

a. Control and expansion joints in unit masonry.
b. Perimeter joints between materials listed above and frames of doors, windows and louvers.
c. Control joints in ceilings and other overhead surfaces.
d. Other joints as indicated.

2. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:

a. Control joints on exposed interior surfaces of exterior walls.
b. Perimeter joints of exterior openings where indicated.
c. Vertical joints on exposed surfaces of interior unit masonry walls and partitions.
d. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
e. Joints between plumbing fixtures and adjoining walls, floors, and counters.
f. Other joints as indicated.

B. Related Sections include the following:

1. Division 04 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
2. Division 08 Section "Glazing" for glazing sealants.
3. Division 09 Section "Tiling" for sealing tile joints.

1.2 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.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial 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. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

E. Qualification Data: For Installer.

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.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

B. Perform work in accordance with sealant manufacturer’s requirements for preparation of surfaces and material installation instructions.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the commencement of the Work.

1. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
2. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

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.

1.5 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.

1.6 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: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

C. 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

2.1 MANUFACTURERS

A. A. Silicone Sealants:
1. Bostik, Inc: www.bostik-us.com
2. Pecora Corporation: www.pecora.com.
3. Degussa Building Systems/Sonneborn: www.chemrex.com.
4. Substitutions: See Section 01600- Product Requirements

B. Polyurethane Sealants:
   1. Bostik, Inc: www.bostik-us.com
   2. Pecora Corporation: www.pecora.com.
   3. Degussa Building Systems/Sonneborn: www.chemrex.com.
   4. Substitutions: See Section 01600- Product Requirements

C. Butyl Sealants:
   1. Bostik, Inc: www.bostik-us.com
   2. Pecora Corporation: www.pecora.com.
   3. Degussa Building Systems/Sonneborn: www.chemrex.com.
   4. Substitutions: See Section 01600- Product Requirements

D. Acrylic Emulsion Latex Sealants:
   1. Bostik, Inc: www.bostik-us.com
   2. Pecora Corporation: www.pecora.com.
   3. Degussa Building Systems/Sonneborn: www.chemrex.com.
   4. Substitutions: See Section 01600- Product Requirements

2.2 SEALANTS

A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by the more stringent of the South Coast Air Quality Management District Rule No.1168.

B. General Purpose Exterior Sealant: Polyurethane; ASTM C 920, Grade NS, Class 25, Uses M, G, and A; single component.
   1. Color: color as selected
   2. Applications: Use for:
      a. Control, expansion, and soft joints in masonry
      b. Joints between concrete and other materials
      c. Joints between metal frames and other materials
      d. Other exterior joints for which no other sealant is indicated.

C. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.
   1. Applications: Use for:
      a. Concealed sealant bead in sheet metal work
      b. Concealed sealant bead in siding overlaps

D. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C 834, Type OP, Grade NF, single component, paintable.
   1. Color: color as selected
   2. Applications: Use for:
      a. Interior wall and ceiling control joints.
      b. Joints between door and window frames and wall surfaces
      c. Other interior joints for which no other type of sealant is indicated

E. Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C 920, Class 25, Uses T, I, M and A; single component.
   1. Color: Gray.

2. Applications: Use for
   a. Joints in sidewalks and vehicular paving.

2.3 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.1 EXAMINIATION

A. Verify that substrate surfaces and joint openings are ready to receive work

B. Verify that joint backing and release tapes are compatible with sealant.

3.2 PREPARATION

A. Remove loose materials and foreign matter which might impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C 1193

D. Protect elements surrounding the work of this section from damage or disfigurement

3.3 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C 1193.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

D. Install bond breaker where joint backing is not used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

G. Tool joints concave

3.4 CLEANING

A. Clean adjacent soiled surfaces

3.5 PROTECTION OF FIISHED WORK

A. Protect sealants until cured.

END OF SECTION 079220

SECTION 081100 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. "Hollow Metal" (HM) steel doors and frames to be painted.
2. "Pre-Finished Knock-Down" (PFKD) steel frames.

1.2 SUBMITTALS

A. Product Data: For each product indicated. Include door designation, type, level and model, material description, label compliance, fire-resistance ratings, and finishes.

B. Door Schedule. Use same reference designations indicated on Drawings.

1.3 QUALITY ASSURANCE

A. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Amweld Building Products, Inc.
2. Ceco Door Products; a United Dominion Company.
3. Steelcraft; a division of Ingersoll-Rand.
4. Timely Industries.

2.2 MATERIALS

A. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.

B. Metallic-Coated Steel Sheets: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with an A40 zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.

C. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher-leveled standard of flatness where used for face sheets.

2.3 "HOLLOW METAL" (HM) DOORS

A. Interior Doors: Complying with ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level indicated.

1. Level 2 and Physical Performance Level B, Model 1 (Full Flush).

B. Exterior Doors: Complying with ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level indicated.

1. Level 2 and Physical Performance Level B, Model 1 (Full Flush).

2.4 "HOLLOW METAL" (HM) FRAMES

A. General: ANSI A250.8; conceal fastenings, unless otherwise indicated.

B. Frame Steel Sheet Thickness:

1. 0.053-inch- unless otherwise indicated.

C. Door Silencers: Three silencers on single-door frames and two silencers on double-door frames.

D. Plaster Guards: 0.016-inch- thick, steel sheet plaster guards or mortar boxes to close off interior of openings.

E. Supports and Anchors: Not less than 0.042-inch- thick zinc-coated steel sheet.

1. Masonry Wall Anchors: 0.177-inch- diameter, steel wire complying with ASTM A 510 may be used in place of steel sheet.

F. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Zinc-coat items that are to be built into exterior walls according to ASTM A 153/A 153M, Class C or D as applicable.

2.5 "PRE-FINISHED KNOCK-DOWN" (PFKD) FRAMES

A. Frame Steel Sheet Thickness:

1. 0.042-inch- unless otherwise indicated.

B. Casing Steel Sheet Thickness:

1. 0.026-inch- unless otherwise indicated.

C. Supports and Anchors: Manufacturer’s standard.

2.6 FABRICATION

A. General: Fabricate steel door and frame units to comply with ANSI A250.8 free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant.

B. Exterior Doors: Fabricate doors, panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch- thick, metallic-coated steel channels with channel webs placed even with top and bottom edges.

C. Interior Door Faces: Fabricate exposed faces of doors and panels, including stiles and rails of non-flush units, from cold-rolled steel sheet.

D. Core Construction: Manufacturer's standard core construction that produces a door complying with SDI standards.

E. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch at jambs and heads, except not more than 1/4 inch between pairs of doors. Not more than 3/4 inch at bottom.

F. Clearances for Fire-Rated Doors: As required by NFPA 80.

G. Door-Edge Profile: Manufacturer’s standard.

H. Tolerances: Comply with SDI 117.

I. Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.

J. “Hollow Metal” (HM) Frame Construction:

1. Fabricate frames with mitered or coped and continuously welded corners and seamless face joints. Provide temporary spreader bars.
2. Provide terminated stops where indicated.

K. “Pre-Finished Knock-Down” (PFKD) Construction:

1. Roll form or break frames to standard shapes as shown on drawings.
2. Prepare frames for heat-treated, zinc-plated casing retainer clips. Clips mechanically fastened for secure, properly aligned installation of casing.
3. Provide holes on perimeter of frame for insertion of fasteners.
4. Provide oval alignment slots to allow for insertion of screwdriver to adjust frame.
5. All frames to have 14 gauge hinge-reinforcement plates with extruded tapped holes, for a minimum of 3/16" thread penetration depth.

6. Frames shall be lanced on the face of the frame for application of snap-on-casing.

L. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

M. Locate hardware as indicated or, if not indicated, according to ANSI A250.8.

N. Glazing Stops: Manufacturer's standard, formed from 0.032-inch- thick steel sheet.

1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
2. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.

O. Door Louvers: Provide where indicated in the door schedule.

1. Provide sight-proof stationary louvers for interior doors where indicated, constructed of inverted V-shaped or Y-shaped blades formed of 24-gage cold-rolled steel set into 20-gage steel frame.

P. Astragals: As required by NFPA 80 to provide fire ratings indicated.

2.7 FINISHES

A. “Hollow Metal” (HM) Frames:

1. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

B. “Pre-Finished Knock-Down” (PFKD) Frames:

C. Frame finish shall be electrostatically baked on enamel on a cleaned and phosphate treated surface with paint film thickness approximately 1.0 mil.

1. Color: To be selected from manufacturer’s standard colors.
2. Provide aerosol touch-up paint for after installation, on-site repair as recommended by manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Placing “Hollow Metal” (HM) Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

1. Wall Anchors: Provide at least three anchors per jamb. For openings 90 inches or more in height, install an additional anchor at hinge and strike jambs.
2. Gypsum Board Partitions: For in-place partitions, install knock-down, drywall slip-on frames.
3. Fire-Rated Frames: Install according to NFPA 80.

B. Placing “Pre-Finished Knock-Down” (PFKD) Frames:

1. Verify opening dimensions with the plans and shop drawings.
2. Install frames plumb and square using the door as a template to assure perfect alignment of the door and frame.
3. Secure the frame to the wall per manufacturer's specifications.
4. Repair or replace all damaged or defective frames prior to job close-out or final inspection.

C. Door Installation: Comply with ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.

1. Fire-Rated Doors: Install within clearances specified in NFPA 80.
2. Smoke Control Doors: Install to comply with NFPA 105.

D. After installation, remove protective wrappings from doors and frames and touch up prime coat with compatible air-drying primer.

END OF SECTION 081100

SECTION 083313-COILING COUNTER DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Overhead Coiling Counter Doors, manually operated

1.2 REFERENCES

A. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM A 666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

C. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

D. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.

B. Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.

1.4 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Details of construction and fabrication.
4. Installation methods.

1.5 CORRDINATION

A. Coordinate Work with other operations and installation of adjacent finish materials to avoid damage to installed materials.

1.6 WARRANTY

A. Warranty: Manufacturer's limited door warranty for 2 years for all parts and components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis for design: Overhead Door Corp., 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Fax: (972)906-1499. Web Site: www.overheaddoor.com.

B. Substitutions: Equal as approved by Architect.

2.2 OVERHEAD COILING STEEL COUNTER DOORS

A. Anodized Aluminum Counter Doors: Overhead Door Corporation 652 Series.
1. Wall Mounting Condition: Between jambs mounting

B. Curtain: Interlocking slats, Type F-158 fabricated of anodized aluminum. Endlocks attached to alternate slats to maintain curtain alignment and prevent lateral slat movement.
1. Anodized Finish: Dark Bronze Anodized

C. Bottom Bar: Extruded aluminum tubular shape with astragal.

D. Guides: Extruded aluminum.
1. Finish: PowderGuard Weathered finish with iron/black powder.

E. Brackets: Steel plate to support counterbalance, curtain and hood.

F. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel.

G. Hood: Provided with intermediate support brackets as required and fabricated of:
1. Aluminum.

H. Operation:
1. Manual push up.

I. Locking:
1. Slide bolt locks suitable for use with padlock

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify opening sizes, tolerances and conditions are acceptable

B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07900.

F. Install perimeter trim and closures.

3.3 ADJUSTING

A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.

B. Adjust hardware and operating assemblies for smooth and noiseless operation.

END OF SECTION 083313

SECTION 083323-OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Overhead Coiling Service Doors

1.2 REFERENCES

A. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM A 666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

C. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

D. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

F. NEMA MG 1 - Motors and Generators.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.

B. Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.

1.4 DESIGN/PERFORMANCE REQUIREMENTS

A. Overhead coiling service doors:
1. Wind Loads: Design door assembly to withstand wind/suction load of 20 psf (958 Pa) without damage to door or assembly components.
2. Operation: Design door assembly, including operator, to operate for not less than 20,000 cycles.

B. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.5 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Details of construction and fabrication.
4. Installation methods.

1.6 CORRDINATION

A. Coordinate Work with other operations and installation of adjacent finish materials to avoid damage to installed materials.

1.7 WARRANTY

A. Warranty: Manufacturer’s limited door and operator system, except the counterbalance spring and finish, to be free from defects in materials and workmanship for 3 years or 20,000 cycles, whichever occurs first.

B. Warranty: Manufacturer’s limited door warranty for 2 years for all parts and components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis for design: Overhead Door Corp., 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Fax: (972)906-1499. Web Site: www.overheaddoor.com.

B. Substitutions: Equal as approved by Architect.

2.2 OVERHEAD COILING SERVICE DOORS

A. Light Commercial Doors: Overhead Door Corporation, 600 Series Coil-Away Service Doors.
1. Curtain: Interlocking roll-formed galvanized steel slats, flat crown profile type CAW, 26 gauge for widths up to 12 feet 4 inches (3.75 m), 24 gauge for widths up to 16 feet (4.88

m). End of each slat shall be locked from lateral movement by a staking lock system. (Galvanized alternate malleable end locks.)

2. Finish:
   a. Curtain slats and hood shall be galvanized in accordance with ASTM A 653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester top coat.
      1) Powder coat: PowderGuard
         a) PowderGuard Premium: Weather resistant polyester powder coat color as selected by the Architect.
      2) Non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.
3. Weatherseals: Vinyl bottom seal.
4. Bottom Bar: Extruded aluminum
5. Guides: Roll-formed galvanized steel shapes attached to continuous galvanized steel wall angle.
   a. Finish: PowderGuard Weathered finish with iron/black powder
6. Brackets: Galvanized steel to support counterbalance and curtain.
7. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel and supporting the curtain with deflection limited to 0.03 inch per foot of span. Spring tension shall be adjustable.
8. Hood: 24 gauge galvanized steel with intermediate supports as required.
9. Electric Motor Operation: Provide UL listed electric operator, size as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second.
   a. Sensing Edge Protection
   b. Operator Controls:
      1) Push-button operated control stations with open, close, and stop buttons.
      2) Controls for interior location.
      3) Controls surface mounted.
   c. Motor Voltage: 115/230 single phase, 60 Hz.
   d. Locking:
      1) Interior slide bolt lock for electric operation.
   e. Wall Mounting Condition: Face-of-wall.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify opening sizes, tolerances and conditions are acceptable

B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Coordinate installation of electrical service with Section 16150. Complete wiring from disconnect to unit components.

F. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07900.

G. Install perimeter trim and closures.

H. Instruct Owner’s personnel in proper operating procedures and maintenance schedule.

3.3 ADJUSTING

A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.

B. Adjust hardware and operating assemblies for smooth and noiseless operation.

END OF SECTION 083323

SECTION 084113 – ALUMINUM FRAMED STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior storefront systems.

1.2 PERFORMANCE REQUIREMENTS

A. Provide systems, including anchorage, capable of withstanding loads and thermal and structural movements indicated without failure when supporting full dead loads and without framing members transferring stresses to glazing.

B. Structural Loads:

1. Wind Load: As indicated on Drawings.
2. Seismic Load: As indicated on Drawings.

C. Structural Performance: Provide systems, including anchorage, capable of withstanding loads indicated.

1. Deflection Normal to Glazing Plane: Limited to 1/175 of clear span or 3/4 inch, whichever is smaller.
2. Deflection Parallel to Glazing Plane: When carrying full dead load, not to exceed amount that reduces glazing bite below 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

D. Structural Testing: ASTM E 330 at 150 percent of inward and outward wind-load design pressures for duration required by design wind velocity without system evidencing material failures, structural distress, deflection failures, or permanent deformation of main framing members exceeding 0.2 percent of clear span.

E. Air Infiltration: Limited to 0.06 cfm/sq. ft. of system surface area when tested according to ASTM E 283 at a static-air-pressure difference of 6.24 lbf/sq. ft..

F. Water Penetration: No water leakage when tested according to ASTM E 331 at minimum differential pressure of 20 percent of inward acting wind-load design pressure but not less than 6.24 lbf/sq. ft..

G. Temperature Change (Range): Accommodate 120 deg F ambient and 180 deg F material surfaces.

H. Condensation Resistance Factor (CRF): Not less than 45 per AAMA 1503.1.

I. Average Thermal Conductance (U-Value): Not more than 0.63 Btu/sq. ft. x h x deg F per AAMA 1503.1.

1.3 SUBMITTALS

A. Product Data: For each system indicated.

B. Shop Drawings: Include plans, elevations, sections, details of installation and attachments to other Work.

1. Prepare data based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

C. Samples: For each exposed finish and for each color required.

D. Product test reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of providing aluminum framed storefront system that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.

C. Source Limitations: Obtain aluminum-framed storefront system through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum-framed storefront system and are based on the specific system indicated. Refer to Division 01 Section “Product Requirements”. Do not modify size and dimensional 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.

1.5 WARRANTY

A. Manufacturer’s Warranty: Submit, for Owner’s acceptance, manufacturer’s standard warranty.
1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for systems is based on the following:

1. Kawneer Company, Inc.'s "Trifab 601T Framing System"

a. 2" x 6" nominal dimension
b. Thermally broken framing components
c. Center Glazed

B. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Arch Amarlite.
2. Vistawall Architectural Products.
3. EFCO Corporation.
4. International Aluminum Corporation; U.S. Aluminum.
5. Tubelite Architectural Systems.
6. Architect approved equivalent.

2.2 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" (1.8 mm) wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.

B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum members, trim hardware, anchors, and other components.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

E. Sealant: For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

F. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

2.3 COMPONENTS

A. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposes shall be stainless steel.

C. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Division 08 Section “Glazing”.

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:
   1. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.
   2. Color: Matching structural sealant.

2.5 FABRICATION

A. 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 fit joints; make joints flush, hairline and weatherproof.
   3. Means to drain water passing joints, condensation 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.
   7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

B. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

C. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

D. Storefront Framing: Fabricate components for assembly using manufacturer's standard installation instructions.

E. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.6 ALUMINUM FINISHES

A. Dark Bronze Anodized Finish

PART 3 - EXECUTION

3.1 EXAMINIATION

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 work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather tight framed aluminum-storefront system installation.
   1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
   2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
   3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
   4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum-framed storefront system, accessories, and other components.

B. Install aluminum-framed storefront system level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.

D. Install aluminum-framed storefront system and components to drain condensation, water penetrating joints, and moisture migrating within aluminum-framed storefront system to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum-framed storefront system, accessories, and other components.

B. Install aluminum-framed storefront system level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.

D. Install aluminum-framed storefront system and components to drain condensation, water penetrating joints, and moisture migrating within aluminum-framed storefront system to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.4 ADJUSTING, CLEANING AND PROTECTION

A. Clean aluminum surfaces immediately after installing aluminum-framed storefronts. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 084113

SECTION 084327-TRANSLUCENT EXTERIOR CHANNEL GLASS WALL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes glazing for the following products and applications:
   1. Translucent exterior linear glass units.
   2. Framing
   3. Glazing accessories

1.2 REFERENCES

A. A.Comply with applicable provisions of the following curtain wall test criteria for design, materials, fabrication, and installation of component parts:
   1. ASTM E 330-84, ASTM E 331-86, ASTM E 283-91, AAMA 501.1, AAMA 501.4-00, ANSI Z97.1-84, 16 CFR 1201 category II, AAMA 1503-98, ASTM E 90, ASTM E 413, ASTM E 1332, DIN EN 572.1, DIN EN 572.7. (Visual characteristics for all U-profile glass in accordance with glass manufacturer's product definition. Dimensional standards for tempered glass per manufacturer's product definition.)

1.3 DEFINITIONS

A. Translucent Linear Glass: Translucent, channel shaped linear glass unit. Size and pattern as indicated on drawings.

B. Basic System: Thermally broken aluminum frame with double [single] glazed, translucent, vertical [horizontal] linear glass with 2-3/8 inch (60mm) deep channel flange.

1.4 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Glazing Contractor: Responsible for conforming the system [units], to the architectural plans, including anchorage to structural system and necessary modifications to meet specified requirements and maintain visual design concepts.
   2. Drawings: Shop drawings will show the complete assembly installed as described under this section, fully identify all fasteners, shims, gaskets, sealants and hardware required for the complete system installation and be stamped by an engineer licensed in the state where the project is located. Dimensions of all components, alloys, tempers, and finishes will be clearly identified. Provide engineering calculations for all conditions required by the project.
   3. Provide concealed fastening wherever possible.
   4. Attachment Considerations: Accommodate project design concepts and provide for building movement anticipated from all possible causes. Provide for expansion and

contraction in all components to eliminate the possibility of loosening, warping, buckling or bulging of all components.

B. Glass Requirements
1. 1. Glass: ASTM C 1036, Type 2, Class 1, Quality q3 finish F1, cast or rolled glass, channel shape, surface texture as selected by architect.
a. Tempered Glass
1) Where required by wind loads or safety considerations glass to be SGCC certified to ANSI Z 97.1-09 and CPSC Title 16 Part 1201 (16 CFR 1201, category II) for unlimited size. Safety film shall not be used to satisfy safety glazing requirements, except in longitudinally cut pieces which cannot be tempered. [Architect or Engineer to select approved safety film.].
2) Tempered glass to be 100% heat soak tested in accordance with DIN EU 14179-1 (approximately 8 ½ hour treatment).
b. Annealed Glass: In accordance with ANSI Z97.1-84 and 16 CFR 1201 category II.
1) Basic system with safety film: No free passage at 18-inch impact drop (in accordance with ANSI Z97.1-84 single glazed procedures).
2) Basic system with safety film: No free passage at 48-inch impact drop (in accordance with 16 CFR 1201 category II single glazed procedures).
c. Wire Glass: Shall not be considered a safety glass.

C. Interface with Adjacent Systems:
1. Integrate design and connections with adjacent construction.

D. Bird Collision Avoidance:
1. Glass should be recognized as bird-friendly by industry accepted standards or testing bodies such the American Bird Conservancy (ABC) or similar independent agency.

1.5 SUBMITTALS

A. Product Data: Submit following:
1. Product data for translucent linear glass units, framing system, and glazing accessories.

B. Shop Drawings:
1. Submit plan view, elevation details, connection details, and installation details including interface with adjacent construction.
2. Drawings will identify all gaskets, tapes, sealants, fasteners, shims, hardware and accessories used to install the system. They will clearly identify adjacent materials completely and label these materials as “by others”. The drawings will show all dimensions for sealant joints, maximum allowable offset for adjacent components, overall facade alignment tolerance, and maximum allowable deviation of supporting construction from the dimensions shown on the architectural drawings, maximum shim space at anchors etc. [Stamped with seal and signature by registered professional engineer licensed in the jurisdiction where the project is located with a minimum of five (5) years’ experience in the design of curtain wall systems.]

C. Samples:
1. Glass: Submit three 8 inch (200mm) lengths by full panel width of standard production material. Note: Cast glass can vary slightly in color,

2. Frame: one 8 inch (200mm) section of each frame element.
3. Components: submit samples of all glazing accessories (tapes, shims, gaskets, sealants, screws, etc.).

D. Informational Submittals: Submit following packaged separately from other submittals:
1. Test reports: Submit following:
a. Certified test reports showing compliance with specified design requirements.
2. Manufacturer’s fabrication and installation instructions.

1.6 QUALITY ASSURANCE

A. Single Source Responsibility: Manufacturer shall be responsible for all components it supplies for the basic system.

B. Manufacturer’s authorized representative shall make visits as required to validate warranty.

C. Welder Qualifications: AWS certified within past 12 months for each type of weld required.

D. Certifications:
1. Certificates verifying AWS qualifications for each welder employed on Project.

1.7 DELIVERY, STORAGE AND HANDLING

A. General: Store on a level surface, above ground, in a watertight enclosed space fully ventilated and protected from damage and in accordance with manufacturer’s recommendations.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form, made out to Owner and signed by manufacturer, in which manufacturer agrees to furnish replacements for units that deteriorate from normal use by developing defects attributable to the manufacturing process, f.o.b. the nearest shipping point to Project site, within warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Basis-of-Design Product: The design is based on Bendheim Frame System SF60 with Lamberts LINIT channel glass; Bendheim Wall Systems Inc. 61 Willet St, Passaic, NJ 07055, 800-221-7379, email – linit@bendheim.com; www.bendheimwall.com.
1. Acceptable Alternates: As approved by Architect

B. Glass products of other manufactures matching the aesthetics, performance, and certifications of the above listed specified products will be considered for approval if submitted as part of the bid

proposal and accompanied by samples, performance data, certifications and written statement that the manufacturer will conform to all requirements of these Specifications.

2.2 MATERIALS

A. Glass: ASTM C 1036, Type 2, Class 1, Quality q3 finish F1, cast or rolled glass, channel shape, surface texture as selected by architect, country of origin to be Germany.
   1. Color: To be selected from manufacturer's standard colors
      a. Untreated and uncoated low iron glass should have a minimum 90% visible light transmission when measured as a single channel and a maximum of Fe2 O3 (iron oxide) content of 0.0140 verified by test reports.

2.3 COMPONENTS

A. Translucent Linear Glass Units:
   1. Lamberts LINIT channel glass (P23/60/7), (P26/60/7) (P33/60/7)
   2. Surface Texture of glass to be Solar.
   3. Annealed glass shall be provided cut to size in accordance with EN 572.7.

B. Framing:
   1. Aluminum: Extruded units per the profiles shown or as required to suit conditions indicated.
      a. Minimum wall thickness of 0.125 inch (3.18mm) for framing members and rails, 0.090inch (2.3 mm) for sheets.

2.4 ACCESSORIES

A. Anchorage Devices: Standard fabricated steel or aluminum assemblies of shapes, plates, bars or tubes.
   1. Hot-dip galvanized steel assemblies after fabrication, ASTM A123, 2.0 ounce (0.05kg) minimum coating.

B. Fasteners: Non-magnetic stainless steel or other Engineer approved non-corrosive materials compatible with items being fastened.
   1. Provide concealed fasteners wherever possible.
   2. Exposed locations: Stainless steel screws with approved finish.
   3. Concealed locations: Stainless steel or approved fasteners in accordance with approved engineering calculations.

C. Expansion/Chemical Anchor Devices: Lead-shield or toothed-steel, drilled-in, expansion bolt, or chemical/epoxy set anchors.

D. Protective Coatings: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 30 mil (0.76 mm) thickness for each coat; or alkyd type zinc chromate primer, FS TT-P-645.

E. Perimeter Joint Sealant and Backer Rod: Silicone-Glazing.
   1. Color: translucent [or manufacturer's color selected by Architect]

2. Primer: As required by sealant manufacturer for applications shown.
3. Sealant Backing, Bond Breaker Rod and Tape: Closed cell unless otherwise required by sealant manufacturer. Translucent backer rod to be used if requested by the architect.
4. Acceptable Manufacturers:
   a. Silicones: Dow Corning, General Electric, Tremco.
   b. Acrylic seam sealant: Schnee Morehead.
   c. Translucent backer rod – supplied by Bendheim.

2.5 FABRICATION

A. Coordination of Fabrication: Check all field conditions for acceptable conformance to architect's drawings.

B. General:
1. Install framing in lengths as long as possible. Allow for thermal movement as required by project engineer.
2. Conceal fasteners wherever possible.
3. Install system so that all glazing pockets weep to the exterior of the building.
4. Isolate dissimilar metals and aluminum in contact with concrete utilizing protective coating or pre-formed separators which will prevent contact and corrosion.

C. Aluminum Framing: Provide members of size, shape and profile indicated, designed to provide for glazing from exterior or interior, fabricated and assembled in accordance with manufacturer's fabrication and installation manual.
1. Provide manufacturer's standard Azo-braded thermal isolation within aluminum extrusions.
2. Fabricate frame assemblies with mitered or coped joints.
3. Maintain accurate relation of planes and angles.
4. Provide end dams at all vertical interruptions of horizontal extrusions.
5. Fabricate framing for expansion and contraction to accommodate a thermal variation of [180] degrees Fahrenheit.
6. Make provisions in framing for minimum edge clearance, nominal edge cover and nominal pocket width for thickness and type of glazing or in-fill used in accordance with requirements of manufacturer's fabrication and installation manual and GANA Glazing Manual.

D. Welding: Comply with recommendations of American Welding Society (AWS).
1. Use recommended electrodes and methods to avoid distortion and discoloration.
2. Grind exposed welds smooth and flush with adjacent surfaces; restore material finish.

2.6 FINISHES

A. Fluorocarbon Coating: AAMA 2604 [2605].
1. Resin: 70 percent polyvinylidene fluoride (PVF2).
2. Substrate: Cleaned and pre-treated.
3. Primer: Manufacturer's standard epoxy or acrylic coating, dry film thickness:
   a. Extrusion: Minimum 0.20 mil (0.005 mm).
4. Color coat: PVDF, Dry film thickness:

a. Extrusion: Minimum 0.80 mil (0.020 mm).
5. Clear top coat (three coat finish only): Dry film thickness
a. Extrusion: Minimum 0.40 mil (0.010 mm)
6. Color: Duranar by PPG. Manufacturer's standard color [Arcadia Silver UC70123F] as selected by architect. [Custom color as selected by architect.]
7. Acceptable Coatings Manufacturers:
a. Akzo Coatings, Inc., Columbus, OH.
b. Lilly Industries Inc., Indianapolis, IN.
c. Morton International, Inc., Chicago, IL.
d. PPG Industries Inc., Delaware, OH and Springdale, PA.
e. Valspar Corporation, Garland, TX.
8. Application: Specified coatings applied to visible surfaces.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Architect approved with a minimum of (5) years experience in the installation of curtain wall systems.

3.2 EXAMINIATION

A. Site Verification of Conditions: Do not commence work until field conditions conform adequately to architectural drawings.

3.3 INSTALLATION

A. Install units in accordance with drawings, specifications, and approved Shop Drawings, plumb, level, square, and free from warp or twist while maintaining dimensional tolerances and alignment with surrounding construction.

B. Erect framing, vinyl spacer, and glass in accordance with manufacturer's printed installation instructions. Clean glass immediately before installing. Protect or seal all installed glass units daily on both sides of glass, between frame and glass, and between linear glass units to prevent infiltration of airborne debris.

C. Perimeter Joint Sealant: Insure compatibility of joint components and adhesion of perimeter joint sealant to surfaces that receive sealant.

D. Erection Tolerances – Framing Members:
1. Limit variations of jambs from plumb and horizontal frame members from level:
a. 1/8 inch in 12 feet (3 mm in 3000 mm) vertically.
b. 1/8 inch in 20 feet (3 mm in 6000 mm) horizontally.

2. Limit variations from Theoretical Locations: 1/4 inch (6 mm) for any member at any location.
3. Limit Offsets in End-To-End and Edge-To-Edge Alignment: 1/32 inch (0.8 mm) maximum out of plane offset for horizontal and vertical glazing legs of framing members designed to be in the same plane.

3.4 FIELD QUALITY CONTROL

A. Employ manufacturer's representative as necessary to insure proper installation and to verify work is done in accordance with manufacturer's requirements.

3.5 CLEANING

A. Clean as recommended by manufacturer. Do not use materials or methods which may damage system components or surrounding construction.

3.6 PROTECTION

A. Protect finished surfaces from damage.

END OF SECTION 084327

SECTION 085113 – ALUMINUM FRAMED WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior aluminum windows

1.2 PERFORMANCE REQUIREMENTS

A. Provide systems, including anchorage, capable of withstanding loads and thermal and structural movements indicated without failure when supporting full dead loads and without framing members transferring stresses to glazing.

B. Air Infiltration: The test specimen shall be tested in accordance with ASTM E283 at a minimum size of 60" x 90" (1524 x 2286). Air infiltration rate shall not exceed 0.10 cfm/ft2 at a static air pressure differential of 6.24 psf (300 Pa). The test specimen shall meet the Fixed rating of less than 0.25 (m3/h)/m at 300Pa when tested in accordance with CAN/CSA-A440-00 Windows.

C. Water Resistance: The test specimen shall be tested in accordance with ASTM E547 and ASTM E331 at a minimum size of 60" x 90" (1524 x 2286). There shall be no leakage as defined in the test method at a static air pressure differential of 10 psf (500 Pa). The test specimen shall meet the B5 rating with no water leakage at 500 Pa when tested in accordance with CAN/CSA-A440-00 Windows.

D. Uniform Load Deflection: A minimum static air pressure difference of 80 psf (3840 Pa) shall be applied in the positive and negative direction in accordance with ASTM E330. There shall be no deflection in excess of L/175 of the span of any framing member. The test specimen shall meet the C5 rating when tested in accordance with CAN/CSA-A440-00 Windows.

E. Uniform Load Structural: A minimum static air pressure difference of 60 psf (2874 Pa) shall be applied in the positive and negative direction in accordance with ASTM E330. The unit shall be evaluated after each load.

F. Component Testing: Window components shall be tested in accordance with procedures described in AAMA/WDMA/CSA 101/I.S.2/A440-05.

G. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than .34 BTU/hr/ft2/°F.

H. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than (72 frame) and (74 glass), or Condensation Index (I): when tested to CSA-A440-00, the Condensation Index shall not be less than (62 frame) and (66 glass.

1.3 SUBMITTALS

A. Product Data: For each system indicated.

B. Shop Drawings: Include plans, elevations, sections, details of installation and attachments to other Work.

1. Prepare data based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

C. Samples: For each exposed finish and for each color required.

D. Product test reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An installer which has had successful experiences with installation of the same or similar units required for this project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace systems that fail in materials and workmanship within two years from date of Substantial Completion. Failure includes, but is not limited to the following:

1. Structural failures including, but not limited to, excessive deflection.
2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
3. Failure of operating components to function normally.
4. Water leakage through fixed glazing and frame areas.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for systems is based on the following:

1. Kawneer Company, Inc.'s "Series 5500 Thermal Windows"

a. 2" x 4" nominal dimension
b. Thermally broken framing components
c. Center Glazed

B. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Arch Amarlite.
2. Vistawall Architectural Products.
3. EFCO Corporation.
4. International Aluminum Corporation; U.S. Aluminum.
5. Tubelite Architectural Systems.
6. Architect approved equivalent.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" (1.8) wall thickness at any location for the main frame and sash members.

B. Glazing: Specified in Division 8 Section "Glazing."

C. Glazing Gaskets: Pressure-glazing system of black, resilient glazing gaskets with sealed corners, setting blocks, and shims or spacers.

D. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.

E. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

F. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

2.3 FABRICATION

A. Fabricate framing in profiles indicated for flush glazing (without projecting stops). Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete system.

B. Window framing shall be designed for screw spline corner construction. Operating sash extrusions shall be tubular with mitred, clip, adhesive, stake joint construction. All framing joints shall be sealed to provide neat weathertight connections.

C. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

D. Fabricate aluminum windows that are re-glazable without dismantling sash or framing.

E. Glazing Stops: Provide snap-on glazing stops coordinated with Division 08 Section “Glazing” and glazing system indicated. Provide glazing stops to match frame.

2.4 ALUMINUM FINISHES

A. Dark Bronze Anodized Finish

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install aluminum framed window system level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

B. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.

C. Install aluminum framed window system and components to drain condensation, water penetrating joints, and moisture migrating within system to the exterior.

D. Separate aluminum from dissimilar materials to prevent corrosion or electrolytic action at points of contact.

3.2 ADJUSTING, CLEANING AND PROTECTION

A. Adjust operating sashes, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weather tight closure. Lubricate hardware and moving parts.

B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

C. Clean glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

E. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 085113

SECTION 085200-WOOD WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Outswing, aluminum clad wood, Folding Windows with 3 inch (76mm) stiles complete with hardware, glazing, weatherstripping, and standard or specified anchorages, trim, attachments, and accessories.

1.2 REFRENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM E283-04’ - Standard Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors.
   2. ASTM E330-02’ - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
   3. ASTM E547-00’ - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.
   4. ASTM E1425-07’ or AAMA 1801-97 - Certification of Acoustical Performance.
   5. ASTM F588-07’ (Windows).
   6. ASTM E 1996-04’ - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Windborne Debris in Hurricanes.
   7. ASTM E 1886-04’ - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.
   8. ASTM E2190-08’ - Standard Specification for Insulating Glass Unit Performance and Evaluation.

B. American Architectural Manufacturers Association/Window and Door Manufacturers Association (AAMA/WDMA), American National Standards Institute/Window and Door Manufacturers Association (ANSI/WDMA), Canadian Standards Association (CSA).
   1. AAMA/WDMA/CSA 101/I.S.2/A440-05’, 101/I.S.2/A440-08’ - Standard / Specification for Windows, Doors and Skylights.
   2. WDMA I.S. 4-07’A Water Repellant Preservative Treatment for Millwork.

C. National Fenestration Rating Council (NFRC)
   1. NFRC 100-2004’ & 2010’ - Determining Fenestration U-Factor.
   2. NFRC 100-2004’ & 2010’ - Test Procedure for Thermal Transmittance of Fenestration.
   3. NFRC 200-2004’ & 2010’ Determining Fenestration SHGC & Tv.
   4. ASTM E1423-06’ - Determining Thermal Transmittance of Fenestration Systems.
   5. NFRC 500-2010’ - Determining Fenestration Product Condensation Resistance.

D. WDMA Hallmark Program
   1. WDMA Hallmark Program Procedural Guide C.S.-1.

E. E. Consumer Product Safety Commission (CPSC)

1. CPSC 16 CFR 1201 - Safety Glazing Standards.
2. ANSI Z-97.1 - Safety Glazing Standards for Tempered Glass.

1.3 SYSTEM DESCRIPTION

A. Design and Performance Requirements
   1. Applications of windows include:
   2. Light commercial application
   3. Air, water, structural, and forced entry resistance shall be at levels which meet the specified design pressure as per AAMA/WDMA/CSA 101/I.S.2/A440-05', 101/I.S.2/A440-08'.
   4. Unique, non-listed unit's performance, when not tested, may be addressed by a manufacturer's Statement of Qualification.

B. Index (I): when tested to CSA-A440-00, the Condensation Index shall not be less than 62 frame and 66 glass.

1.4 SUBMITTALS

A. Product Data: For each system indicated.

B. Shop Drawings: Include plans, elevations, sections, details of installation and attachments to other Work.

   1. Prepare data based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

C. Samples: For each exposed finish and for each color required.

1.5 QUALITY ASSURANCE

A. Insulating Glass – two certification programs: IGCC and IGMAC. Possible IGMA Certification (harmonized IGMAC & SIGMA).

B. NFRC Certification Program for Energy Rating of Fenestration.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver in original packaging, store in an upright position off the ground in a clean, dry area. Protect from weather and construction activities.

B. Prime or seal wood surfaces, including surfaces to be concealed by wall construction if more than 30 days will expire between delivery and installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for systems is based on the following:
   1. Description: Outswing folding windows are factory assembled, as manufactured by Kolbe & Kolbe Millwork Co., Inc., Wausau, Wisconsin.
   2. Substitutions: Equal as approved by Architect

2.2 MATERIALS

A. Frame: Constructed of kiln-dried pine, with pine interior stops, water repellent, preservative treated in accordance with WDMA I.S. 4-07'A. VistaLuxe assembled frames have factory installed heavy vinyl nailing fins at head and side jambs. Nailing fin at head has integral drip cap.
   1. Frames ship setup, or assembled, as standard. Frames in excess of 177 inches (4496mm) by 106 inches (2692mm) will ship knocked down.
   2. Jamb Thickness: Two piece assembled frame is 1-1/16 inch (27mm) thick at side jambs with a 1/2 inch (13mm) rabbeted-in interior stop for a total of 1-9/16 inch (40mm). Frame at head jamb is 3-25/32 inch (96mm).
   3. Basic jamb width: Standard is 6-9/16 inch (167mm).
   4. Sill thickness: 2-7/16 inch (62mm).
   5. Sill: Standard weep sill with bumper is made of Bronze anodized 1/8 inch (3.2mm) thick 6063 extruded aluminum alloy with a thick oak interior threshold
   6. Exterior: All frame parts are .050 inch (1.3mm) thick 6063 extruded aluminum alloy with accessory grooves, press fit onto the wood frame.
   7. Corner Construction: Mitered corners use internal corner key and sealer.

B. Panels: Window panels are constructed of kiln dried pine, water repellent, preservative treated in accordance with WDMA I.S. 4-07'A.
   1. Thickness: 1-3/4 inch (44mm).
   2. Top Rails: Standard 3 inch (76mm).
   3. Stiles: All locking stiles are constructed of laminated veneer lumber (LVL) with solid wood edge banding. Standard stile dimension is 3 inch (76mm)
   4. Bottom Rail: Standard 5 inch (127mm).
   5. Exterior: Panel parts on windows are completely covered by a .063 inch (1.6mm) thick 6063 extruded aluminum alloy with all corners coped and sealed.
   6. Corner Construction: Joined by wood dowels and glue.
   7. Interior glazed.

C. Surface Finish:
   1. Exterior Finish – Anodized Aluminum: Dark Bronze
   2. Interior Finish – Paint: to be selected from manufacturer's standard colors

D. Hardware:
   1. Access Panel Lock Options: Active handle along with interior and exterior escutcheon plates for access panel, or access door, made of solid brass. Gasket is made of Black Neoprene. All handles are shipped loose for field installation.
      a. 3-Point Multi-Point Lock – Center gear is made of solid Brass. Color Option: Stainless Steel.
         1) Standard handle set

2. Standard Folding Panel Lock Option.

E. Weatherstripping: Frame and panels are to be fully weatherstripped for tight seal.

2.3 GLAZING

A. Glass:
1. Standard Double Pane one lite IG is 7/8 inch (23mm) with LoE2-270, argon filled.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of conditions: Before installation, verify that openings are plumb and square and of proper dimension. Report frame defects or unsuitable conditions to the General Contractor before proceeding.

B. Acceptance: Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

A. Install windows according to manufacturer’s installation instructions.

B. Install sealant and related flashing materials at perimeter of assembly in accordance with Section 07900 Joint Sealers or 07 92 00 – Joint Sealants.

C. Install accessory items as required.

3.3 ADJUSTING, CLEANING AND PROTECTION

A. Adjust operable sash to work freely with hardware functioning properly. Re-adjust at completion of the project if directed.

B. Remove visible labels

C. Leave windows in a job clean condition.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 085200

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Mechanical door hardware for the following:

    a. Swinging doors.
    b. Sliding doors.
    c. Folding doors.

2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware.

B. Related Sections:

1. Section 081113 "Hollow Metal Doors and Frames" for door silencers provided as part of hollow-metal frames.
2. Section 081216 "Aluminum Frames" for door silencers provided as part of aluminum frames.
3. Section 081416 "Flush Wood Doors" for astragals and integral intumescent seals provided as part of labeled fire-rated assemblies.
4. Section 081433 "Stile and Rail Wood Doors" for astragals and integral intumescent seals provided as part of labeled fire-rated assemblies.
5. Section 084113 "Aluminum-Framed Entrances and Storefronts" for installation of entrance door hardware, except cylinders.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Schedules shall be kept current with all changes to the project. If changes occur, project hardware schedules shall be maintained to reflect the changes as they are approved. Omitted items shall be deleted from openings, added and replaced items shall be included. Installation submittals shall be kept current as changes occur. Upon request, a complete updated hardware schedule shall be provided to the contractor. Supplemental submittals that include only the changed openings will not be acceptable.

C. Prior to final payment, provide a record copy of hardware schedules, including all revisions and updates. All openings shall be listed to reflect final installed configuration only.

D. Shop Drawings: Details of electrified door hardware, indicating the following:

1. Wiring Diagrams: For power, signal, and control wiring and including the following:

a. Details of interface of electrified door hardware and building safety and security systems.
b. Schematic diagram of systems that interface with electrified door hardware.
c. Point-to-point wiring.
d. Risers.
e. Elevations doors controlled by electrified door hardware.

2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

E. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
c. Format: Use same scheduling sequence and format as in the Contract Documents.
d. Content: Include the following information:

1) Identification number, location, hand, fire rating, size, and material of each door and frame.
2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
5) Fastenings and other pertinent information.
6) Explanation of abbreviations, symbols, and codes contained in schedule.
7) Mounting locations for door hardware.
8) List of related door devices specified in other Sections for each door and frame.

2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Architectural Hardware Consultant.

B. Product Certificates: For electrified door hardware, from the manufacturer.

1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

D. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Hardware Supplier Qualifications: The hardware supplier must be a corporate member in good standing of The Door and Hardware Institute (DHI), employing at least one Architectural Hardware Consultant (AHC) who is currently participating in DHI’s continuing education program (CEP).

C. Architectural Hardware Consultant Qualifications: A 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 who is currently certified by DHI as follows:

1. For door hardware, an Architectural Hardware Consultant (AHC).

D. Source Limitations: Obtain each type of door hardware from a single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

E. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

F. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.

G. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

H. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

I. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC/ANSI A117.1 and IAC - Illinois Accessibility Code, latest version.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
2. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

J. Keying Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." In addition to Owner, Construction Manager, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant and Owner's security consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

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.

K. Pre-installation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Inspect and discuss electrical roughing-in for electrified door hardware.
4. Review sequence of operation for each type of electrified door hardware.
5. Review required testing, inspecting, and certifying procedures.

L. Items of hardware not definitely specified herein but necessary for completion of the work shall be provided. Such items shall be of type and quality suitable to the service required and comparable to the adjacent hardware. Where size and shape of members is such as to prevent the use of types specified, hardware shall be furnished of suitable types having as nearly as practicable the same operation and quality as the type specified. Sizes shall be adequate for the service required.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

D. Deliver keys to Owner by registered mail or overnight package service.

1.8 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 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 hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

a. Exit Devices: Two years from date of Substantial Completion.
b. Manual Closers: Ten years from date of Substantial Completion.

B. Factory direct order number shall be provided for each shipment of locks, closers and exit devices with warranty, prior to final payment.

1.10 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.2 HINGES

A. Hinges: BHMA A156.1.

1. Hinge Base Metal: Unless otherwise indicated, provide the following:
   a. Exterior Hinges: Stainless steel, with stainless steel pin.
   b. Interior Hinges: Steel, with steel pin.
2. Number of Hinges:
   a. Provide not less than 3 hinges per door leaf for doors 90 inches or less in height and one additional hinge for each 30 inches of additional height.
3. Size of Hinges
   a. Provide standard weight (.134” thick) 4-1/2” x 4-1/2” ball bearing hinges on all doors up to and including 3’-0” in width. Over 3’-0” in width provide extra heavy weight ball bearing hinges (.180” thick) 4-1/2” x 4-1/2”.
4. Hinge options:
   a. Provide non removable pins at exterior openings and outswinging interior doors.
   b. All hinges shall be flat button tipped hinges
5. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Hager Companies.
   b. Ives.
   c. McKinney.

2.3 CONTINUOUS HINGES

A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hager Companies.
b. Select.
c. Zero International.

2.4 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch (13 mm) latchbolt throw.
2. Mortise Locks: Minimum 3/4-inch (19 mm) latchbolt throw.

C. Lock Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

D. Lock Trim:

1. Description: Provide as indicated in hardware sets.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim and aluminum frames.
3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

F. Mortise Locks: BHMA A156.13; Series 1000; Grade 1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Corbin Russwin.
b. No alternate manufacturers will be accepted without architect's approval prior to bidding.

2.5 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hager.
b. Ives.
c. Trimco.
d. No alternate manufacturers will be accepted without architect's approval prior to bidding.

2.6 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

A. Automatic and Self-Latching Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hager.
b. Ives.
c. Trimco.
d. No alternate manufacturers will be accepted without architect's approval prior to bidding.

2.7 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Corbin Russwin.
b. No alternate manufacturers will be accepted without architect's approval prior to bidding.

B. Standard Lock Cylinders: BHMA A156.5; Grade 1; face finished to match lockset.

2.8 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.

1. Master Key System: All new cylinders are to be keyed into the existing master key system.

B. Keys: Brass or Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: "DO NOT DUPLICATE."

2. Quantity: In addition to one extra key blank for each lock, provide the following:

a. Cylinder Change Keys: Three.
b. Master Keys: Five.
c. Grand Master Keys: Five.

2.9 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel, unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hager.
b. Ives.
c. Rockwood Manufacturing Company.

2.10 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release.

B. Astragals: BHMA A156.22.

2.11 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable

to meet field conditions and requirements for opening force. Provide extra duty arm at all parallel arm applications.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. LCN.
    b. No alternate manufacturers will be accepted without architect's approval prior to bidding.

2.12 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Hager Companies.
    b. Ives.
    c. Rockwood.

2.13 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Glynn-Johnson.
    b. Rixson.
    c. Sargent.
    d. No alternate manufacturers will be accepted without architect's approval prior to bidding.

2.14 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Hager Companies.
    b. National Guard Products.
    c. Pemko.

2.15 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hager Companies.
b. National Guard Products.
c. Pemko.

2.16 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick stainless steel with countersunk screw holes and 4 beveled edges; with manufacturer's standard machine or self-tapping screw fasteners.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hager.
b. Ives.
c. Rockwood.
d. No alternate manufacturers will be accepted without architect’s approval prior to bidding.

2.17 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hager Companies.
b. Ives.
c. Rockwood Manufacturing Company.

2.18 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and

hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:

a. Wood or Machine Screws: For the following:

1) Hinges mortised to doors or frames**;** use threaded-to-the-head wood screws for wood doors and frames.
2) Strike plates to frames.
3) Closers to doors and frames.

b. Steel Through Bolts: For the following unless door blocking is provided:

1) Surface hinges to doors.
2) Closers to doors and frames.
3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.19 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. 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.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

A. Mounting Heights: 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. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).

E. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.

1. Configuration: Provide one power supply for each door opening with electrified door hardware.

F. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

G. 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 will impede traffic.

H. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

I. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

J. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 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 is allowed to 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 six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door

hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Section 017900 "Demonstration and Training."

3.8 DOOR HARDWARE SCHEDULE

SET 01

1	EA	CONTINUOUS HINGE	780-224HD	CLR	HAGER
1	EA	DORMITORY	ML2065 X NSA X M19V	626	CORBIN RUSSWIN
1	EA	CLOSER	4040XP	689	LCN
1	EA	WALL STOP	409	630	ROCKWOOD
1	SET	SEALS	5050C	BLK	NGP
1	EA	THRESHOLD	896	AL	NGP

SET 02

	EA	HINGES	AS SPECIFIED	630	HAGER
1	EA	STOREROOM LOCK	ML2057 X NSA	626	CORBIN RUSSWIN
2	EA	CLOSER	4040XP	689	LCN
2	EA	OVERHEAD STOP	GJ100 SERIES	630	GLYNN-JOHNSON
1	SET	AUTO FLUSHBOLTS	FB31P	630	IVES
1	EA	DUSTPROOF STRIKE	DP1	626	IVES
1	EA	COORDINATOR	COR X FL	628	IVES
2	EA	MOUNTING BRACKETS	AS REQUIRED	628	IVES
1	SET	SEALS	5050C	BLK	NGP
2	EA	SWEEP	200N	AL	NGP
1	SET	ASTRAGAL	115N	AL	NGP
1	EA	THRESHOLD	8425	AL	NGP

SET 03

	EA	HINGES	AS SPECIFIED	630	HAGER
1	EA	STOREROOM LOCK	CL3357 X NZD	626	CORBIN RUSSWIN
1	EA	CLOSER	4040XP	689	LCN
1	EA	WALL STOP	409	630	ROCKWOOD
1	SET	WEATHERSTRIP	160S	AL	NGP

1	EA	SWEEP	200N	AL	NGP
1	EA	THRESHOLD	8425	AL	NGP

SET 04

	EA	HINGES	AS SPECIFIED	630	HAGER
1	EA	CLASSROOM LOCK	CL3357 X NZD	626	CORBIN RUSSWIN
1	EA	CLOSER	4040XP	689	LCN
1	EA	WALL STOP	409	630	ROCKWOOD
1	SET	WEATHERSTRIP	160S	AL	NGP
1	EA	SWEEP	200N	AL	NGP
1	EA	THRESHOLD	8425	AL	NGP

SET 05

	EA	HINGES	AS SPECIFIED	652	HAGER
1	EA	PRIVACY	ML2060 X NSA X M19V	626	CORBIN RUSSWIN
1	EA	CLOSER	4040XP	689	LCN
1	EA	WALL STOP	409	630	ROCKWOOD

SET 06

	EA	HINGES	AS SPECIFIED	652	HAGER
1	EA	CLASSROOM LOCK	CL3357 X NZD	626	CORBIN RUSSWIN
1	EA	CLOSER	4040XP	689	LCN
1	EA	WALL STOP	409	630	ROCKWOOD

SET 07

	EA	HINGES	AS SPECIFIED	652	HAGER
1	EA	STOREROOM LOCK	CL3357 X NZD	626	CORBIN RUSSWIN
1	EA	CLOSER	4040XP	689	LCN
1	EA	WALL STOP	409	630	ROCKWOOD

SET 08

	EA	HINGES	AS SPECIFIED	652	HAGER
1	EA	OFFICE LOCK	CL3351 X NZD	626	CORBIN RUSSWIN
1	EA	CLOSER	4040XP	689	LCN
1	EA	WALL STOP	409	630	ROCKWOOD

SET 09

	EA	HINGES	AS SPECIFIED	652	HAGER
1	EA	PRIVACY	CL3320 X NZD	626	CORBIN RUSSWIN
1	EA	WALL STOP	409	630	ROCKWOOD

SET 10

	EA	HINGES	AS SPECIFIED	652	HAGER
1	EA	PRIVACY	CL3320 X NZD	626	CORBIN RUSSWIN
1	EA	CLOSER	4040XP	689	LCN
1	EA	WALL STOP	409	630	ROCKWOOD

SET 11

	EA	HINGES	AS SPECIFIED	652	HAGER
2	EA	EXIT LOCK	CL3380 X NZD	626	CORBIN RUSSWIN
2	EA	WALL STOP	409	630	ROCKWOOD

SET 12

	EA	HINGES	AS SPECIFIED	630	HAGER
1	EA	STOREROOM LOCK	CL3357 X NZD	626	CORBIN RUSSWIN
1	EA	CLOSER	4040XP	689	LCN
1	EA	OVERHEAD STOP	GJ100 SERIES	630	GLYNN-JOHNSON
1	SET	WEATHERSTRIP	160S	AL	NGP
1	EA	SWEEP	200N	AL	NGP
1	EA	THRESHOLD	425	AL	NGP

**PROVIDE LCN SPECIAL TEMLATE ST1630 AND 4040XP-18TJ PLATE AS REQUIRED FOR CLOSER AND OVERHEAD STOP INSTALLATION.

SET 13

	EA	HINGES	AS SPECIFIED	630	HAGER
1	EA	OFFICE LOCK	CL3351 X NZD	626	CORBIN RUSSWIN
1	EA	CLOSER	4040XP	689	LCN
1	EA	OVERHEAD STOP	GJ100 SERIES	630	GLYNN-JOHNSON
1	SET	WEATHERSTRIP	160S	AL	NGP
1	EA	SWEEP	200N	AL	NGP
1	EA	THRESHOLD	8425	AL	NGP

SET 14

	EA	HINGES	AS SPECIFIED	652	HAGER
1	EA	CLASSROOM LOCK	CL3355 X NZD	626	CORBIN RUSSWIN
1	EA	CLOSER	4040XP	689	LCN
1	EA	OVERHEAD HOLDER	GJ100H	630	GLYNN-JOHNSON

**PROVIDE LCN SPECIAL TEMPLATE ST1630 X 4040XP-18TJ PLATE AS REQUIRED FOR CLOSER AND OVERHEAD STOP INSTALLATION.

SET 15

	EA	HINGES	AS SPECIFIED	652	HAGER
1	EA	STOREROOM LOCK	CL3357 X NZD	626	CORBIN RUSSWIN
1	EA	CLOSER	4040XP	689	LCN
1	EA	WALL STOP	409	630	ROCKWOOD
1	SET	SEALS	5050C	BLK	NGP
1	EA	THRESHOLD	896	AL	NGP

SET 16

1	EA	CONTINUOUS HINGE	780-224HD	CLR	HAGER
1	EA	PUSH	70C X C/C	630	ROCKWOOD
1	EA	PULL	BF111 X 70C X C/C	630	ROCKWOOD
1	EA	DEADBOLT	ML2017	626	CORBIN RUSSWIN
1	EA	CLOSER	4040XP	689	LCN

1	EA	WALL STOP	409	630	ROCKWOOD

SET 17

1	EA	CONTINUOUS HINGE	780-224HD	CLR	HAGER
1	EA	DORMITORY	ML2065 X NSA X M19V	626	CORBIN RUSSWIN
1	EA	CLOSER	4040XP	689	LCN
1	EA	OVERHEAD STOP	GJ100 SERIES	630	GLYNN-JOHNSON
1	SET	WEATHERSTRIP	160S	AL	NGP
1	EA	SWEEEP	200N	AL	NGP
1	EA	THRESHOLD	8425	AL	NGP

SET 18

1	EA	CONTINUOUS HINGE	780-224HD	CLR	HAGER
1	EA	PUSH	70C X C/C	630	ROCKWOOD
1	EA	PULL	BF111 X 70C X C/C	630	ROCKWOOD
1	EA	DEADBOLT	ML2017	626	CORBIN RUSSWIN
1	EA	CLOSER	4040XP	689	LCN
1	EA	WALL STOP	409	630	ROCKWOOD

**FIELD VERIFY EXISTING FRAME PREPS AND PROVIDE HINGE FILLERS AS REQUIRED.
**FILL EXISTING FRAME STRIKE AND CUT NEW DEADBOLT STRIKE AS REQUIRED.

SET 19

	EA	HINGES	AS SPECIFIED	630	HAGER
1	EA	STOREROOM LOCK	ML2057 X NSA	626	CORBIN RUSSWIN
1	EA	CLOSER	4040XP X SHCUSH	689	LCN
1	SET	WEATHERSTRIP	160S	AL	NGP
1	EA	SWEEP	200N	AL	NGP
1	EA	THRESHOLD	8425	AL	NGP

**FIELD VERIFY EXISTING FRAME PREPS AND PROVIDE NEW HINGES TO MATCH EXISTING PREPS.

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes glazing for the following products and applications:

1. Doors.
2. Interior borrowed lites.
3. Storefront framing.

1.2 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 thicknesses indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, 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. Specified Design Wind Loads: As indicated.
b. 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.

c. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm.
d. 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 a maximum change (range) of 120 deg F, 180 deg F in ambient and surface temperatures, respectively, 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.

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 mm thick.
2. For insulating-glass units, properties are based on units with lites 6 mm thick and a nominal 1/2-inch- wide interspace.
3. Center-of-Glass U-Values: NFRC 100 methodology using LBL-35298 WINDOW 4.1 computer program, expressed as Btu/ sq. ft. x h x deg F.
4. Center-of-Glass Solar Heat Gain Coefficient: NFRC 200 methodology using LBL-35298 WINDOW 4.1 computer program.
5. Solar Optical Properties: NFRC 300.

1.3 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: 12-inch- square, for each type of glass product indicated, other than monolithic clear float glass.

C. Glazing Schedule: Use same designations indicated on Drawings.

1.4 QUALITY ASSURANCE

A. Sealant Compatibility and Adhesion Testing: Use sealant manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

B. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.

C. Glazing Publications: Comply with recommendations of the following, unless more stringent requirements are indicated.

1. GANA Publications: "Glazing Manual."
2. SIGMA Publications: SIGMA TM-3000, "Vertical Glazing Guidelines."

D. Insulating-Glass Certification Program: Permanently marked with certification label of Insulating Glass Certification Council.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form, made out to Owner and signed by manufacturer, in which manufacturer agrees to furnish replacements for units that deteriorate from normal use by developing defects attributable to the manufacturing process, f.o.b. the nearest shipping point to Project site, within warranty period.

1. Insulating Glass:

a. Deterioration: Failure of hermetic seal resulting in obstruction of vision by dust, moisture, or film on interior surfaces of glass.

b. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other articles including schedules where subparagraph 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.

2.2 GLASS MATERIALS

A. Annealed Float Glass: ASTM C 1036, Type I (transparent glass, flat), Quality q3 (glazing select); class as indicated in schedules at the end of Part 3.

B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent glass, flat); Quality q3 (glazing select); class, kind, and condition as indicated in schedules at the end of Part 3

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed.

C. Tempered Glass: Comply with ASTM C1172, ANSI Z97.1, and CPSC 16 CFR 1201, Category II.
1. Laminate glass by manufacturer’s standard heat and pressure process.

D. Insulating-Glass Units: Preassembled 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 the Insulating-Glass Schedule at the end of Part 3.

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 "Performance Requirements" Article. Provide Kind FT (fully tempered) where safety glass is indicated.
2. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated in the Insulating-Glass Schedule at the end of Part 3 are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
3. Sealing System: Dual seal with manufacturers standard primary and secondary sealants.
4. Spacer: Aluminum with mill or clear-anodized finish.
5. Corner Construction: Manufacturer's standard.
6. Overall Unit Thickness and Thickness of Each Lite: 25 and 6 mm.
7. Interspace Content: Argon.

E. Glass Identification:
1. Apply manufacturer's label indicating type and thickness to each light of glass. Show position of exterior face when installed, where applicable.

2.3 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. Colors of Exposed Sealants: As selected.

B. Elastomeric Glazing Sealants: ASTM C 920, Type S (single component), Grade NS (nonsag), Class 25, Use NT (nontraffic), M, G, A, and, as applicable to glazing substrates indicated, O.

C. Cylindrical Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.4 GLAZING GASKETS

A. Compression Gaskets: Molded or extruded gaskets of type and material indicated below and of profile and hardness required to maintain watertight seal:

1. EPDM dense compression gaskets complying with ASTM C 846.

2.5 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 A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore 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).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.6 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products 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 standard, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 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.

1. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
2. Protect glass edges from damage during handling and installation. Remove glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance from Project site and legally dispose of off Project site.
3. Apply primers to joint surfaces where required for adhesion of sealants, as determined by sealant compatibility and adhesion testing.
4. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
5. Provide spacers for glass lites where the length plus width is larger than 50 inches unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances.

B. Protection:

1. 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.
2. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter.

C. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged, including natural causes, accidents, and vandalism, during construction period.

3.2 MONOLITHIC FLOAT-GLASS SCHEDULE

A. Clear Uncoated Fully Tempered Float Glass: Class 1 (clear) Kind FT (fully tempered).

B. Tinted Uncoated Fully Tempered Float Glass: Class 2 (tinted, heat-absorbing, and light-reducing), Kind FT (fully tempered), Condition A (uncoated surfaces).

1. Available Products:

a. PPG Industries; “SolarGray”

b. Pdc Michigan;
c. Architect approved alternate.

2. Tint Color: Gray.
3. Visible Light Transmittance: 37% to 44%
4. Solar Heat Gain Coefficient: 35% to 46%
5. Outdoor Visible Reflectance: 5% to 7%

3.3 INSULATING-GLASS SCHEDULE

A. Clear Uncoated Insulating Glass:

1. Overall Unit Thickness and Thickness of Each Lite: 25 and 6 mm.
2. Interspace Content: Argon.
3. Indoor Lite: Float glass, Class 1 (clear) float glass, annealed.

a. Provide kind FT (fully tempered), Condition A (uncoated surfaces) where indicated on drawings or required by applicable codes.

4. Outdoor Lite: Float glass, Class 1 (clear), annealed.

a. Provide kind FT (fully tempered), Condition A (uncoated surfaces) where indicated on drawings or required by applicable codes.

B. Tinted Uncoated Insulating Glass:

1. Available Products:

a. PPG Industries; “SolarGray”
b. Pdc Michigan;
c. Architect approved alternate.

2. Overall Unit Thickness and Thickness of Each Lite: 25 and 6 mm.
3. Interspace Content: Argon.
4. Indoor Lite: Float glass, Class 1 (clear) float glass, annealed.

a. Provide kind FT (fully tempered), Condition A (uncoated surfaces) where indicated on drawings or required by applicable codes.

5. Outdoor Lite: Float glass, Class 2 (tinted, heat absorbing, and light reducing), annealed.

a. Provide kind FT (fully tempered), Condition A (uncoated surfaces) where indicated on drawings or required by applicable codes.

b. Tint Color: Gray.

6. Visible Light Transmittance: 37% to 44%
7. Winter Nighttime U-Value: 47% to 49%
8. Summer Daytime U-Value: 55% to 57%

9. Solar Heat Gain Coefficient: 35% to 46%

END OF SECTION 088000

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior gypsum wallboard.
2. Exterior gypsum board panels for ceilings .
3. Tile backing panels.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph 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.

B. Ceiling and Soffit Framing:

1. Steel Studs and Runners: ASTM C 645, in depth indicated.

a. Minimum Base Metal Thickness: As indicated or 0.0312 inch (20 gage).

2. Deep-Leg Deflection Track: ASTM C 645 top runner with 2-inch- deep flanges.
3. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

a. Minimum Base Metal Thickness: As indicated or 0.027 inch.

4. Cold-Rolled Channel Bridging: 0.0538-inch bare steel thickness, with minimum 1/2-inch- wide flange, and in depth indicated.

   a. Clip Angle: 1-1/2 by 1-1/2 inch, 0.068-inch- thick, galvanized steel.
5. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.2 PANEL PRODUCTS

A. Panel Size, General: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Gypsum Wallboard: ASTM C 36.

1. Regular Type: In thickness indicated and with long edges tapered.

2. Abuse Resistant: In thickness indicated with long edges tapered.
3. Mold-resistant: ASTM C1396, in thickness indicated and with long edges tapered.

C. Gypsum Panels for Ceilings:
1. Regular Type: In thickness indicated with long edges tapered.
2. Mold-resistant: ASTM C1396, in thickness indicated and with long edges tapered.

D. Exterior Gypsum Panels for Ceilings and Soffits:

E. Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M, with core type and in thickness indicated.

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.
3. Expansion (Control) Joint: One-piece control joint with V-shaped slot and removable strip covering slot opening.
4. Architectural F Reveal Bead

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

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 and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, flanges of trim accessories, and fasteners, use setting-type taping compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound or drying-type, all-purpose compound if compatible.
4. Finish Coat: For third coat, use setting-type, sandable topping compound or drying-type, all-purpose compound if compatible.

D. Joint Compound for Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Use setting-type taping and setting-type, sandable topping compounds.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

C. Isolation Strip at Exterior Walls:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

PART 3 - EXECUTION

3.1 NON-LOAD-BEARING STEEL FRAMING INSTALLATION

A. General: Comply with ASTM C 754, and ASTM C 840 requirements that apply to framing installation.

B. Partition and Soffit Framing:

1. Where studs are installed directly against exterior walls, install isolation strip between studs and wall.
2. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
3. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb, unless otherwise indicated.
    b. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

4. Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

3.2 PANEL PRODUCT INSTALLATION

A. Gypsum Board: Comply with ASTM C 840 and GA-216.

1. Space screws a maximum of 12 inches o.c. for vertical applications.
2. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.
3. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
4. On partitions/walls, apply gypsum panels vertically (parallel 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 board.
    b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

5. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Install with 1/4-inch gap where panels abut other construction or penetrations.

3.3 FINISHING

A. Installing Trim Accessories: 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. Finishing Gypsum Board Panels: 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.

1. Prefill open joints and damaged surface areas.
2. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
3. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

C. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:

1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
2. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where panels are substrate for tile and where indicated.
3. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.

END OF SECTION 092900

City of Sterling Heights - Dodge Park

PROJECT NUMBER 170402

SECTION 093013

CERAMIC TILE

1 GENERAL

1.1 SECTION INCLUDES

A. Ceramic tile floor and base finish.

B. Ceramic tile wall and wainscot finish.

C. Thresholds at door openings.

1.2 SUBMITTALS

A. Product Data: Not Required.

B. Shop Drawings: Required. Submit shop drawings indicating tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, thresholds, and setting details.

C. Samples: Not Required.

D. Field Samples: Not Required.

E. Pre-Installation Conference: Review installation procedures and coordination required with related work.

1.3 QUALITY ASSURANCE

A. Quality Standards: 2016 TCNA Handbook for Ceramic Tile Installation.
B. American National Standards Institute (ANSI) Specifications for the Installation of Ceramic Tile.
C. American National Standards Institute (ANSI) Specifications for Ceramic Tile ANSI A137.1.
D. American Society for Testing and Materials (ASTM).

E. Static Coefficient of Friction:
    1. For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
        a. Level Surfaces:
            1. Minimum 0.6 wet.
        b. Step Treads
            1. Minimum 0.6 wet.
        c. Ramp Surfaces
            1. Minimum 0.8 wet.

F. Submit maintenance data and recommended cleaning and stain removal methods.

G. Installer qualifications:
   1. Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for Project and with a record of successful in-service performance.

H. Source Limitations for Tile:
   1. Obtain each color, grade, finish, type, composition, and variety of tile from a one source with resources to provide products of from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying progress of the work.

I. Source Limitations for Setting and Grouting Materials:
   1. Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

J. Source Limitations for Other Products:
   1. Obtain each of the following products specified in this Section from one source and by a single manufacturer for each product:
      a. Stone thresholds.
      b. Cementitious backer units.
      c. Joint sealants.
      d. Waterproofing.

I. Environmental Requirements: Adhesives and sealants must comply with South Coast Air Quality Management District Rule 1168 for VOC limits.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.

B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

C. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.5 PROJECT CONDITIONS

A. Condition of slab
   1. Verify that slab is properly cured and that surface of slab is level and smooth prior to commencing work
B. Environmental Limitations:
   1. Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer’s written instructions.

1.6 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
   1. Tile and Tim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

1.7 ENVIRONMENTAL CRITERIA

A. Redirect recyclable recovered resources back into the manufacturing process.

2 PRODUCTS

2.1 MANUFACTURERS/PRODUCTS

A. CT-1 Ceramic Floor Tile manufactured by Crossville
   1. Size: 12x24 inch
   2. Color: AV273 Whiskey Lullaby UPS
   3. Pattern: Reclamation
   4. Source: Virginia Tile
   5. Rep: Robin Speer, speerr@virginiatile.com, (734) 765-6875
   6. Grout: TEC 925 Sable
   7. Base: 4x24 single bullnose
   8. Tile floor edging: Schluter Schiene AE n
   9. Installation: See drawings for tile pattern

B. CT-2 Ceramic Wall Tile manufactured by American Olean
   1. Size: 4 1/4 x 12 ¾ inch
   2. Color: 37 Nutmeg
   3. Pattern: Urban Canvas
   4. Surface Finish: Matte
   5. Source: Virginia Tile
   6. Rep: Robin Speer, speerr@virginiatile.com, (734) 765-6875
   7. Grout: TEC 925 Sable
   8. Base: Cove A-34C1 4-1/4” x 12-3/4”
   9. Installation: brick

C. CT-3 Ceramic Wall Tile manufactured by American Olean
   1. Size: 4 1/4 x 12 ¾ inch
   2. Color: 37 Nutmeg
   3. Pattern: Urban Canvas – Wave tile
   4. Surface Finish: Gloss
   5. Source: Virginia Tile
   6. Rep: Robin Speer, speerr@virginiatile.com, (734) 765-6875
   7. Grout: TEC 925 Sable
   8. Base: Cove A-34C1 4-1/4” x 12-3/4”
   9. Installation: brick

D. CT- 4 Ceramic Wall Tile manufactured by American Olean
   1. Size: 4 1/4 x 12 ¾ inch
   2. Color: 92 Biscuit
   3. Pattern: Urban Canvas

4. Surface Finish: Matte
5. Source: Virginia Tile
6. Rep: Robin Speer, speerr@virginiatile.com, (734) 765-6875
7. Grout: TEC 925 Sable
8. Base: Cove A-34C1 4-1/4" x 12-3/4"
9. Installation: brick

E. CT- 5 Ceramic Wall Tile manufactured by American Olean
1. Size: 4 1/4 x 12 ¾ inch
2. Color: 11 Mushroom
3. Pattern: Urban Canvas
4. Surface Finish: Matte
5. Source: Virginia Tile
6. Rep: Robin Speer, speerr@virginiatile.com, (734) 765-6875
7. Grout: TEC 925 Sable
8. Base: Cove A-34C1 4-1/4" x 12-3/4"
9. Installation: brick
10. Tile edging: Schluter trim at top of cove base on block walls where no tile wainscot

F. CT- 6 Ceramic Wall Tile manufactured by Crossville
1. Size: 12 x 24 inch
2. Color: A1415 Memphis Blue
3. Pattern: Argent
4. Surface Finish: Unpolished
5. Source: Virginia Tile
6. Rep: Robin Speer, speerr@virginiatile.com, (734) 765-6875
7. Grout: TEC 925 Sable
8. Base: Cove A-34C1 4-1/4" x 12-3/4"
9. Installation: See drawings for tile pattern
10. Tile edging: Schluter trim at top of cove base on block walls where no tile wainscot

G. CT- 7 Ceramic Wall Tile manufactured by Crossville
1. Size: 12 x 24 inch
2. Color: A1406 Emerald Green
3. Pattern: Argent
4. Surface Finish: Unpolished
5. Source: Virginia Tile
6. Rep: Robin Speer, speerr@virginiatile.com, (734) 765-6875
7. Grout: TEC 925 Sable
8. Installation: See drawings for tile pattern

H. CT- 8 Ceramic Wall Tile manufactured by Crossville
1. Size: 6 x 24 inch
2. Color: A14409 Lemon Drop
3. Pattern: Argent
4. Surface Finish: Unpolished
5. Source: Virginia Tile
6. Rep: Robin Speer, speerr@virginiatile.com, (734) 765-6875
7. Grout: TEC 925 Sable
8. Installation: See drawings for tile pattern

I. CT- 9 Ceramic Wall Tile manufactured by Crossville
1. Size: 6 x 24 inch

2. Color: A1410 Orange Crush
3. Pattern: Argent
4. Surface Finish: Unpolished
5. Source: Virginia Tile
6. Rep: Robin Speer, speerr@virginiatile.com, (734) 765-6875
7. Grout: TEC 925 Sable
8. Installation: See drawings for tile pattern

2.2 ACCESSORIES/MIXES

A. Setting Materials

1. Floors: TEC® Ultimate Large Tile Mortar installed per manufacturer's instructions.

B. Grouting Materials

1. Grout: TEC Power Grout installed per manufacturer's instructions.

2. Use grout release when using contrast color grout. Provide a neutral cleaner and sealer capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

C. Sealants

1. General

a. Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer characteristics indicated [that comply with applicable requirements of Division 7 Section "Joint Sealants".]

2. Colors

a. Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

D. Trim Units

1. Provide tile trim units to match characteristics of adjoining flat tile and to comply with following requirements:

2. Size:
   a. As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.

3. Shapes
   a. General
      1) As noted below, selected from manufacturer's standard shapes as required. Verify with drawings.
   b. Base for Thinset Mortar Installations. Base in toilet & bathing room floors to be at least 4 inches high per MBC
   c. Wainscot Cap for Thinset Mortar Installations.
      1) Surface bullnose.

d. Internal Corners.
1) Field-butted square corners, except with coved base and cap angle pieces designed to member with stretcher shapes.

E. Cementitious Backer Units

1. General:

a) Provide cementitious backer units complying with ANSI A 118.9, of thickness and width and in maximum lengths available to minimize end-to-end butt joints.

F. Miscellaneous Materials

1. Metal Edge Strips

a. Zinc alloy or stainless steel terrazzo strips, 1/8 inch wide at top edge with integral provision for anchorage to mortar bed or substrate unless otherwise indicated. Schluter-Schiene AE Anodized Aluminum

2. Trowelable Underlayments and Patching Compounds

a. Latex-modified, Portland-cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated. Levelquik RS by Custom or approved equal.

3. Waterproofing & Anti-Fracture Floor Tile Membrane

a. Elastomeric, waterproofing & anti-fracture membrane: RedGard by Custom or equal acceptable to the Designer.

4. Temporary Protective Coating

a. Provide product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout, is compatible with tile, mortar, and grout products, and is easily removable after grouting is completed without damaging grout or tile.
b. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120°F (49°C) to 140° (60°C) per ASTM D 87.
c. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as a temporary protective coating for tile.

5. Tile Cleaner and Sealer

a. A neutral cleaner and sealer capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

6. Factory Blending:
a. For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one

package show the same range in colors as those taken from other packages and match approved samples.

7. Mixing Mortars and Grout:
   a. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturer' written instructions.
   b. Add materials, water, and additives in accurate proportions.
   c. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.
   d. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturer's written instructions.

3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and areas where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

B. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.

C. Medium bed mortar may be applied if slab conditions do not allow thin set. Use LevelQuik by Custom Building Products or approved equal.

D. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.

E. Do not proceed with installation until unsatisfactory conditions have been corrected. Beginning installation means Installer accepts condition of existing surface.

3.2 PREPARATION

A. Remove coatings, including curing compounds, and other substances that contain soap, wax, oil, or silicone and are incompatible with tile-setting materials by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

B. Provide concrete substrates for tile floors installed with dry-set or latex-portland cement mortars that comply with flatness tolerances specified in referenced ANSI A108 series of tile installation standards for installations indicated.
   1. Use trowelable leveling and patching compounds per tile-setting material manufacturers written instructions to fill cracks, holes, and depressions.
   2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Blending:
   1. For tile exhibiting color variations verify that tile has been blended in factory and packaged accordingly so that tile units taken from one package show the same

range in colors as those taken from other packages. If not factory blended, blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating:
1. Where indicated under tile type or needed to prevent adhesion or staining of exposed tile surfaces by grout, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of temporary protective coating indicated below, taking care not to coat unexposed tile surfaces.

E. Protect surrounding work from damage or disfiguration.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standard:
1. Comply with parts of ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines:
1. TCNA "Handbook for Ceramic Tile Installation". Comply with TCNA installation methods indicated in ceramic tile installation schedules.

C. General:
1. Lay tile to pattern indicated on drawings.
2. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions, except as otherwise shown. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments. Do not interrupt pattern through openings.
3. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so that plates, collars, or covers overlap tile.

D. Jointing Pattern:
1. Lay tile in grid pattern, unless otherwise shown. [Align joints when adjoining tiles on floor, base, walls, and trim are same size unless outside corners will be too large. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths unless otherwise shown.
2. Make joints watertight, without voids, cracks, excess mortar or excess grout.
3. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so that extent of each sheet is not apparent in finished work.
4. For stair treads, use full tile in center of tread. Place equal cuts to each side.

E. Wainscots:
1. Lay out tile wainscots to next full tile beyond dimensions indicated on drawings. Do not use bullnose base as part of wainscot.

F. Movement Joints:
1. Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints where indicated per architectural drawings. Prepare joints for sealants to comply with requirements of ASTM.

G. Grouting:
   1. Grout tile to comply with the requirements of the following installation standards.
      a. For ceramic tile grouts (sand-portland cement, dry-set, commercial Portland cement, and latex-portland cement grouts), comply with ANSI A108.10.

H. Cementitious Backer Boards:
   1. At showers and similar wet areas, install Cementitious backer unties to comply with manufacturer's instructions for type of application indicated and treat joints with same material as for setting tile

3.4 WATERPROOFING INSTALLATION

A. Install waterproofing in compliance with waterproofing manufacturer's written instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate.
B. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 FLOOR TILE INSTALLATION

A. General:
   1. Install tile to comply with requirements indicated below for setting bed methods, TCNA installation methods related to types of subfloor construction, and grout types.

B. Joint Widths:
   1. Install tile on floors with the following joint widths:
      a. Ceramic Porcelain Tile:
         1) 1/8 inch.

C. Back Buttering:

   1. For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
      a. Exterior tile floors.
      b. Tile floors in wet areas, including showers, tub enclosures, laundries, and swimming pools.
      c. Tile floors installed with chemical-resistant mortars and grouts.
      d. Tile floors composed of tiles 8 by 8 inches or larger.
      e. Tile floors composed of rib-backed tiles.

D. Metal Edge Strips:

   1. Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

3.6 WALL TILE INSTALLATION

A. General:

1. Install types of tile designated for wall applications to comply with requirements indicated below for setting-bed methods, TCA installation methods and ANSI setting-bed standards related to subsurface wall conditions, and grout types.
2. Install metal lath and scratch coat to walls to comply with ANSI A108.1A, Section

B. Joint Widths:

1. Install tile on walls with the following joint widths:
   a. Ceramic Mosaic Tile:
      1) 1/8 inch.

   b. Wall Tile:
      1) 1/8 inch.

C. Back Buttering:

1. For installation indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
   a. Exterior tile wall installations.
   b. Tile wall installation in wet areas, including showers, tub enclosures, laundries, and swimming pools.
   c. Tile installed with chemical-resistant mortars and grouts.
   d. Tile wall installations composed of tiles 8 by 8 inches or larger.
   e. Glass tile.

D. End vertical wainscot edges with full tile and trim piece.

3.7 CLEANING & PROTECTION

A. Cleaning:
1. On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
2. Remove latex-portland cement grout residue from tile as soon as possible. Use approved cleaning agent.
3. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
4. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. Finished Tile Work:
1. Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.
2. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer that ensure tile is without damage or deterioration at time of Substantial Completion.
   a. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

b. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

3. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces and provide tile and grout sealer at quarry tile installation.
4. Deliver any extra materials to Owner, properly packaged and identified.

3.8 SCHEDULES

A. See Drawings.

END OF OUTLINE

Date:

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes aluminum acoustical panels for ceilings.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Samples: For each acoustical panel, for each exposed suspension system member, and for each color and texture required.

C. Maintenance data.

1.3 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory or an NVLAP-accredited laboratory.

B. Fire-Test-Response Characteristics:

1. Surface-Burning Characteristics: Acoustical panels complying with ASTM E 1264 for Class A materials, when tested per ASTM E 84.

PART 2 - PRODUCTS

2.1 GENERAL

A. Acoustical Panel Type:
1. Basis of Design: Subject to compliance with project requirements, the design is based on the following: USG Corporation, “Celebration Canopies”.
2. Classification: Provide ceiling panels complying with ASTM E 1264 for type, form and pattern as follows:
   a. Type: VII, Perforated aluminum facing (pan) with mineral glass or fiber base backing.
   b. Pattern: Pattern No. C250A ¼” round perforations, 12% open area
3. Pan Face Finish painted in color to match manufacturer’s full range: Color to be selected.
4. Acoustical Backer: Mars 90 Panel
5. Edge Detail: Square
6. Panel Thickness: 1-3/4 inch (44 mm)
7. Modular size: 24 inches x 48 inches (610 mm x 1219 mm)

8. Panel Warranty: 30 year lifetime system warranty against visible sag, mold and mildew.

B. Accessories
1. Hanger Bracket (1 per corner typical, factory riveted in place)
2. Panel Closure (at each corner, factory riveted in place).
3. Suspension System Hanger Wire: Galvanized carbon steel; soft temper; pre-stretched; yield stress load at least three times the design load but not less than 12-gauge.
a. Spacing and gauge per IBC, UL and CISCA design.
b. Supplied and installed by ceilings subcontractor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install ceiling panels to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Measure each ceiling area and establish layout of acoustical panels.

C. Suspend ceiling hangers from building's structural members, plumb and free from contact with insulation or other objects within ceiling plenum. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers, use trapezes or equivalent devices.

1. Do not support ceilings directly from permanent metal forms or floor deck; anchor into concrete slabs.
2. Do not attach hangers to steel deck tabs.

D. Install acoustical panels with undamaged edges and fit accurately into suspension system.

END OF SECTION 095113

City of Sterling Heights - Dodge Park

PROJECT NUMBER 170402

SECTION 096519

RESILIENT FLOORING

1 GENERAL

1.1 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

1.2 SUBMITTALS

A. Product Data: Not Required.

B. Shop Drawings: Not Required.

C. Samples: Not Required.

D. Operations & Maintenance Data
   1. Include maintenance procedures, recommend maintenance materials, and suggested schedule for cleaning.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Compliance with 2015 Michigan Building Code.

B. Environmental Requirements: Adhesives for flooring and base to comply with South Coast Air Quality Management District (SCAQMD) Rule 1168.

1.4 EXTRA MATERIALS

A. Provide not less than 12 sq. ft. of flooring and 16 lineal feet of base of each material specified.

2 PRODUCTS

2.1 MANUFACTURERS/PRODUCTS

A. Rubber Tile RT-1
   1. Size: 24 x 24 inch
   2. Source: Johnsonite, Product Triumph, Model Speckled
   3. Color: KJ2 Tidal
   4. Adhesive: Johnsonite 975 Two-Part Urethane Adhesive
   5. Rep: Jim Hagood, 734.260.2177, jhagood@bishopdistributing.com

B. Base RB-1: Thermoplastic rubber, top set straight
   1. Height: 6 inch.
   2. Source: Johnsonite, Product Millwork, Model Reveal
   3. Color: 283 Toast
   4. Use roll stock if quantity allows.
   5. Rep: Jim Hagood, 734.260.2177, jhagood@bishopdistributing.com

C. Base RB-2: Thermoplastic rubber, top set cove
   1. Height: 4 inch.
   2. Source: Johnsonite
   3. Color: 283 Toast
   4. Use roll stock if quantity allows.
   5. Rep: Jim Hagood, 734.260.2177, jhagood@bishopdistributing.com

D. Transition Strips. Provide CTA Series reducers for carpet thickness to concrete floor as required. Carpet to resilient adapters as required. T moldings are not acceptable.
   1. Width: 4 inch for CTA reducers
   2. Source: Johnsonite
   3. Color: 283 Toast
   4. Rep: Jim Hagood, 734.260.2177, jhagood@bishopdistributing.com

E. Adhesive: Per manufacturer recommendation for site conditions. Solvent-free, water-resistant adhesive. SCAQMD Rule 1168. VOC's shall not exceed 50 g/l.

C. Leveling and Patching Compounds: Low VOC latex type as recommended by manufacturer of resilient products.

3 EXECUTION

3.1 INSPECTION

A. Examine sub-floors and walls prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring or base material.

B. Inspect sub-floors prior to installation to determine that surfaces are free from curing, sealing, parting, and hardening compounds; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold or mildew.

C. Report conditions contrary to contract requirements which would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.

D. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the sub-floor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

3.2 PREPARATION

A. Smooth concrete surfaces, removing rough areas, projections, ridges, bumps, and filling low spots, control or construction joints, and other defects as recommended by the flooring manufacturer.

B. Remove paint, varnish, oils, release agents, sealers, and waxes. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesive used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents.

C. Perform subfloor Calcium Chloride Tests (and Bond Tests) to determine if surfaces are dry; free of curing and hardening compounds, old adhesive and other coatings; and ready to receive flooring.

D. Vacuum or broom-clean surfaces to be covered immediately before the application of flooring. Make subfloor free from dust, dirt, grease, and all foreign materials.

3.3 INSTALLATION - TILE MATERIAL

A. Install in accordance with manufacturer's instructions.
   1. Install with Johnsonite adhesive specified for the site conditions and follow adhesive label for proper use.
   2. Do not Quarter Turn tile.

B. Mix tile from container to ensure shade variations are consistent.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Set flooring in place, press with heavy roller to attain full adhesion.

E. Install tile to square grid pattern with all joints aligned.

F. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on drawings.

G. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.

H. Install edge strips at unprotected or exposed edges, and where flooring terminates.

I. Scribe flooring to walls, columns, existing cabinets, floor outlets, and other appurtenances to produce tight joints.

J. Install flooring under movable partitions without interrupting floor pattern.

K. Install transition strips where required. Fit joints tightly.

3.4 INSTALLATION-BASE MATERIAL

A. Apply top set wall base to walls, columns, casework, and other permanent fixtures in areas where top-set base is required. Install base in lengths as long as practical, with inside corners fabricated from base materials that are mitered or coped. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces.

B. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints. Use roll material where quantity allows.

C. Install without gaps at seams and with tops of adjacent pieces aligned.

D. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold.

E. Install base on solid backing. Bond tight to wall and floor surfaces. If quality concerns arise, call for Designer review before proceeding.

F. Scribe and fit to door frames and other interruptions.

G. Abut 2 different bases at internal corners only.

H. Fill voids with plastic filler along top edge of resilient wall base on masonry surfaces or other similar irregular substrates. Use Color Rite or equal.

I. Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.

3.5 PROTECTION AND CLEANING

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Remove excess adhesive from floor, base, and wall surfaces without damage.

C. Clean floor and base surfaces in accordance with manufacturers' instructions.

D. Upon completion of installation of floor covering and adjacent work, and after materials have set, clean surfaces with a neutral cleaner as recommended by manufacturer for type of floor covering material installed.

3.6 WASTE MANAGEMENT

A. Close and seal tightly all partly used adhesive containers and store protected in well-ventilated, fire safe area at moderate temperature.

3.7 SCHEDULES

A. See Drawings.

END OF OUTLINE

Date:

City of Sterling Heights - Dodge Park

PROJECT NUMBER 170402

SECTION 096813

CARPET TILE

1 GENERAL

1.1 SECTION INCLUDES

A. Carpet Tiles, glue down adhesion with releasable adhesive.

B. Matching accessories.

1.2 RELATED SECTIONS

A. Section 093013: Edging of adjacent ceramic tile floor.

1.3 SUBMITTALS

A. Product Data: Not Required.

B. Shop Drawings: Required. Indicate layout of joints, direction of pattern.

C. Samples: Not Required.

D. Operations & Maintenance Data
1. Submit operation and maintenance data.
2. Include maintenance procedures, recommend maintenance materials, and suggested schedule for cleaning.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: 2015 Michigan Construction Code for class I flame/smoke rating in accordance with NFPA 253.

B. CRI Carpet Installation Standard 2015.

C. Environmental Requirements: Carpet must meet or be lower than the current VOC content limits of the Carpet and Rug Institute Green Label Plus. Carpet adhesives must comply with South Coast Air Quality Management District (SCAQMA) Rule 1168.

1.5 WARRANTY

A. Standard Warranty.

B. Provide manufacturer warranty agreeing to repair or replace product with defective workmanship including edge ravel, delamination, shrinkage, curling and doming for a period of one year from the installation date.

C. Provide adjustment warranty by the installer for the guarantee period and within 15 days written notice, reset and repair any areas of faulty workmanship by the installer.

1.6 EXTRA MATERIALS

A. Provide overage of 5% of each carpet used for shelf stock. Installation costs will be based on installed carpet and will not include overage carpet.

B. After completion of installation, deliver to Owner all unused modular carpet in the mill cartons with mill labels securely attached.

C. Store inside in well ventilated area protected from weather, moisture, soiling and extreme temperature.

2 PRODUCTS

2.1 MANUFACTURERS/PRODUCTS

A. CPT-1 Carpet: Tufted, manufactured by Shaw Commercial.
1. Color: 75481 Movement
2. Pattern: Diffuse
3. Size: 24 inch x 24 inch
4. Repeat: None
5. Backing: Standard Ecoworx
6. Installation method: Ashlar
7. Rep: Patrick Imesch, patrick.imesch@shawinc.com, (313) 300-0279

B. CPT-2 Carpet: Tufted, manufactured by Shaw Commercial.
1. Color: 34761 Portabella
2. Pattern: Path
3. Size: 24 inch x 24 inch
4. Repeat: None
5. Backing: Standard Ecoworx
6. Installation method: Ashlar
7. Rep: Patrick Imesch, patrick.imesch@shawinc.com, (313) 300-0279

C. Accessories
1. Sub-Floor Filler: White premix latex; type recommended by carpet manufacturer.
2. Primers and Adhesives: Waterproof; of types recommended by carpet manufacturer. Shaw 5000 pressure sensitive adhesive or other Shaw product appropriate to site conditions.
3. Miscellaneous materials: As recommended by manufacturer of modular carpet and selected by installer to meet project circumstances.

3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are smooth and flat with maximum variation of 1/8 inch in 10 ft (3 mm in 3 m) and are ready to receive work.

B. Verify concrete floors are dry to a maximum moisture content of 7 percent; and exhibit negative alkalinity, carbonization, or dusting.

C. Beginning of installation means acceptance of existing substrate and site conditions.

D. Check dimensions supplied in these specifications and drawings. Check all other conditions affecting work in the field.

E. Per CRI guidelines, verify concrete floors do not have moisture emissions exceeding 3 pounds per 1000 sq. ft. for 24 hours; and alkalinity level to be between pH 7.0 – 9.0.

3.2 PREPARATION

A. Remove sub-floor ridges and bumps. Scrape existing adhesive. Fill low spots, cracks, joints, holes, and other defects with sub-floor filler.

B. Apply, trowel, and float filler to leave smooth, flat, hard surface.

C. Prohibit traffic until filler is cured.

D. Vacuum floor surface.

E. Store carpet modules and adhesive in a heated room at a minimum temperature of 68 ° F at least 3 days prior to installation.

F. Sequence modular carpet with other work to minimize possibility of damage and soiling of carpet during remainder of construction period.

3.3 INSTALLATION

A. Install carpet tile and adhesive in accordance with manufacturer’s instructions.

B. Integrate and blend carpet from different cartons to ensure minimal variation in color match.

C. Cut carpet tiles straight. Fit carpet tight to intersection with vertical surfaces without gaps.

D. Locate change of color or pattern between rooms under door centerline.

E. Install carpet using the arrows marked by the manufacturer on the back of each module.

F. Trim cleanly around floor mounted boxes and poke-thrus. Provide insert for trim ring if needed.

G. Install the carpet in a temperature of not less than 68° F.

3.4 CLEANING & PROTECTION

A. Remove and dispose of debris, carpet scraps, cartons, etc.

B. Remove excess adhesive from carpet surface with approved cleaning agent. Replace any tiles that cannot be cleaned.

C. Clean and vacuum carpet surfaces. Remove any protruding face yarns with sharp scissors.

D. Do not permit traffic over unprotected floor surface.

E. Deliver specified overrun and usable scraps of carpet to Owner, properly packaged and identified.

3.5 SCHEDULES

A. See Drawings.

END OF OUTLINE

Date:

City of Sterling Heights - Dodge Park

Project Number 170402

SECTION 09 91 23

PAINTING

1 GENERAL

1.1 SUMMARY

A. Section Includes
   1. Surface preparation and field application of paint and coatings.

1.2 SUBMITTALS

A. Product Data: Not Required.

B. Samples: Draw-downs.

C. Certification: Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

D. Product Data: Submit a complete list of paint materials proposed for use, together with manufacturer's technical information, including paint label analysis and application instructions.

E. Environmental Requirements: VOC emissions from paints must not exceed the VOC and chemical component limits of Green Seal's Standard GS-11 requirement. Other architectural coatings, primers and under coats shall not exceed South Coast Air Quality Management District (SCAQMD) Rule 1113.

1.3 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

B. "Exposed" shall refer to items and surfaces not concealed by ceilings or chases or insulation covering or similar permanent sight barriers.

C. "Exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.

D. "Finished areas" shall refer to areas of building with tile or painted or otherwise finished walls, or with resilient tile or terrazzo or otherwise finished floor, or with painted plaster or painted drywall, or suspended acoustical or otherwise finished ceilings.

E. “Paint” includes coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Compliance of Michigan Building Code.

B. Industry Standards: Drywall Finishing Council ‘Recommended Levels of Paint Finish over Gypsum Board.’

C. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.

D. Coordination of Work: Review other sections in which primers are to be provided to ensure compatibility of total system for various substrates. On request, furnish information or characteristics of finish materials to ensure use of compatible primers.

1. Notify the Designer of problems anticipated using the materials specified.

E. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.5 DELIVERY AND STORAGE

A. Deliver materials to job site in the manufacturer’s original, new and unopened packages and containers bearing manufacturer’s name and label, and 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.

1.6 PROJECT CONDITIONS

A. Apply water-base paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F. (10 degrees C) and 90 degrees F. (35 degrees C), unless otherwise permitted by paint manufacturer’s printed instructions.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperature are between 45 degrees F. (7 degrees C) and 95 degrees F. (35 degrees C), unless otherwise permitted by paint manufacturer’s printed instructions.

1.7 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.

1. Quantity: Furnish the Owner with an additional 5 percent, but not less than 1 gallon (3.785 L) or 1 case, as appropriate, of each material and color applied.

2 PRODUCTS

2.1 PAINT MATERIALS, GENERAL

A. All paint materials to be part of a single system to be supplied by one manufacturer. No substitutions will be accepted. Designer may request site visit(s) by manufacturer's rep to confirm conformance to specs.

B. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

C. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

D. Trade Names: Where the trade name or other designation of a product of a named manufacturer has been changed by the manufacturer from that specified, submit a statement giving the specified identification and the new identification for the same product.

E. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.

1. Products containing lead or chromates are prohibited for use on this Project.

2.2 MANUFACTURERS/PRODUCTS

A. PT-1 Gypsum Board:
1. Manufacturer: Benjamin Moore Ultra Spec 500 Interior Low Sheen N537
2. Color: 985 Indian River
3. One coat of primer sealer. Tint primer to half formula. Benjamin Moore Ultra Spec 500 interior latex primer N534
4. Two coats of paint, cut & roll.
5. Rep: Beth Maguire, (847) 372-1854, beth.maguire@benjaminmoore.com

B. PT-2 Gypsum Board:
1. Manufacturer: Benjamin Moore Ultra Spec 500 Interior Low Sheen N537
2. Color: 1644 Blue Dusk
3. One coat of primer sealer. Tint primer to half formula. Benjamin Moore Ultra Spec 500 interior latex primer N534
4. Two coats of paint, cut & roll.

5. Rep: Beth Maguire, (847) 372-1854, beth.maguire@benjaminmoore.com

C. PT-3 Concrete Block,
   1. Manufacturer: Benjamin Moore ULTRA SPEC® MASONRY ACRYLIC LATEX SATIN - FIL 452
   2. Color: AC-32 Pismo Dunes
   3. Primer typically not required. Previously painted surfaces may be primed or spot primed as necessary. For best hiding results, tint the primer to the approximate shade of the finish coat.
   4. One or two coats as required to cover.
   5. Rep: Beth Maguire, (847) 372-1854, beth.maguire@benjaminmoore.com

D. PT-4 Interior Plaster, Gypsum Board:
   1. Manufacturer: Benjamin Moore Muresco Ceiling White
   2. Color: 258 White
   3. One coat of Benjamin Moore Fresh Start All-Purpose 100% Acrylic Primer 023.
   4. Two coats cut & roll Benjamin Moore Muresco Ceiling White 258.
   5. Rep: Beth Maguire, (847) 372-1854, beth.maguire@benjaminmoore.com

E. PT-5 Interior Steel-Primed:
   1. Manufacturer: Benjamin Moore Advance Waterborne Interior Alkyd Satin – 792
   2. Color: tbd
   3. One or two coats as required to cover.
   4. Rep: Beth Maguire, (847) 372-1854, beth.maguire@benjaminmoore.com

F. PT-6 Interior Steel:
   1. Manufacturer: Benjamin Moore Ultra Spec 500 Interior Semi-Gloss N539
   2. Color: Deep Bronze (ready mix)
   3. Primer Ultra Spec HP Acrylic Metal Primer – HP04 as needed.
   4. Intermediate and top coats as required to cover.
   5. Rep: Beth Maguire, (847) 372-1854, beth.maguire@benjaminmoore.com

G. PT-6 Exterior Steel:
   1. Manufacturer: Benjamin Moore Ultra Spec Exterior – N448 Satin
   2. Color: Deep Bronze (ready mix)
   3. Primer Ultra Spec HP Acrylic Metal Primer – HP04 as needed.
   4. Intermediate and top coats as required to cover.
   5. Rep: Beth Maguire, (847) 372-1854, beth.maguire@benjaminmoore.com

H. PT-7 Exterior Wood & Fiber Cement Trim - Painted (Opaque):
   1. Manufacturer: Benjamin Moore Ultra Spec Exterior Satin - N448
   2. Color: tbd
   3. Fresh Start Multi-Purpose Latex Primer – N023
   4. One or two coats as required to cover.
   5. Rep: Beth Maguire, (847) 372-1854, beth.maguire@benjaminmoore.com

I. PT-8 Gypsum Board:
   1. Manufacturer: Benjamin Moore Ultra Spec 500 Interior Low Sheen N537
   2. Color: AC-32 Pismo Dunes
   3. One coat of primer sealer. Tint primer to half formula. Benjamin Moore Ultra Spec 500 interior latex primer N534
   4. Two coats of paint, cut & roll.
   5. Rep: Beth Maguire, (847) 372-1854, beth.maguire@benjaminmoore.com

J. PT-9 Concrete Block
   1. Manufacturer: Benjamin Moore ULTRA SPEC® MASONRY ACRYLIC LATEX SATIN - FIL 452
   2. Color: Deep Bronze (ready mix)
   3. Primer typically not required. Previously painted surfaces may be primed or spot primed as necessary. For best hiding results, tint the primer to the approximate shade of the finish coat.
   4. One or two coats as required to cover.
   5. Rep: Beth Maguire, (847) 372-1854, beth.maguire@benjaminmoore.com

3 EXECUTION

3.01 PREPARATION

A. Test old paint for lead before sanding, scraping, or removing. If lead is present, conform to procedures applicable when hazardous or contaminated materials are discovered.

B. Demo existing wallcovering and verify that substrates are completely dry, free of harmful substances, and in satisfactory condition to receive painting materials.

C. Extinguish pilot lights before painting with solvent-based paint.

3.1 EXAMINATION

A. Verify that [surfaces] [substrate conditions] are ready to receive work as instructed by product manufacturer.

   1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

   2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

   1. Notify the Designer about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.

   1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair. Prepare surface to a minimum Level 4 drywall finish.

C. Concrete and Unit Masonry Surfaces scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

D. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

E. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.

F. Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

G. Cleaning: Before applying paint or other surface treatments, clean the substrates of substrates that could impair the bond of the various coatings. Remove oil and grease before cleaning.

    1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

H. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

    1. Provide barrier coats over incompatible primers or remove and reprime.

    2. Cementitious Materials: Prepare concrete, concrete masonry block, surfaces to be painted. Remove loose mortar, 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 the paint manufacturer.

        b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before applications. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.

    3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.

        a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

4. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

5. Gypsum Board: Primer is not required on previously painted surfaces in good condition and similar color [for Super Spec C274] Remove any peeling or scaling paint and sand these areas to feather edges smooth with adjacent surfaces. Greasy walls and ceilings must be washed with a strong detergent solution. Prime new walls per manufacturer's instructions.

3.3 APPLICATION

A. Apply products in accordance with manufacturer's instructions. Use applicators and techniques best suited for substrate and type of material being applied.

B. Do not apply finishes to surfaces that are not dry.

C. Apply each coat to uniform finish.

D. Allow applied coat to dry before next coat is applied.

E. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

F. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

G. Prime concealed surfaces of interior and exterior woodwork with primer paint.

H. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.

I. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

J. Paint exposed surfaces of all new work whether or not colors are designated in Room Finish Schedule or Legend on the Drawings, except where a surface or material is specifically indicated not to be painted or is to remain natural. If the Schedule & Legend do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not the Schedule & Legend indicate colors. If the Schedule & Legend do not indicate color or finish, the Designer will select from standard colors and finishes available.

1. Painting includes field painting exposed bare and covered pipes, ducts, and conduit, except for required pipe identification, hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment in finished areas, except as otherwise indicated.

K. Access Panels and Electric Panelboards: Paint access panels and electric panelboards to match adjacent wall or ceiling.

L. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels, unless otherwise specified.

M. Painting will be required on following prefinished items that do not blend with color scheme.

1. Grilles.
2. Diffusers

N. Painting of Existing Surfaces: All room or areas that have been remodeled, altered, or patched shall have all existing surfaces repainted so as to completely redecorate such rooms or areas to match similar new surfaces specified to be painted or finished.

O. Wall rating designations shall be painted on fire and smoke barrier walls above the finished ceiling. Size and spacing shall be as required. Coordinate with Owner's Project Representative.

3.4 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and support except where items are prefinished.

1. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

C. Paint interior surfaces of air ducts, [and convector and baseboard heating cabinets] that are visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, [and convector and baseboard cabinets] to match face panels.

D. Paint exposed conduit and electrical equipment occurring in finished areas.

E. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

G. Wall rating designations shall be painted on fire and smoke barrier walls above the finished ceiling. Size and spacing shall be as required. Coordinate with Owner's Project representative.

3.5 CLEANING

A. Allow paint to dry 2 weeks before cleaning.

B. Clean interior and exterior surfaces exposed to view, clean debris from site.

C. Collect waste material that may constitute a fire hazard, place in closed metal containers and remove daily from site.

D. Deliver any extra materials to Owner, properly packaged and identified.

E. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping, using care not to scratch or otherwise damage finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting as acceptable by the Designer.

B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 SCHEDULES

A. See Drawings

END OF OUTLINE

Date:

SECTION 102113- SOLID PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes toilet compartments as follows:

1. Type: Solid Plastic (HDPE)
2. Compartment Style: Overhead braced and floor anchored.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Include plans, elevations, sections, details of installation, and attachments to other Work.

C. Samples: For each exposed finish and for each color and pattern required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. General Partitions Mfg. Corp.
2. Scranton Products
3. Bradley Corporation
4. Or approved equal.

2.2 MATERIALS

A. Doors, panels and pilasters to be 1" thick with homogeneous color throughout, constructed from high density polyethylene (HDPE) resins, which are, waterproof non-absorbent and have a self-lubricating surface that resists markings from pens, pencils and other writing instruments.

2.3 CONSTRUCTION

A. Doors, panels and pilasters shall be 1" thick with uniformly machined edges.

B. Doors and panels shall be 55" high and mounted at 14" above the finished floor.

C. Doors and panels to have an extruded aluminum heat sink strip attached to the lower edge.

D. Pilasters shall be 81-1/2" high finished height. Pilasters shall include a mounting system comprised of a one piece 304 stainless steel with #4 finish 3" high shoe with an integral plate in the bottom. The shoe shall be mounted to the floor utilizing concrete anchors supplied by Global Partitions. The concrete anchors shall be driven through the plate affixing it to the concrete floor. The concrete anchors shall have 27001bs of holding strength when used in 5000psi concrete flooring. The pilaster height shall be adjusted by utilizing the machine thread bolt supplied which is placed into a metal insert installed in the bottom of the pilaster at the manufacturing facility.

E. Pilasters are overhead braced with an extruded anti-grip aluminum headrail.

2.4 HARDWARE

A. Door hardware shall be as noted:
1. Heavy-duty diecast (vault) zamac hinge shall have gravity-acting cams and are fabricated from a die cast aluminum alloy with a brushed finish and wrap around flanges. The cam is constructed from a :Y." diameter nylon rod and a 3/8" stainless steel pin. Slide latch, strike/keeper and hinges are through-bolted onto doors and pilasters using stainless steel vandal-resistant through bolts. Hinges are easily adjusted at the jobsite to a full close or partially open position, as required. Keeper provides for emergency access into the stall by lifting up on the bottom of the door.

B. Panel and pilaster brackets shall be as noted:
1. Aluminum stirrup brackets shall be 2" long made of heavy-duty anodized extruded aluminum (6063-T5 Alloy). Stirrup brackets shall be 1/8" thick and mounted with stainless steel, vandal-resistant screws. Panels shall be attached with stainless steel, vandal-resistant through bolts. The attachment of brackets to the adjacent wall construction shall be accomplished with 2 Y," stainless steel vandal-resistant screws and plastic anchors.

C. Pilaster shoes shall be of a one piece design and integral to the mounting system and formed from #304 stainless steel 3" high with a #4 satin finish. Pilaster shoes are anchored to the pilaster with #10 stainless steel, vandal-resistant screws.

D. Headrail shall be made of heavy-duty anodized extruded aluminum (6063-T5 alloy). Headrail is anti-grip and attaches to the top of the pilaster with stainless steel, tamper-resistant screws. Headrail is attached to the adjacent wall construction with a headrail bracket.

E. Headrail brackets shall be made from a die cast aluminum alloy and shall be attached to the adjacent wall construction with 2 W stainless steel, tamper-resistant screws and plastic anchors.

2.5 FABRICATION

A. Toilet Compartments: Overhead braced and floor anchored.

B. Doors: Unless otherwise indicated, 30-inch- wide in-swinging doors for standard toilet compartments and 36-inch- wide out-swinging doors with a minimum 32-inch- wide clear opening for compartments indicated to be accessible to people with disabilities.

C. Door Hardware: Stainless steel. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be accessible to people with disabilities.

1. Hinges: Self-closing type, adjustable to hold door open at any angle up to 90 degrees.
2. Latches and Keepers: Recessed unit designed for emergency access and with combination rubber-faced door strike and keeper.
3. Coat Hook: Combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
4. Door Bumper: Rubber-tipped bumpers at out-swinging doors or entrance screen doors.
5. Door Pull: Provide at out-swinging doors. Provide units on both sides of doors at compartments indicated to be accessible to people with disabilities.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units rigid, straight, level, and plumb, with not more than 1/2 inch between pilasters and panels and not more than 1 inch between panels and walls. Provide brackets, pilaster shoes, bracing, and other components required for a complete installation. Use theft-resistant exposed fasteners finished to match hardware. Use Hex-type bolts for through-bolt applications.

B. All doors and panels to be mounted at 14" above the finished floor.

C. Clearance at vertical edges of door shall be uniform top to bottom.

D. No evidence of cutting, drilling and/or patching shall be visible on the finished work.

E. Finished surfaces shall be cleaned after installation and be left free of all imperfections.

END OF SECTION 102113

City of Sterling Heights - Dodge Park

Project Number 170402

SECTION 10 26 00

WALL AND DOOR PROTECTION

1 GENERAL

1.1 SECTION INCLUDES

A. Rigid wall protection.

1.2 SUBMITTALS

A. Product Data: Not required.

B. Samples: Not required.

C. Shop Drawings: Not required.

D. Maintenance data for wall protection system components.

E.

1.3 REFERENCES

A. Michigan Building Code.

B. American Society for Testing and Materials (ASTM).

C. Underwriters Laboratory (UL).

1.4 QUALITY ASSURANCE

A. Installer qualifications: Engage an installer who has no less than 3 years experience in installation of systems similar in complexity to those required for this project.

B. Manufacturer’s qualifications: Not less than 5 years experience in the production of specified products and a record of successful in-service performance.

C. Code compliance: Assemblies should conform to all applicable codes including IBC, and Life Safety.

D. Fire performance characteristics: Provide wall protection system components with UL label indicating that they are identical to those tested in accordance with ASTM-E84-01 for Class 1 characteristics listed below.
   1. Flame spread: 25 or less.
   2. Smoke developed: 450 or less.

E. Impact Strength: Provide assembled wall protection units that have been tested in accordance with the applicable provisions of ASTM F476-76.

F. Chemical and stain resistance: Provide wall protection system components with chemical and stain resistance in accordance with ASTM D-1308.

G. Color Match: Provide wall protection components that are color matched in accordance with the following:
   1. Delta E difference of no greater than 1.5 using the Hunter (Lab) Scale. (Specifier note: Construction Specialties' colors are matched under cool white fluorescent lighting and computer controlled within manufacturing tolerances. Color may vary if alternate lighting sources are present.)

H. Single source responsibility: Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.

I. Environmental Requirements: PVC free products

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging with labels clearly indicating manufacturer and material.

B. Storage: Store materials indoors in a clean, dry area protected from damage and in accordance with manufacturer's instructions. Material must be stored flat.

C. Store materials in original, undamaged packaging in a cool, dry place out of direct sunlight and exposure to the elements. A minimum room temperature of 40°F (4°C) and a maximum of 100°F (38°C) should be maintained.

D. Handling: Protect materials during handling and installation to prevent damage.

1.6 PROJECT CONDITIONS

A. Materials must be acclimated in an environment of 65° - 75°F (18° - 24°C) for at least 24 hours prior to beginning the installation. .

B. Maintain wall and door surface temperature between 65 and 85 degrees (F) during installation.

C. Do not install if relative humidity is greater than 80%.

D. Installation areas must be enclosed and weatherproofed before installation commences.

2 PRODUCTS

2.1 MANUFACTURERS

A. WP-1 Acrovyn Wall Protection System by Construction Specialties, Inc., Muncy, PA, Mississauga, Ontario

1. 4’x8’ or 4’x10’ rigid sheet
2. CS Acrovyn 40000 .040N Sheet
3. Standard Suede texture
4. Color: 929 Oyster Gray
5. Top cap/wainscot trim to match.

2.2 ADHESIVES

A. Furnish adhesives approved by wall and door protection manufacturer.

2.3 FABRICATION

A. General: Fabricate wall protection systems to comply with requirements indicated for design, dimensions, detail, finish and member sizes.

3 EXECUTION

3.1 EXAMINATION

A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
   1. Do not proceed until unsatisfactory conditions have been corrected.

B. Inspect surfaces to receive wall and door protection. Notify the Designer in writing if wall surfaces are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.2 SURFACE PREPARATION

A. Surface preparation: Prior to installation, clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as required by manufacturer’s instructions.
B. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer’s installation instructions.

3.3 INSTALLATION

A. Install wall and door protection in accordance with manufacturer’s written instructions using only approved mounting hardware, and locating all components firmly into position, level and plumb.

B. Temperature at the time of installation must be between 65° - 75°F (18° - 24°C) and be maintained for at least 48 hours after the installation.

C. Adjust panels to ensure tight seams.

D. Install wall and door protection plumb and at [full height] [height as indicated on the drawings], with surfaces free from distortion.

3.4 CLEANING

A. Clean wall and door protection in accordance with manufacturer’s instructions.

B. Remove excess adhesive.

C. Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.

D. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

END OF OUTLINE

Date:

SECTION 102800 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Toilet and bath accessories.
2. Underlavatory guards.
3. Warm-air dryers
4. Framed mirrors.
5. Illuminated mirrors

1.2 CORRODINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use room and product designations indicated on Drawings.

1.4 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace mirrors that develop visible silver spoilage defects within 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Products: The design for toilet and bath accessories described in Part 2 are based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Toilet and Bath Accessories:

   a. American Specialties, Inc.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.

2. Underlavatory Guards:

   a. Brocar Products, Inc.
   b. Truebro, Inc.

3. Warm Air Dryers:
   a. Excel Dryer, Inc.
4. Illuminated Mirrors:
   a. Aamsco, Inc.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, No. 4 finish (satin), 0.0312-inch minimum nominal thickness, unless otherwise indicated.

B. Brass: ASTM B 19, ASTM B 16, or ASTM B 30 castings.

C. Steel Sheet: ASTM A 366/A 366M, 0.0359-inch minimum nominal thickness.

D. Galvanized Steel Sheet: ASTM A 653/A 653M, G60.

E. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

F. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.

G. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.

H. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

I. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

J. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

2.3 TOILET AND BATH ACCESSORIES

A. Toilet Tissue Dispenser **(T.P.D.-1)**:

1. Basis-of-Design Product: Bobrick, Model #B-2892 Double Jumbo-Roll

2. To be used in all public toilet rooms

B. Toilet Tissue Dispenser **(T.P.D.-2)**:

1. Basis-of-Design Product: Bobrick, Model #B-2888 Double Roll

2. To be used in Amphitheater toilet rooms

C. Liquid-Soap Dispensers:

1. See plumbing drawings

D. Grab Bars:

1. Basis-of-Design Product: Bobrick, Model #B-6806 series, sizes as indicated.

E. Mirror Units:

1. Basis-of-Design Product: Bobrick, Model #B-165 series, sizes as indicated.

F. Illuminated Mirror Units:
1. Aamsco, Forte-8060 Backlit LED

G. Surface Mounted Waste Receptacles:
1. Basis-of-Design Product: Bobrick, Model #B-5277

H. Surface Mounted Sanitary Napkin Disposal:
1. Basis-of-Design Product: Bobrick, Model #B-5270

I. Horizontal Baby Changing Station
1. Basis-of-Design Product: Koala Kare, Model #KB200

J. Underlavatory Guards:

1. Insulating Piping Coverings: White, antimicrobial, molded-vinyl covering for supply and drain piping assemblies intended for use at accessible lavatories to prevent direct contact with and burns from piping. Provide components as required for applications indicated with flip tops at valves that allow service access without removing coverings.

K. Warm Air Hand Dryer:
1. Basis-of-Design Product: Excel Dryer, Model #XL-BW

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Install grab bars to withstand a downward load of at least 250 lbs when tested according to method in ASTM F 446.

B. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items. Remove temporary labels and protective coatings.

END OF SECTION 102800

SECTION 104413 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes fire-protection cabinets.

B. Portable Fire Extinguishers shall be provided by Owner.

1.2 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.

1. Cabinets: Include door hardware, cabinet type, trim style, panel style, and details of installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum: ASTM B 209 sheet and ASTM B 221 extrusions, alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated.

2.2 FIRE-PROTECTION CABINETS

A. Basis-of-Design Product: The design for systems is based on the following:

1. J. L. Industries, Inc.'s, Academy Series, Model #1025B17

B. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Larsen's Manufacturing Company.
2. Architect Approved Manufacturer

C. Fire Protection Cabinet General Requirements:

1. 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.

a. Cabinet Metal: Aluminum sheet.

2. Cabinet Type: Suitable for fire extinguisher.
3. Cabinet Mounting: Surface Mounted
4. Cabinet Trim Style: Rolled edge trim and aluminum tub of aluminum extrusions, riveted.
5. Cabinet Trim Material: Manufacturer's standard aluminum sheet.
6. Door Material: Manufacturer's standard aluminum sheet.
7. Door Glazing: Manufacturer's standard, as follows:

    a. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, Class 1 (clear).

8. Door Style: Manufacturer's standard design vertical duo panel with frame.
9. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.

10. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide lever handle design with cam-action latch equivalent to J. L. Industries, Inc.'s, "SAF-T-LOK". Provide continuous-type hinge permitting door to open 180 degrees.

11. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Locate as directed by Architect.

    a. Identify fire extinguisher in cabinet with the words "FIRE EXTINGUISHER" applied to door.

        1) Application Process: Manufacturer's standard process.
        2) Lettering Color: Red.
        3) Orientation: Vertical.

2.3 FINISHES

A. Aluminum Anodic Finish: Class II, clear anodic coating complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine roughing-in for hose valves, hose racks, and cabinets to verify actual locations of piping connections before cabinet installation.

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.

C. Adjust cabinet doors that do not swing or operate freely.

D. Refinish or replace cabinets and doors damaged during installation.

END OF SECTION 104413

SECTION 105020-CANOPIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Building supported, pre-engineered metal canopies including fascia channels, decking, tension rods, and attachment hardware.

1.2 REFERENCES

A. Aluminum Association (AA)DAF 45 - Designation System for Aluminum Finishes

B. American Architectural Manufacturers Association (AAMA)
1. 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Architectural Extrusions and Panels.

C. American Society of Civil Engineers (ASCE) 7 - Minimum Design Loads for Buildings and Other Structures.

D. ASTM International (ASTM)
1. B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
2. B429 - Standard Specification for Aluminum-Alloy Extruded Pipe and Tube

1.3 SYSTEM DESCRIPTION

A. Design Requirements: Design canopy system to withstand:
1. Standards for wind pressure, snow load, and drifting snow load in accordance with current adopted form of the Uniform Construction code or accepted requirements of local municipality.

1.4 QUALITY ASSURUANCE

A. Installer Qualifications: Minimum 5 years experience in installation of pre-manufactured canopies.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Contract Documents are based on: Extrudeck Series, MASA Architectural Canopies, 21 Randolph Ave. Avenel, NJ 07001, 800-761-7446 www.architecturalcanopies.com.

B. Acceptable Alternates: As approved by Architect

2.2 MATERIALS

A. Aluminum Extrusions:
1. ASTM B221& ASTM B429 6063-T5 alloy and temper.

B. Hardware:
1. All fasteners shall be stainless steel or zinc coated for corrosion resistance.

2.3 COMPONENTS

A. Framing:
1. Type: Extruded aluminum “J” channel fascia
2. Size: 8” x .125”

B. Canopy Supports: Extruded Aluminum Canopy Support “I” Beam

C. Decking: 3” x 6” x .090” Interlocking Extruded aluminum flat soffit decking

D. Attachment: 1.050” diameter steel hanger rod, finished to match canopy. Square wall plates.

E. Fascia Profiles: 8” Standard “J” Frame

F. Other Components: other components as indicated or as required for system attachment and performance.

2.4 FABRICATION

A. Fabricate canopy system in accordance with approved Shop Drawings
1. Kit canopies to be mechanically assembled with shear stress strength as per engineering. Pre- assembled canopies are shop welded by MASA approved personnel.
2. Drainage system to be concealed type. Covered surfaces direct water to field drilled drain, to be coordinated at site.

2.5 FINISHES

A. Aluminum:
1. Pre- Treatment: Pre-treat to ASTM D1730 type B, Method 5 using a multi stage chromate process or an approved chrome- free pretreatment process approved by powder coating manufacturer for optimized weather resistance.
2. Finish coat: AAMA 2603 Thermosetting Polyester Resin-based Powder
3. Source: Tiger Drylac powder coating or equivalent.
4. Color: To be selected by architect from manufacturers standard color range

PART 3 - EXECUTION

3.1 FIELD DIMENSIONS

A. Field verify dimensions of supporting structure at site of installation prior to fabrication.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved Shop Drawings.

B. Install components plumb and level, in proper plane, free from warp and twist.

C. Anchor system to building components; provide adequate clearance for movement caused by thermal expansion and contraction and wind loads.

3.3 ADJUSTING

A. Touch up minor scratches and abrasions on finished surfaces to match original finish.

B. Clean with mild, non-abrasive solution and a cotton cloth under low pressure.

END OF SECTION 105020

SECTION 111319-LOADING DOCK EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Loading Dock equipment in this section includes:
   1. Dock levelers.

1.2 RELATED SECTIONS

A. Section 03100 - Concrete Forms and Accessories: Placement of anchors into concrete.

B. Section 03300 - Cast-In-Place Concrete

C. Section 05500 - Metal Fabrications: Metal angles for edge of dock.

1.3 REFERECNES

A. American National Standards Institute (ANSI):
   1. ANSI MH30.1- Industrial Loading Dock Boards (Ramps).
   2. ANSI MH29.1- Industrial Scissor Lifts.
   3. ANSI MH30.3- Vehicle Restraining Devices (Safety, Performance, and Testing)

1.4 SUBMITTALS

A. Product Data: For each product specified.
   1. Bumpers: Indicate unit dimensions, method of anchorage, and details of construction.
   2. Levelers: Indicate materials and finish, installation details, roughing-in measurements, and operation of unit.

B. Shop Drawings: Include plans, elevations, sections, details of installation, and attachments to other Work.

C. Assurance/Control Submittals:
   1. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
   2. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

1.5 QUALITY ASSURANCE

A. Dock Levelers: Conform to requirements of ANSI MH30.1.

B. Vehicle Restraining Devices: Conform to requirements of ANSI MH30.3.

C. Manufacturer's Qualifications:
1. Manufacturer specializing in manufacturing Products specified with minimum 30 years' experience.
2. Manufacturer to have quality assurance improvement programs.
3. Manufacturer shall be associated with Loading Dock Equipment
4. Manufacturers (LODEM) setting ANSI standards.
5. Manufacturers welding procedure compliant with A.W.S.D1 .1 specifications

1.6 WARRANTY

A. Warranty: Provide manufacturer's standard warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Blue Giant Equipment Corp., which is located at: 85 Heart Lake Rd. S., Brampton, ON, Canada L6W 3K2 Toll Free Tel: 800-668-7078 Tel: 905-457-3900

B. Acceptable Alternative: As approved by Architect

2.2 MECHANICAL DOCK LEVELERS

A. Mechanical Dock Levelers: Edge-of-Dock (EOD) Series Dock Levelers, Model MDC-M as manufactured by BLUE GIANT.
1. Type: Mechanical edge-of-dock, hinged dock leveler welded to 8 inches (203 mm) pour-in channel embedment within foundation dock face and comes complete with wall mounted bumper blocks. Deck length includes 15 inches (381 mm) lip when extended.
a. Model MDC7220M: 72 inches (1829 mm) W by 27 inches (686 mm) L.
2. Function:
a. Vertical Travel: Working range up to 5 inches (127 mm) above and below dock level.
b. Automatic Vertical Compensation: Unit provides float up to 5 inches (127 mm) above and below dock level.
c. Lip Operation: Lip automatically extends as unit is lowered onto truck bed. Lip is returned to stored position upon truck's departure. The length of the lip shall not be less than 15 inches (381 mm) overall length.
3. Operation:
a. Mechanical Model: Pulling the removable comfort grip handle back raises the spring-assisted deck to a vertical position. Pushing the comfort grip handle forward lowers deck, and lip automatically extends.
4. Rated Capacity:
a. Welding procedure compliant with A.W.S.D1.1 specifications. ANSI/NFPA70 approved electrical components. Dock Leveler capacities available from 20,000lb to 30,000lb (9,090 kg to 13,636 kg).
5. Finish and Color:

a. Unit painted factory standard grey color. Deck and lip constructed out of high tensile steel. Four way diamond tread plate. Grease fittings on lips on capacities 25,000 lb (11,363kg) and 30,000 lb (13,636kg).

6. Warranty: Warranties are subject to standard limitations on liability. Consult manufacturer for full details on warranty information and product registration.
7. Standard Accessories:
   a. Night Locks.
   b. Standard, two model DB411 laminated bumpers 14 inches (356 mm) W by 10 inches (254 mm) H by 4.5 inches (114 mm) D.
   c. 15 inch (381 mm) lip

PART 3 - EXECUTION

3.1 EXAMINIATION

A. Verification of existing conditions before starting work.

B. Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive work.

3.2 INSTALLATION

A. Install dock leveler and/or dock lift unit in prepared opening in accordance with manufacturer's instructions.

B. Set square and level.

C. Anchor unit securely, flush with dock. Weld back of dock leveler to pit frame. Touch-up welds with matching paint.

D. Install dock bumpers in accordance with manufacturer's instructions.

3.3 ADJUSTING

A. Adjust installed unit for smooth and balanced operation.

END OF SECTION 111319

SECTION 129302-BOLLARDS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Removable Bollards.
   2. Fixed Bollards.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product literature, including color charts and installation details.

1.3 QUALITY ASSURANCE

A. Performance: Removable bollard shall remove completely from the base unit. The bollard body shall be no more than eight (8) inches below grade to allow for minimal lifting efforts (excludes ASTM and DOS units).

B. Performance: For Fixed Bollards, provide bollards which install as a single unit in a pier footing or as an array in a continuous footer installation with specified dimensions and is secured in the ground.

C. Manufacturer: Bollard units of all types must be supplied by a single manufacturer having the resources to provide consistent quality in appearance and physical properties.

D. Materials: Steel shall be US domestic mill certified steel. The main body of the product must be constructed from ASTM A500 steel and be accompanied with steel mill certifications/test reports for the steel being used to ensure the durability and performance of the product. Secondary and non-ASTM steel may not be substituted.

1.1 DELIVERY, STORAGE AND HANDLING

A. Package units appropriately to protect finish. Inspect materials to ensure that specified materials have been received.

B. Store units to avoid damage from moisture, abrasion, and other construction activities..

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis for Design: Blue Ember Technologies, LLC. MaxiForce Bollards line of products, Sykesville, MD 21784, Tel 410-552-9888, Fax 410-552-9939, Website: http://www.maxiforcebollards.com

B. Acceptable alternates: As approved by Architect.

2.2 REMOVABLE BOLLARDS

A. Removable Bollards: Provide MaxiForce Removable Bollards by Blue Ember Technologies.
   1. Body Style:
      a. MRRP Round Style, Padlock Operated.
   2. Head Style: Removable and interchangeable.
      a. RS1 - Round Style 1 Head for Round or HD Body Style.
   3. Base Type: As required for installation.
      a. R - Removable.
   4. Padlock Operated Unit (without wrench operation): Unlock and remove the padlock to allow the bollard to be removed. Reverse the sequence to return bollard to its original and locked position. Bollard may be returned to its original locked position without the use of any tools or other devices.
   5. Materials: Free from surface blemishes and defects where exposed to view in the finished installation.
      a. Steel Plate: A36; ASTM A36/A36M.
      b. Steel Tube: A500; ASTM A500.
      c. Stainless components: Series 300 Stainless Steel
      d. Fasteners: Series 300 Stainless Steel.
   6. Finish: Factory applied after surface imperfections removed and exposed faces of welded joints dressed smooth.
      a. Powder Coat Finish (Standard): Factory applied TIGER Drylac Powder Coatings Essentials Chart color or equivalent.
      b. Base (Ground Sleeve) Units: Powder coated with a black textured powder coating to help reduce slippery surfaces when the bollard units are removed.

2.3 FIXED BOLLARDS

A. Fixed Bollards: Provide MaxiForce Fixed Bollards by Blue Ember Technologies.
   1. Body Style: MFS Standard (rectangular) Style.
      a. SS1 - Standard Style 1 Head for Standard Body.
   2. Body Style: MFR Round Style.
      a. RS1 - Round Style 1 Head for Round Body.
   3. Materials: Free from surface blemishes and defects where exposed to view in the finished installation.
      a. Steel Plate: A36; ASTM A36/A36M.
      b. Steel Tube: A500; ASTM A500.
      c. Fasteners: Series 300 Stainless Steel.
   4. Finish: Factory applied after surface imperfections removed and exposed faces of welded joints dressed smooth.
      a. Powder Coat Finish (Standard): Factory applied TIGER Drylac Powder

PART 3 - EXECUTION

3.1 INSTALLATION

A. A.Comply with manufacturer's recommendations for installation and approved submittals and the following:
   1. Install bollards level and true and in proper relation to adjacent surfaces.
   2. Install base units with top plate flush with the finished surface to avoid tripping hazard.
   3. Insert bollard into base unit after the base is leveled and cured.
   4. Test for proper operation and adjust if necessary.

B. Protect bollards from damage during construction operations.

END OF SECTION 129302

SECTION 131800-DASHER BOARDS (SOCCER)

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes glazing for the following products and applications:
   1. Manufacture, supply and installation of a complete factory prefabricated, arena board system.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings:
   1. Shop drawings shall bear the professional stamp and signature of a professional engineer licensed to design structures in the jurisdiction of manufacture.
   2. Shop drawings shall show, in appropriate scale, dimensions, details of arena board system, methods of joining, fastening, joint locations, methods of anchoring, sizes of anchorage's, hardware, details of other pertinent components of the work, and adjacent constructions to which work of this Section will be attached.
   3. Shop drawings shall indicate dimensioned layout and placement drawings for installation of floor anchors.

C. Samples:
   1. Submit samples of materials, finishes and colors for review.

D. Operation and Maintenance Data:
   1. On completion of installation, supply three copies of instructions covering removal and replacement of panel system, adjustments and other relevant operating and maintenance data.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Arena board system shall be provided by a firm having satisfactory experience in manufacturing and installing arena boards, using persons trained and skilled in the type of work required for both manufacturing and installing. Provide references and a completed jobs list that match the scope of this project.

1.4 WARRANTY

A. Warrant the work of this Section against defects in materials and workmanship for a period of two (2) years from the date of substantial completion of the contract. Misuse, abuse and/or accident not caused by normal use is excluded. Glass breakage is excluded. Board

misalignment from ice build-up underneath, excessive ice edge or ice thickness beyond 1-1/2" is excluded. Exclusions are considered maintenance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis for Design:
   1. Athletica Sport Systems , 554 Parkside Drive, Waterloo, Ontario, Canada N2L 5Z4 Phone: 519.747.1856 Fax: 519.747.3659 - AND -17200 Medina Rd., Suite 600, Minneapolis, Minnesota, USA 55447 Phone: 763.249.7465 Fax: 763.249.7475 www.SportSystemsCorp.com
   2. Acceptable alternates:
      a. As approved by Architect

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B221, 6005-T5 or T6 alloy and temper

B. High Density Polyethylene (HDPE): High impact, integrally colored, high-density polyethylene, bright white and other colors as specified, ½" thickness.

2.3 FABRICAITON

A. General:
   1. As far as practical, execute fitting and assembly in the shop with the various parts or assemblies ready for erection at the project site.
   2. Accurately fit together all joints, corners and intersections. Match components carefully to produce continuity of line and design.
   3. Provide devices for anchoring the assemblies to the substrate with adjustment to permit correct and accurate alignment.
   4. Fabricate anchoring devices required to secure the work of this Section. Supply anchors and layout drawing.
   5. System components shall be numbered for ease of installation, disassembly, and reinstallation.

2.4 SYSTEM DESCRIPTION FOR BASE BID REQUIREMENTS

A. Arena Panels
   1. Arena panels shall be factory prefabricated in demountable sections. The design of all panels whether straight, curved or in which a gate is located shall be similar. Each panel to be 42" in height, and shall be made of extruded structural aluminum box sections assembled into frames using high strength fasteners. Aluminum to be mill finish. Frames

shall allow for fastening of the HDPE facing and anchoring at base. Ensure flush mating of the HDPE facing at arena panel joints.

2. Typical sections shall consist of a minimum two vertical posts and three horizontal stringers. Frames shall be connected end to end with heavy duty, 5/8" (16mm) bolts and shall be connected to rink slab/perimeter concrete structure with minimum 5/8" (16mm) threaded rods and nuts or bolts, epoxied into the perimeter concrete.
3. Cladding: Panels to be clad with ½" (12mm) white High Density Polyethylene (HDPE) facing the full height of each panel, and with ½" (12mm) color impregnated HDPE cap rail and kickplate, color to be selected from standard options (red, blue, yellow and gold). Both edges of cap rail shall have a smooth and radiused edge. Top edge of kick plate to have a radiused edge.
4. The HDPE facing shall be attached to the arena board framing with ¼" (6 mm) diameter screws. Screws to be zinc-plated or stainless steel. Heads of screws shall be painted to color match the facing, kick plate or top cap as appropriate, or if stainless steel, may be left unpainted. Spacing of the screws shall not exceed 9" (225 mm) on center.
5. Color extensions of red and blue game lines shall be colored HDPE strips inlaid flush to the HDPE facing and inlaid flush to the HDPE kickplate in conformance with rink layout requirements per governing bodies.

B. Gates:
1. Access gates in locations as shown on drawings, with 1" (25mm) and 1-1/2" (37mm) thick replaceable White HDPE Thresholds. Access gates shall be built into standard 8'-0" (2440mm) sections and shall be 3'-0" (914mm) wide, left or right hand swing. Gate latch shall be a single latch type. Double access gates shall be double gates incorporated into a standard 8' 0" (2438mm) panel, with locking hardware similar to equipment gates.
2. Provide a flush mounted push-button latch release in the cap rail on the ice entrance gates where shields would otherwise prevent latch operation. The push-button shall be designed to be simple to operate from both sides of the shielding gates, yet prevent accidental opening.
3. Provide "Gate Levelling Screws" at all gate locations.

C. Board Anchors:
1. All arena boards shall be tightly fastened to the perimeter slab by means of zinc plated bolts or threaded rods and nuts. Anchors: Galvanized Steel or Zinc plated, permanent drilled on site anchor bolt system for securing to concrete substrate. Threaded rod and nuts for perimeter curb installation.
2. The dasher board manufacturer shall provide a supervisor on site during the concrete pour to ensure anchor integrity. Snap in plugs or threaded plugs with flush tops to fill the anchors when the boards are removed are provided with removable systems.

D. Gap Closures:
1. Provide 2-piece HDPE angle between the boards and all raised areas behind the boards and / or as shown on drawings.

E. Protective Netting:
1. Install Black Nylon protective netting, 12'-0" high or as shown on drawings.
2. Install all protective netting on conduit.

2.5 MAINTENANCE / EXTRA MATERIALS

A. Supply, in addition to quantities required for the Work, extra materials and products to be stored by the Owner as follows:
   1. Fifty additional painted screws of each color required for fastening of HDPE facings.
   2. One extra piece of tempered glass shielding of each standard size required.
   3. Deliver extra stock to Owner in cartons or wooden crates clearly labelled to identify contents. Place extra stock in the designated storage area where directed.

PART 3 - EXECUTION

3.1 EXAMINIATION

A. Before commencing erection and installation, examine the work of other Sections to which the work of this Section will be attached.

B. Report immediately in writing to the Contractor/Architect/Engineer, all discrepancies in accuracy and suitability, conditions that will adversely affect the installation and permanency of the work of this Section.

3.2 INSTALLATION

A. General
   1. Provide a complete installation of the board system by the manufacturer or manufacturer approved dealer in accordance with the drawings and specifications.

B. Gates
   1. Provide quantity and location of equipment and access gates as indicated on the drawings.

3.3 ADJUSTING

A. Upon completion of the Work of this Section, inspect, test and adjust installation.

B. Test all operable elements and ensure easy and smooth operation

C. Upon completion of installation do a general cleanup.

3.4 CLEANING

A. Final cleaning to be carried out as part of General Conditions.

END OF SECTION 131800

SECTION 133419-METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes metal building systems:
   1. Structural steel framing system.
   2. Metal roof system.
   3. Metal wall system.

1.2 REFERENCED STANDARDS

A. American Institute of Steel Construction (AISC):
   1. AISC 360 - Specification for Structural Steel Buildings.
   2. B. AISC 341 – Seismic Provisions for Structural Steel Buildings (when appropriate).
   3. AISC Design Guide 3 – Serviceability for Steel Buildings

B. AISC Design Guide 3 – Serviceability for Steel Buildings
   1. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.

C. American Welding Society (AWS):
   1. AWS D1.1 / D1.1M – Structural Welding Code – Steel.
   2. AWS D1.3 / D1.3M – Structural Welding Code – Sheet Steel.

D. Association for Iron & Steel Technology (AISE):
   1. AISE 13 – Specifications for Design and Construction of Mill Buildings.

E. ASTM International (ASTM):
   1. ASTM A 325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
   2. ASTM A 653 / A 653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   3. ASTM A 792 / A 792M – Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
   4. ASTM B 117 – Standard Practice for Operating Salt Spray (Fog) Apparatus.
   5. ASTM C 518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   6. ASTM C 1363 – Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.
   7. ASTM D 522 – Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
   8. ASTM D 523 – Standard Test Method for Specular Gloss.
   9. ASTM D 968 – Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.

10. ASTM D 1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
11. ASTM D 2244 – Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
12. ASTM D 2247 – Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
13. ASTM D 2794 – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
14. ASTM D 3361 – Standard Practice for Unfiltered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
15. ASTM D 4214 – Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
16. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
17. ASTM E 96 / E 96M – Standard Test Methods for Water Vapor Transmission of Materials.
18. ASTM E 1592 – Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
19. ASTM G 87 – Standard Practice for Conducting Moist SO2 Tests.

F. FM Global:
1. FMRC Standard 4471 – Approval Standard for Class 1 Roofs for Hail Damage Resistance, Combustibility, and Wind Uplift Resistance.

G. Metal Building Manufacturers Association (MBMA):
1. MBMA Metal Building Systems Manual.
2. Seismic Design Guide for Metal Building Systems.

H. The Society for Protective Coatings (SSPC):
1. SSPC-Paint 15 - Primer for Use Over Hand Cleaned Steel performs to SSPC-Paint 15 standards.
2. SSPC-SP2 – Hand Tool Cleaning.

I. Underwriters Laboratories (UL):
1. UL 580 – Standard for Tests for Uplift Resistance of Roof Assemblies.
2. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.

1.3 PERINSTALLATION MEETINGS

A. Convene pre-installation meeting 2 weeks before start of installation of metal building system.

B. Require attendance of parties directly affecting work of this section, including Contractor, Architect, Engineer, installer, and metal building system manufacturer’s representative.

C. Review materials, installation, protection, and coordination with other work.

1.4 SUBMITTALS

A. Product Data: Submit metal building system manufacturer's product information, specifications, and installation instructions for building components and accessories.

B. Erection Drawings: Submit metal building system manufacturer's erection drawings, including plans, elevations, sections, and details, indicating roof framing, transverse cross-sections, covering and trim details, and accessory installation details to clearly indicate proper assembly of building components.

C. Certification: Submit written "Certificate of design and manufacturing conformance" prepared and signed by a Professional Engineer, registered to practice in the State of Michigan verifying that the metal building system design and metal roof system design (including panels, clips, and support system components) meet indicated loading requirements and codes of authorities having jurisdiction.
   1. Certification shall reference specific dead loads, live loads, snow loads, wind loads/speeds, tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads, end-use categories, governing code bodies, including year, and load applications.
   2. Submit certification 1 week before bid date on the metal building system manufacturer's letterhead.

D. Dealer Certification: Submit certification 1 week before bid date that the metal building system supplier or metal roof system supplier is a manufacturer's authorized and franchised dealer of the system to be furnished.
   1. Certification shall state date on which authorization was granted.

E. Installer Certification: Submit certification 1 week before bid date that the metal building system or roof system installer has been regularly engaged in the installation of building systems of the same or equal construction to the system specified.

F. Warranty Documentation: Submit manufacturer's standard warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Manufacturer regularly engaged, for past 10 years, in manufacture of metal building systems of similar type to that specified.
   2. Accredited based on IAS Accreditation Criteria AC472 and requirements in International Building Code (IBC), Chapter 17.

B. Installer's Qualifications:
   1. Installer regularly engaged, for past 5 years, in installation of metal building systems of similar type to that specified.
   2. Employ persons trained for installation of metal building systems.

C. Certificate of design and manufacturing conformance:
   1. Metal building system manufacturer shall submit written certification prepared and signed by a Professional Engineer, registered to practice in the State of Michigan verifying that building system design and metal roof system design (including panels,

clips, and support system components) meet indicated loading requirements and codes of authorities having jurisdiction.
2. Certification shall reference specific dead loads, live loads, snow loads, wind loads/speeds, tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads, end-use categories, governing code bodies, including year, and load applications.
3. Certificate shall be on metal building system manufacturer's letterhead.
4. Refer to Submittals article of this specification section.

D. Material Testing:
1. In addition to material certifications of structural steel, metal building system manufacturer shall provide, upon request at time of order, evidence of compliance with specifications through testing.
2. This quality assurance testing shall include testing of structural bolts, nuts, screw fasteners, mastics, and metal coatings (primers, metallic coated products, and painted coil products).

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage and Handling Requirements:
1. Store and handle materials in accordance with manufacturer's instructions.
2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
3. Do not store materials directly on ground.
4. Store materials on flat, level surface, raised above ground, with adequate support to prevent sagging.
5. Protect materials and finish during storage, handling, and installation to prevent damage

1.7 WARRANTY

A. Metal building system manufacturer shall provide a written weathertightness warranty for a maximum of 25 years against leaks in standing seam roof panels, arising out of or caused by ordinary wear and tear under normal weather and atmospheric conditions.
1. Warranty shall be signed by both the metal roof system manufacturer and the metal roof system installer.
2. Maximum liability of warranty shall be no less than $0.70 per square foot of roof area

B. Metal building system manufacturer shall provide a paint film written warranty for 25 years against cracking, peeling, chalking, and fading of exterior coating on painted roof and wall panels.
1. Warranty shall be signed by metal building system or roof system manufacturer and state that the coating contains 70 percent "Kynar 500" or "Hylar 5000" resin.
2. Metal building system manufacturer shall warrant that the coating shall not peel, crack, or chip for 25 years.

3. For a period of 25 years, chalking shall not exceed ASTM D 4214, #8 rating and shall not fade more than 5 color difference units in accordance with ASTM D 2244.

C. Metal Building System Manufacturer's Certification: Metal building system manufacturer shall submit a signed written Certification 1 week before bid date, stating that the metal roof system manufacturer or approved representative will provide warranties and Inspection and Report Service specified in this specification section.
1. Warranty terms shall be submitted with bid.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis for Design:
1. Metal Building System Manufacturer: Butler Manufacturing, PO Box 419917, Kansas City, Missouri 64141. Phone 816-968-3000. Website www.butlermfg.com.

B. Acceptable Alternates:
1. Rhino Steel Building Systems
2. Rigid Global Buildings
3. Nucor Building Systems
4. Armstrong Steel Building Systems
5. Equal as approved by Architect

2.2 BUILDING DESCRIPTION

A. Building Dimensions: Indicated on the Drawings.
1. Horizontal Dimensions: Measure to inside face of wall sheets.
2. Eave Height: Measure from top of finished floor to intersection of insides of roof and sidewall sheets.
3. Clear Height Between Finished Floor and Bottom of Roof Beams: Indicated on the Drawings.

B. Primary Structural Members:
1. Primary Framing System: Steel framing system as specified in this specification section.
2. Frames: Welded-up plate section columns and roof beams, complete with necessary splice plates for bolted field assembly as specified in this specification section.
3. Bolts for Field Assembly of Primary Steel: High-strength bolts as indicated on erection drawings of metal building system manufacturer.
4. Beam and Post Endwall Frames: Endwall corner posts, endwall roof beams, and endwall posts as required by design criteria.
5. Exterior Columns: Welded-up "H" sections or cold-formed "C" sections.
6. Connection of Primary Structural Members: ASTM A 325 bolts through factory-punched holes.
7. Primary Structural Members: Paint with metal building system manufacturer's standard primer with surface preparation as specified in this specification section.

C. Secondary Structural Members:
1. Secondary Framing System: Manufacturer's framing system as specified in this specification section.
2. a. C/Z Purlins and Girts: Acrylic-coated G30 galvanized finish.
b. Truss Purlins: Acrylic-coated G30 galvanized finish.

D. Metal Roof System: metal roof system as specified in this specification section.

E. Where metal panels are required to be painted, use coating system as specified in this specification section.

2.3 DESIGN REQUIREMENTS

A. Governing Design Code:
1. Structural design for the building structural system shall be provided by the metal building system manufacturer for the following design criteria:
a. Governing Code: 2015 Michigan Building Code

B. Roof Live Load:
1. Roof live loads are loads produced during the life of the structure by moveable objects.
2. Wind, snow, seismic, or dead loads are not live loads.
3. Roof live loads are applied based on the Tributary Area as stated in code.

C. Roof Snow Load:
1. Roof snow load used for designing the structure shall not be reduced and shall be the product of the following criteria:
a. Snow Load Coefficient (Ce): 1.2 (sheltered)
b. Thermal Factor (C_t): _1.2 (unheated)_____
c. Snow Importance Factor (I): 1.0
d. Ground Snow Load (Pg): 25 psf
e. Roof Snow Load (Pf): 25.2 psf.
2. Design snow load shall include the effects of minimum flat roof load limits, rain on snow, drifting snow, and unbalanced snow load as defined in the governing building code specified above.

D. Wind Load:
1. Wind load used for designing the structure shall be the product of the following criteria:
a. Wind Exposure Category: B
b. Wind Velocity Pressure Exposure Coefficient (K_z): 1.0
c. Wind Topographic Factor (K_{zt}): 1.0
d. Wind Directionality Factor (K_d): 1.0
e. Wind Velocity (V), miles per hour: 115 (Risk Category II)
f. Wind Importance Factor (I_w): 1.0
2. Wind Pressure Coefficients and the design pressures shall be applied in accordance with the governing code.

E. Seismic Loads:
1. Seismic load used for designing the structure shall be based on the following criteria:
a. Spectral response acceleration for short periods (S_s): 0.09 % g.

b. Spectral response acceleration for 1-sec. period (S_1): 0.0454 % g.
c. Site Class: D
d. Seismic Importance Factor (I): 1.0

2. Seismic loads shall be applied in accordance with the governing code.

F. Dead Load: Dead load shall consist of the weight of building system construction, such as roof, framing, and covering members.

G. Collateral Load:
1. Collateral load in pounds per square foot shall be applied to the entire structure to account for the weight of additional permanent materials other than the building system, such as sprinklers, mechanical systems, electrical systems, hung partitions, and ceilings.
2. This allowance does not include the weight of hung equipment weighing 50 pounds or more.
3. Equipment loads of 50 pounds or more shall be indicated on the Drawings and the structure shall be strengthened as required.
4. Architect will provide the metal building system manufacturer with the magnitude and approximate location of concentrated loads greater than 50 pounds before design of the building starts.

H. Load Combinations: Load combinations used to design primary and secondary structural members shall be in accordance with the governing code.

2.4 DEFLECTIONS

A. Structural Members:
1. Maximum deflection of main framing members shall not exceed 1/240 of their respective spans.
2. Maximum deflection due to snow load in roof panels and purlins shall not exceed 1/180 of their respective spans.
3. Maximum deflection due to wind load in wall panels and girts shall not exceed 1/120 of their respective spans.

B. Lateral deflections, or drift, at the roof level of the structure in relation to the floor or slab on grade, caused by deflection of horizontal force resisting elements, shall not exceed H/100.

C. Calculations for deflections shall be done using only the bare frame method.
1. Reductions based on engineering judgment using the assumed composite stiffness of the building envelope shall not be allowed.
2. Drift shall be in accordance with AISC Serviceability Design Considerations for Low-Rise Buildings.
3. Use of composite stiffness for deflection calculations is permitted only when actual calculations for the stiffness are included with the design for the specific project.
4. When maximum deflections are specified, calculations shall be included in the design data.

2.5 STRUCTURAL STEEL FRAMING SYSTEM

A. General:
   1. Design of Structural System: Clear or multi-span rigid frame with straight columns and roof beams, with gable or single-slope roof.
   2. Actual Building Length:
      a. Structural line to structural line.
      b. Same as nominal; i.e., number of bays times length of bays.
      c. Structural Line: Defined as inside face of wall sheets.
   3. Actual Building Width:
      a. Structural line to structural line.
      b. Nominal building width.
   4. Roof Slope: As shown on drawings
   5. Components and Parts of Structural System:
      a. Indicated on the Drawings or the Specifications.
      b. Clearly marked.
      c. Erection Drawings: Supply for identification and assembly of parts.
      d. Drawings: Carry stamp of a registered professional engineer.
   6. Foundations:
      a. Foundations, Including Anchor Bolt Embedment Length: Properly designed by qualified engineer, retained by other than metal building system manufacturer, in accordance with specific soil conditions for building site.
      b. Reactions for Proper Design of Foundations: Supplied by metal building system manufacturer.
      c. Anchor Bolts:
         1) Anchor Bolt Diameter: Indicated on anchor bolt layout drawings furnished by metal building system manufacturer.
         2) Anchor Bolts: Supplied by Contractor, not metal building system manufacturer.
         3) Anchor Bolts on Moment-Resisting Column Bases: Nuts above and below base plates.

B. Structural Steel Design:
   1. Structural Mill Sections or Welded-up Plate Sections: Design in accordance with AISC Specification for Structural Steel Buildings.
   2. Cold-Formed Steel Structural Members: Design in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
   3. Structural System: Design in accordance with specified building code (Refer to Design Loads and Building Codes).

C. Primary Framing:
   1. Rigid Frames:
      a. Frames: Welded-up plate section columns and roof beams, complete with necessary splice plates for bolted field assembly.
         1) Base Plates, Cap Plates, Compression Splice Plates, and Stiffener Plates: Factory welded into place and connection holes factory fabricated.
         2) Columns and Roof Beams: Fabricated complete with holes in webs and flanges for attachment of secondary structural members and bracing, except for fieldwork as noted on erection drawings furnished by metal building system manufacturer.
      b. Bolts for Field Assembly of Frame Members: ASTM A 325 high-strength bolts as indicated on erection drawings furnished by metal building system manufacturer.

2. Endwall Structural Members: Cold-formed channel members designed in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members or welded-up plate sections designed in accordance with AISC Specification for Structural Steel Buildings.
    a. Endwall Frames: Endwall corner posts, endwall roof beams, and endwall posts as required by design criteria.
        1) Splice Plates and Base Clips: Shop fabricated complete with bolt connection holes.
        2) Base Plates, Cap Plates, Compression Splice Plates, and Stiffener Plates: Factory welded into place and connection holes shop fabricated.
        3) Beams and Posts: Factory fabricated complete with holes for attachment of secondary structural members, except for field work as noted on erection drawings furnished by metal building system manufacturer.
    b. Intermediate Frames: Substituted for end-wall roof beams, when specified.
        1) Factory fabricate necessary endwall posts and holes for connection to intermediate frame used in endwall.

D. Secondary Structural Members:
1. Purlins:
    a. Purlins:
        1) "Z"-shaped, precision-roll-formed, acrylic-coated G30 galvanized steel in different gauges to meet specified loading conditions.
        2) 7-inch, 8-1/2-inch, 10-inch, or 11-1/2-inch-deep "Z" sections.
    b. Outer Flange of Purlins: Factory-punched holes for panel connections.
    c. Attach purlins to main frames and endwalls with 1/2-inch-diameter bolts.
    d. Brace purlins at intervals indicated on erection drawings furnished by metal building system manufacturer.
    e. Concentrated Loads: Hung at purlin panel points.
2. Eave Members:
    a. Eave Struts: Factory punched 7-inch, 8-1/2-inch, 10-inch, or 11-1/2-inch-deep "C" sections, precision-roll-formed, acrylic-coated G30 galvanized steel in different gauges to meet specified loading conditions.
3. Girts:
    a. "Z" or “C”-shaped, precision-roll-formed, acrylic-coated G30 galvanized steel in different gauges to meet specified loading conditions.
    b. 7-inch, 8-1/2-inch, 10-inch, or 11-1/2-inch-deep "Z" or “C” sections.
    c. Outer Flange of Girts: Factory-punched holes for panel connection
4. Bracing:
    a. Locate bracing as indicated on the Drawings.
    b. Diagonal Bracing:
        1) Hot-rolled rods of sizes indicated on the Drawings.
        2) Attach to columns and roof beams as indicated on the Drawings.
    c. Optional fixed-base wind posts or pinned-base portal frames may be substituted for wall rod bracing on buildings as required.
    d. Flange Braces and Purlin Braces: Cold formed and installed as indicated on the Drawings.

E. Welding:

1. Welding Procedures, Operator Qualifications, and Welding Quality Standards: AWS D1.1 - Structural Welding Code – Steel and AWS D1.3 - Structural Welding Code – Sheet Steel.
2. Welding inspection, other than visual inspection as defined by AWS D1.1, paragraph 6.9, shall be identified and negotiated before bidding.
3. Certification of Welder Qualification: Supply when requested.

F. Painting of Structural Steel Framing System:
1. General:
   a. Structural Steel: Prime paint as temporary protection against ordinary atmospheric conditions.
   b. Perform subsequent finish painting, if required, in field as specified in the painting section.
   c. Before painting, clean steel of loose rust, loose mill scale, dirt, and other foreign materials.
   d. Steel Fabricator: Not required to sand blast, flame clean, or pickle steel before painting, unless otherwise specified.
2. Primary Frames:
   a. Clean steel in accordance with SSPC-SP2.
   b. Factory cover steel with 1 coat of gray water-reducible alkyd primer paint formulated to equal or exceed performance requirements SSPC-Paint 15.
   c. Minimum Coating Thickness: 1.0 mil.
3. Secondary Structural Members – Roll-Formed:
   a. Hot-dipped zinc coating, ASTM A 653, G30; followed by 1 coat of clear acrylic finish.
   b. Acrylic-Coated G30 Galvanized Steel: Equal or exceed performance requirements of SSPC Paint-15.
4. Truss Purlins:
   a. Hot-dipped zinc coating, ASTM A 653, G30; followed by 1 coat of clear acrylic finish.
   b. Acrylic-Coated G30 Galvanized Steel: Equal or exceed performance requirements of SSPC Paint-15.

2.6 METAL ROOF SYSTEMS

A. Metal Roof System: Basis for Design - Butler Manufacturing "MR-24®" roof system.

B. Roof System Design:
1. Design roof panels in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
2. Design roof paneling system for a minimum roof slope of 1/4 inch in 12 inches.
3. Design roof paneling system to support design live, snow, and wind loads.
4. Endwall Trim and Roof Transition Flashings: Allow roof panels to move relative to wall panels and/or parapets as roof expands and contracts with temperature changes.

C. Roof System Performance Testing:
1. UL Wind Uplift Classification Rating, UL 580: Class 90.
2. Structural Performance Under Uniform Static Air Pressure Difference: Test roof system in accordance with ASTM E 1592.

3. Roof system has been tested in accordance with U.S. Army Corps of Engineers Unified Facilities Guide Specification Section 07 61 13.
4. FM Global (Factory Mutual):
   a. Roof system has been tested in accordance with FMRC Standard 4471 and approved as a Class 1 Panel Roof.
   b. Metal Building System Manufacturer: Provide specific assemblies to meet required wind rating in accordance with FM Global.
   c. Installation modifications or substitutions can invalidate FM Global approval.

D. Roof Panels:
1. Factory roll-formed, 24 inches wide, with 2 major corrugations, 2 inches high (2-3/4 inches including seam), 24 inches on center.
2. Flat of the Panel: Cross flutes 6 inches on center, perpendicular to major corrugations in entire length of panel to reduce wind noise.
3. Variable Width Panels:
   a. For roof lengths not evenly divisible by the 2'-0" panel width, factory-manufactured variable-width (9-inch, 12-inch, 15-inch, 18-inch, and 21-inch-wide) panels shall be used to ensure modular, weathertight roof installation.
   b. Minimum Length: 15 feet.
   c. Supply maximum possible panel lengths.
4. Panel Material and Finish:
   a. 24-gauge galvanized steel, G90 coating, ASTM A 653, G90.
   b. Paint with exterior colors of factory finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.
   c. PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25 years for the following.
      1) Not to peel, crack, or chip.
      2) Chalking: Not to exceed ASTM D 4214, #8 rating.
      3) Fading: Not more than 5 color-difference units, ASTM D 2244.
5. Panel Material and Finish: Special materials, gauges, or colors as applicable for custom designs.
6. Use panels of maximum possible lengths to minimize end laps.
7. Extend eave panels beyond structural line of sidewalls.
8. Factory punch panels at panel end to match factory-punched holes in eave structural member.
9. Panel End Splices: Factory punched and factory notched.
10. Panel End Laps: Locate directly over, but not fastened to, a supporting secondary roof structural member and be staggered, to avoid 4-panel lap-splice condition.
11. End Laps: Floating. Allows roof panels to expand and contract with roof panel temperature changes.
12. Self-Drilling Fasteners: Not permitted.
13. Ridge Assembly:
   a. Design ridge assembly to allow roof panels to move lengthwise with expansion and contraction as roof panel temperature changes.
   b. Factory punch parts for correct field assembly.
   c. Install panel closures and interior reinforcing straps to seal panel ends at ridge.
   d. Do not expose attachment fasteners on weather side.
   e. Use lock seam plug to seal lock seam portion of panel.
   f. High-Tensile Steel Ridge Cover: Span from panel closure to panel closure and flex as roof system expands and contracts.

E. Provision for Expansion and Contraction:
1. Provision for Thermal Expansion Movement of Roof Panels: Clips with movable tab.
a. Stainless Steel Tabs: Factory centered on roof clip when installed to ensure full movement in either direction.
b. Maximum Force of 8 Pounds: Required to initiate tab movement.
c. Each Clip: Accommodates a minimum of 1.25-inch movement in either direction.
2. Roof: Provide for thermal expansion and contraction without detrimental effects on roof panels, with plus or minus 100-degree F temperature difference between interior structural framework of building and of roof panels.

F. Fasteners:
1. Make connections of roof panels to structural members, except at eaves, with clips with movable stainless steel tabs, seamed into standing seam side lap.
2. Fasten panel clips to structural members with fasteners in accordance with erection drawings furnished by metal building system manufacturer, using factory-punched holes in structural members.
a. Fasteners: Metal-backed rubber washer to serve as torque indicator.
3. Exposed fasteners penetrating metal roof membrane at the following locations do not exceed the frequency listed:
a. Basic Panel System: 0 per square foot.
b. High Eave Trim, No Parapet: 2 per linear foot.
c. Exterior Eave Gutter: 2 per linear foot.
d. Panel Splices: 2 per linear foot.
e. Gable Trim: 0 per linear foot.
f. High Eave with Parapet: 0 per linear foot.
g. Ridge: 0 per linear foot.
h. Low Eave Structural: 1.5 per linear foot.

G. Accessories:
1. Accessories (i.e.,gutters, fascia): Standard with metal building system manufacturer, unless otherwise noted and furnished as specified.
2. Exterior Metal Coating on Gutters, Downspouts, Gable Trim, and Eave Trim: Factory finish system, full-strength, 70 percent “Kynar 500” or “Hylar 5000” fluoropolymer (PVDF) coating.
3. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.
4. Material used in flashing and transition parts and furnished as standard by metal building system manufacturer may or may not match roof panel material.
a. Parts: Compatible and not cause corrosive condition.
b. Copper and Lead Materials: Do not use with Galvalume panels.

2.7 METAL COATING SYSTEMS

A. Metal Coating System: Factory-applied, exterior metal coating system

B. Substrate Preparation:
1. G90 Hot-Dipped Galvanized Steel or AZ50 Galvalume: Factory-controlled chemical-conversion treatment.

C. Coating:
1. Material: Full-strength, 70 percent, “Kynar 500” or “Hylar 5000” fluoropolymer (PVDF) color coating.
2. After steel preparation, coat exterior exposed surface with primer and PVDF
a. Nominal Total Dry Film Thickness: 1.0 mil.
3. Interior Exposed Surfaces: Coat with polyester color coat.
4. Apply coatings to entire material dimensions of steel sheets before forming of panels

D. Physical Characteristics of Exterior Coating:
1. Resistance to failure through cracking, checking, peeling, and loss of adhesion.
2. Measure by the following laboratory weather-simulating tests to obtain test results justifying metal building system manufacturer's 25-year warranty:
a. Humidity resistance at 100 degrees F and 100 percent relative humidity, ASTM D 2247.
b. Salt-spray resistance at 5 percent salt fog, ASTM B 117.
c. Reverse impact resistance, ASTM D 2794.
d. Resistance to accelerated weathering, Atlas Model XW-R Dew Cycle Weather-O-Meter, ASTM D 3361.
e. Resistance to dry heat.
f. Abrasion resistance, ASTM D 968.
g. Chemical/acid/pollution resistance, ASTM D 1308 and G 87.
h. Maintain gloss of finish evenly over entire surface, ASTM D 523

PART 3 - EXECUTION

3.1 EXAMINIATION

A. Examine area to receive metal building system.

B. Notify Architect of conditions that would adversely affect installation or subsequent use.

C. Do not begin installation until unacceptable conditions are corrected.

3.2 ERECTION – STRUCTURAL STEEL FRAMING SYSTEM

A. Erect structural steel framing system in accordance with the Drawings and metal building system manufacturer’s erection drawings.

B. Field Modifications:
1. Require approval of metal building system manufacturer.
2. Responsibility of building erector.
3. Field Modifications to Truss Purlins: Not allowed, unless indicated on erection drawings furnished by metal building system manufacturer.

C. Fixed Column Bases: Grout flush with floor line after structural steel erection is complete.

3.3 INSTALLATION – METAL ROOF SYSTEM

A. Metal Roof System Installation:
   1. Install roof system in accordance with metal building system manufacturer's instructions at locations indicated on the Drawings.
   2. Install roof system weathertight.
   3. Position panel clips by matching hole in clip with factory-punched holes in secondary structural members.
   4. Position and properly align panels by matching factory-punched holes in panel end with factory-punched holes in eave structural member and by aligning panel with panel clip.
   5. Field seam panel side laps by self-propelled and portable electrical lock-seaming machine.
      a. Machine field forms the final 180 degrees of a 360-degree Pittsburgh double-lock standing seam.
      b. Factory apply side lap sealant.
   6. Panel End Laps: Minimum of 6 inches, sealed with sealant (weather sealing compound), and fastened together by clamping plates.
      a. Sealants: Contain hard nylon beads, which prevent mastic from flowing out due to clamping actions.
      b. Join panel laps by 2-piece clamped connection consisting of a bottom reinforcing plate and a top panel strap.
      c. Locate panel end laps directly over, but not fastened to, supporting secondary roof structural member and stagger, to avoid 4-panel lap-splice condition.

3.4 INSTALLATION – ROOF INSULATION SYSTEM

A. Roof Insulation System Installation: Roof insulation system.
   1. Install roof insulation system in accordance with metal building system manufacturer's instructions at locations indicated on the Drawings.

3.5 PROTECTION

A. Protect installed metal building system to ensure that, except for normal weathering, metal building system will be without damage or deterioration at time of Substantial Completion.

END OF SECTION 133419

SECTION 20 0001

MECHANICAL DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 SUMMARY

A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, and services to completely execute the mechanical demolition as described in this specification and as shown and noted on the drawings.

B. The demolition documents plans and specification have been prepared from existing non-as built documents and cursory non-invasive field investigation.

C. It is the contractors obligation to become familiar with the extent of demolition and the existing conditions before submitting their bid.

D. The contractor shall become familiar with the drawings and scope of work of other trades as the work scope of those trades relates to mechanical equipment and connection requirements.

E. During demolition if the contractor discovers unforseen significant non code compliance conditions of the existing installation they shall notify the Architect and Engineer immediately in writting.

F. During demolition the contractor shall record on site maintained as-builts of all hydronic system piping capped branches, plumbing sanitary, waste and domestic hot, cold and hot water recirculation capped branches, and capped supply air, return air and exhaust air ducts for reuse in renovated project space.

1.03 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Contract descriptions, description of alterations work, work by others, future work, occupancy conditions, use of site and premises, work sequence.

B. See Section 01 7419 - Construction Waste Management and Disposal.

C. Section 02 4100 - Demolition: Selective demolition, site demolition, structure removal.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping and ductwork to be demolished serve only equipment and facilities within the demolition areas.

B. Report discrepancies to Owner before disturbing existing installation.

C. Prior to the submission of a Request for Information (RFI) the contractor shall exhaust all efforts to remedy the situation in the field with the assistance of the construction manager (CM). The resolution shall be consistent with the means and methods described within both the drawings and specifications which constitute this contract. If review with the CM does not result in a resolution, it is then acceptable to submit a formal RFI to the architectural/enginnering design team.

D. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

A. Identify locations for capping piping and ductwork before any demolition work commences.

B. Confirm isolation valve locations for domestic water piping and hydronic piping. Repair leaking isolation valves or replace inoperable valves before commencing piping demolition.

C. Cap and seal air-tight supply, return and exhaust air ductwork at shaft walls before commencing sheet metal demolition.

3.03 DEMOLITION OF EXISTING MECHANICAL WORK

A. Remove, relocate and extend existing mechanical piping or sheet metal work to accomodate new construction.

B. Remove sanitary and waste piping to branch connection fitting to negate any dead ends.

C. Remove domestic water piping back to isolation valve.

D. Remove hydronic water piping back to isolation valve.

E. Remove all supply, return and exhaust air ductwork back to main connection.

3.04 CLEANING

A. Clean and repair existing materials and equipment that remain or that are to be reused.

END OF SECTION

SECTION 20 0010

BASIC MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 APPLICATION

A. This section applies to all mechanical work. The contractors involved shall check all sections of the specifications in addition to the particular section covering their specific trade. Each distinct section of the specifications aimed for one trade may have detailed information with regards to other trades, therefore, it is imperative that all sections be reviewed to get a complete picture of all other trades' functions and work required

B. The mechanical contractor is responsible for the installation and operation of the plumbing, fire protection, hvac systems, and temperature control systems.

C. The mechanical contractor is responsible for receiving, unloading and placement of all of the owner provided equipment.

1.03 DRAWINGS

A. The drawings are diagrammatic and show general location and arrangement of all the equipment and piping.

B. Do not scale drawings for measurements.

C. Field verifications of actual existing conditions are required by the contractor since actual locations, distances, and levels will be governed by actual field conditions. All measurements shall be verified at the site.

D. Examine the drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly, providing such fittings, traps, valves and accessories as may be required to meet such conditions.

E. If during field verification, the contractor identifies that there may require substantial changes from the original plans, the contractor shall notify the architect for agreement on necessary adjustment before the installation is started

F. Discrepancies shown between plans, or between plans and actual field conditions, or between plans and specifications shall promptly be brought to the attention of the architect for a decision.

G. Drawings and specifications are intended to cover the completed installation of systems to function as described. The omission of the expressed reference to any item of labor and material necessary to comply with practice codes, ordinances, etc., shall not relieve the contractor from providing such additional labor and material at no cost to Owner.

H. The drawings show the location and general arrangement of equipment, piping and related items. They shall be followed as closely as elements of the construction will permit.

I. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect.

J. The architectural and structural drawings take precedence in all matters pertaining to the building structure, mechanical drawings in all matters pertaining to mechanical trades and electrical drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect for resolution.

1.04 PERMITS

A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for mechanical work shall be secured and paid for by the contractor. All work shall conform to all applicable codes, rules and regulations.

1.05 CODES

A. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams, which may be required by the governing authorities. Where the drawings and/or specifications indicate materials for construction in excess of code requirements, the drawings and/or specifications shall govern.
   1. Michigan Mechanical Code, 2015
   2. Michigan Plumbing Code, 2015

1.06 MAINTENANCE

A. Provide 3 hours of instruction to the owner's designated personnel in the maintenance and operation of equipment and systems.

B. Provide complete maintenance and operating instructional manuals covering all mechanical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. Four (4) copies of all literature shall be furnished for owner and shall be bound in book or ring binder form. Maintenance and operating instructional manuals shall be provided when construction is approximately 75% complete.

1.07 WARRANTY AND GUARANTEE

A. Contractor shall guarantee all work installed by him or his subcontractors to be free from defect in material and workmanship for a period of one year from date of final acceptance of the work, unless a longer period is stipulated under specific headings. Contractor shall repair or replace at no additional cost to the owner, any material or equipment developing defects and shall also make good any damage caused by such defects or the correction of defects. Repairs or replacements shall bear additional guarantee, as originally called for, dated from the final acceptance of the repair or replacement. This requirement shall be binding even though it will exceed product guarantees normally furnished by some manufacturers. Contractor shall submit his own and each equipment manufacturers written certificates, warranting that each item of equipment furnished complies with all requirements of the drawings and specifications. Note that guarantee shall run from date of final acceptance of the work, not from date of installation of a device or piece of equipment.

1.08 SUBMITTALS

A. Types of submittals include the following:
   1. Shop Drawings
   2. Product Data Sheets
   3. Samples
   4. Manufacturers Instructions
   5. Maintenance Data
   6. Warranty

B. Installation of any item that requires submittal approval by the engineer shall be installed at the contractors risk. The contractor, at his cost, shall remove all work installed prior to approval of the submittal.

C. The engineer will not be responsible for errors in quantities, or dimensions required to fit the job condition, details of fabrication to insure proper assembly at the job, or for errors resulting from mistakes in submittals.

D. For underground piping, record dimensions and invert elevations of all piping, including all offsets, fittings, cathodic protection and accessories. Locate dimensions from benchmarks that will be preserved after construction is complete.

E. Product data cut sheets shall be submitted on the material and equipment as requested in these specifications.

1.09 RECORD DRAWINGS

A. Record drawings shall be maintained by the contractor up to date as the project progresses.

B. Recording all deviations from the contract documents, indicate exact locations of all buried services both inside and outside of the building; include concealed piping and equipment in the entire contract. Final record drawings shall reflect the as-built conditions.

1.10 QUALITY ASSURANCE

A. Other referenced standards:
   1. Comply with referenced standards, guidelines, data sheets from various associations, including NFPA, ANSI, ASTM, ASME, ASHRAE

PART 2 PRODUCTS

2.01 SLEEVES AND ESCUTCHEONS

A. Provide sleeves wherever pipes pass through exterior wall, and floors. Sleeves shall be schedule 40 steel pipe cut to length. Sleeves shall terminate flush with walls, partitions and ceilings in finished areas. All sleeves through floor shall extend 2" above floor. Provide cast brass nickel-plated escutcheons with positive catches on each visible sleeve penetration. Sleves are to be sealed at each installation with a 3M approved sealant. The space between the inside of the sleeve and the outside of the pipe or conduit with in the sleeve shall be sealed at each installation with a 3M approved sealant.

2.02 DIELECTRIC UNIONS

A. Dielectric unions shall be used to connect dissimilar metals (such as steel and copper) to prevent electrolytic action.

2.03 FILTERS

A. Provide and maintain filters in air handling systems throughout the construction period and prior to final acceptance of the building. Do not run air handling equipment without all prefilters and final filters as specified. Immediately prior to final building acceptance by the owner, contractor shall replace all disposable type air filters with new.

2.04 BUILDING ATTACHMENTS FOR MECHANICAL WORK SUPPORTS

A. General Requirements:
   1. Provide building attachments required for supporting mechanical work, suitably selected and installed for the loads applied with a minimum additional safety factor of 3.
   2. Where specified attachments are not suitable for conditions, submit to Engineer for approval, proposal for alternate building attachments.
   3. Approved Manufacturers: Grinnell, or equivalent products by Michigan Hanger and B-Line.
   4. Provide supplemental trapeze supports where necessary. Design trapeze to support all trades. Coordinate loads, and supports with all trades. Size trapeze for maximum deflection of 1/64 of the span.

B. Attachments to Structural Steel:
   1. Support mechanical work from building structural steel where possible and approved. No welding or bolting to structural steel is permitted unless authorized by Architect. C-clamps are not permitted.
      a. Center beam clamp - for loads over 120 lb.: Malleable center hung Grinnell Fig. 228.
      b. Side beam clamp with retaining clips - for loads up to 120 lb.

C. Cast in Place Concrete Inserts:
   1. Provide inserts selected for applied load of present load plus 100% for future, and coordinated with concrete work. Except as detailed on drawings, inserts shall be Unistrut or Grinnell. Plan, lay out and coordinate setting of inserts prior to concrete pour. Use Grinnell Fig. 285 lightweight concrete insert for loads up to 400# or Grinnell Fig. 281 Wedge Type concrete insert for loads up to 1200#

D. Drilled Insert Anchors:
   1. Where mechanical work cannot be supported from structural steel, or cast in place concrete inserts, provide drilled concrete insert anchors. Submit for approval, project specific installation drawings for all loads over 100 lbs. Install inserts in web of beam if

possible and approved. Insert depth shall not exceed two thirds the thickness of the concrete. Where existing concrete appears to be deteriorating, or where applied load at insert exceeds 1000 lbs., conduct test of concrete to determine derated capacity of insert. Anchors may be adhesive or expansion type up to 1000 lbs., and shall be adhesive type for loads over 1000 lbs.

2. Manufacturers: Hilti

PART 3 EXECUTION

3.01 GENERAL

A. Demolition of mechanical equipment shall include all existing piping, valves, controls, supports and equipment where such items are not required for reuse. Mechanical equipment not specified for reuse shall be removed by the mechanical contractor from the site.

B. Existing piping and ductwork: when encountered during the course of work, protect, brace and support existing piping and ductwork where required for proper execution of the work.

C. Interruption of existing active piping and ductwork: when the course of work makes shut-down of services unavoidable, the mechanical contractor shall schedule the shut-down at such time as approved by the owners representative, which will cause least interference with established operating routine.

D. Arrange work accordingly, providing such fittings as duct transitions traps, valves and accessories necessary to complete all construction in an orderiy fashion.

E. Install all equipment in strict accordance all directions and recommendations furnished by the manufacturer.

3.02 ACCESSIBILITY

A. Do not locate traps, controls, unions, pull boxes, etc. in any system at a location that will be inaccessible after construction is completed. Maintain accessibility for all components in mechanical, electrical, and plumbing systems.

3.03 ACCESS PANELS:

A. Furnish access panels to access valves, traps, control valves or devices, dampers, damper motors, etc. Access panels shall be sized as necessary for ample access, or as indicated on drawings, but no smaller than 12" x 12" where devices are within easy reach of operator, and at least 24"x24" when operator must pass through opening in order to reach the devices. Architectural Trades shall install access panels coordinated with Mechanical Trades.

B. Access panels in fire rated walls or ceiling must be U.L. labeled for intended use. Unless otherwise indicated on plans, access doors shall be hinged flush type steel framed panel, 14 gauge minimum for frame, and with anchor straps. Only narrow border shall be exposed. Hinges shall be concealed type. Locking device shall be flush type and screw driver operated. Metal surfaces shall be prime coated with rust-inhibitive paint. Panels shall be compatible with architectural adjacent materials Manufacturer: Milcor, Bilco.

C. Coordinate location with architect prior to installation.

3.04 CUTTING AND PATCHING

A. All cutting required shall be done by the contractor whose work is involved, without extra cost the owner. All patching and restoration including the furnishing and installation of access panels in ceiling, walls; etc. Within the building lines shall be done by the respective, responsible contractor. No cutting of structural steel, concrete, or wood shall be done without prior approval and explicit directions of the architect patched by the respective, responsible contractor.

B. The contractor, under whose jurisdiction the work may fall, shall provide labor, material, and tools required to cut, repair, protect, cap, or relocate existing pipes, conduits, or utilities interfering with or uncovered during work, per regulations of the authorities having jurisdiction.

3.05 ROUGH-IN FOR CONNECTION TO EQUIPMENT

A. It shall be the responsibility of each contractor to study the architectural, structural, electrical, and mechanical drawings, conferring with the various trades involved and checking with the supplier of equipment in order to properly rough-in for all equipment.

3.06 MATERIAL AND EQUIPMENT

A. All material and equipment shall be new and of the best quality used for the purpose in good commercial practice, and shall be the standard product of reputable manufacturers. The material and equipment must meet approval of state and local codes in the area it is being used. Roof decks shall not be used to support piping, conduit, equipment, devices, etc.

3.07 SEAL PENETRATIONS

A. Seal the space around pipes in sleeves and around duct openings through walls, floors and ceilings. Provide adequate clearance to allow for proper sealing.

3.08 FIRE STOPPING

A. Provide UL classified firestopping system for mechanical penetrations through rated walls and floors to maintain the fire rating.

3.09 CONTROL WIRING

A. All control wiring for mechanical and electrical equipment, including motor starters, shall be 120 volt maximum and wired with one side of the coil grounded and the operating contacts in the north side of the circuit. All control wiring shall be installed in conduit.

END OF SECTION

SECTION 20 0020

ELECTRICAL REQUIREMENTS FOR MECHANICAL WORK

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SECTION INCLUDES

A. Basic electrical requirements for mechanical work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Mechanical equipment is to be furnished with motors, electrical controls and protective devices, and integral operating devices which are normally included by the manufacturer or required by the Contract Documents.

B. The Mechanical Trades shall provide all control wiring, 120 volts and less, for the equipment and devices furnished under Division 21, 22, and 23 of these specifications, including all wiring devices, conduit, etc.

C. Power wiring 120 volts and greater shall be by the Electrical Trades.

2.02 QUALITY ASSURANCE

A. All electrical devices provided by Mechanical Trades, and all electrical devices furnished as part of the mechanical equipment shall be UnderwritersLaboratories (UL) listed.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 22 0553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2007.

B. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007 (ANSI/ASME A13.1).

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Brady Corp.

B. Champion-America, Inc.

C. Seton Identification Products.

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.

2.03 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

B. Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

A. Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

E. Identify piping, concealed or exposed, with plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs

including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

F. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

3.03 SCHEDULES

A. Identify all mechanical equipment, piping, and ductwork with nameplates, tags and markers.

END OF SECTION

SECTION 22 0719

PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.

D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).

E. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

F. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.

G. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).

H. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2014.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

J. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

K. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER

A. Manufacturers:
   1. Knauf Insulation: www.knaufusa.com.
   2. Johns Manville Corporation: www.jm.com.
   3. Owens Corning Corp: www.owenscorning.com.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.
   4. Density: 3.5 lb/cu. ft

C. Vapor Barrier Jacket:

1. White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E 96 of 0.02 perm-inches.

D. Tie Wire:
   1. 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.
   1. Vapor Barrier Lap Adhesive shall be compatible with the insulation and as recommended by the insulation manufacturer

F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
   1. ASTM C195; hydraulic setting on mineral wool.

G. Fibrous Glass Fabric:
   1. Cloth: Untreated; 9 oz/sq yd weight.
   2. Blanket: 1.0 lb/cu ft density.
   3. Weave: 5 by 5.

H. Indoor Vapor Barrier Finish:
   1. Vinyl emulsion type acrylic, compatible with insulation, white color.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

E. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

F. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

3.03 SCHEDULES

A. Plumbing Systems:
   1. Domestic Hot Water Supply and Return
      a. Glass Fiber Insulation:
         1) Pipe Size Range: 1/2-3 inch.
         2) Thickness: 1 inch.
   2. Domestic Potable and non Potable Cold Water:
      a. Glass Fiber Insulation:
         1) Pipe Size Range: 3 inch.
            (a) Thickness: 1 inch.

END OF SECTION

SECTION 22 1005

PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.
   3. Natural Gas
   4. Pipe hangers and supports.
   5. Valves.
   6. Flow controls.
   7. Check.
   8. Strainers.

1.02 QUALITY ASSURANCE

A. Perform Work in accordance with State of Michigan standards.

B. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

C. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

1.03 REGULATORY REQUIREMENTS

A. Perform Work in accordance with State of Michigan plumbing code.

B. Conform to applicable code for installation of backflow prevention devices.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.05 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: CISPI 301 (latest edition) bearing collective trademark of CISPI, hubless.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310 (latest edition) bearing the markings of NSF International, neoprene gasket and stainless steel clamp and shield assemblies.

B. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 SANITARY SEWER AND VENT PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301 (latest edition) bearing collective trademark of CISPI,, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310 (latest edition) bearing the markings of NSF International, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.04 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.

2.05 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
   2. Joints: Threaded or welded to ASME B31.1.

2.06 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.

B. Plumbing Piping - Drain, Waste, and Vent:
   1. Conform to ASME B31.9.
   2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
   3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
   7. Vertical Support: Steel riser clamp.
   8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Plumbing Piping - Water:
   1. Conform to ASME B31.9.
   2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
   3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
   5. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
   6. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded supports or spacers and hanger rods, cast iron roll.
   7. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   8. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
   9. Vertical Support: Steel riser clamp.
   10. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

11. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
12. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.07 BALL VALVES

A. Manufacturers:
1. Tyco Flow Control: www.tycoflowcontrol.com.
2. Conbraco Industries, Inc: www.apollovalves.com.
3. Nibco, Inc: www.nibco.com.
4. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder ends with union.

2.08 FLOW CONTROLS

A. Manufacturers:
1. Tyco Flow Control: www.tycoflowcontrol.com.
2. ITT Bell & Gossett: www.bellgossett.com.
3. Griswold Controls: www.griswoldcontrols.com.
4. Taco, Inc: www.taco-hvac.com.

B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.

C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

2.09 SWING CHECK VALVES

A. Manufacturers:
1. Tyco Flow Control: www.tycoflowcontrol.com.
2. Hammond Valve: www.hammondvalve.com.
3. Nibco, Inc: www.nibco.com.
4. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Up to 2 Inches:
1. 1, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder ends.

C. Over 2 Inches:
1. 1, Class 125, iron body, bronze swing disc, renewable disc seal and seat, flanged or grooved ends.

2.10 SPRING LOADED CHECK VALVES

A. Manufacturers:
1. Tyco Flow Control: www.tycoflowcontrol.com.
2. Hammond Valve: www.hammondvalve.com.
3. Crane Co.: www.cranecpe.com.
4. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Class 125, iron body, bronze trim, stainless steel springs, bronze disc, Buna N seals, wafer style ends.

2.11 STRAINERS

A. Manufacturers:
1. Mueller Steam Specialties
2. Nibco, Inc.
3. Watts Water Technologies
4. Zurn Industries, LLC.

B. Size 2 inch and Under:

1. Class 150, lead free, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 1-1/2 inch to 4 inch:
1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions. Cast iron soil pipe installed in accordance to CISPI's Handbook.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

G. Provide access where valves and fittings are not exposed.

H. Establish elevations of buried piping outside the building to ensure not less than 4 ft of cover.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

J. Provide support for utility meters in accordance with requirements of utility companies.

K. Install valves with stems upright or horizontal, not inverted. Refer to Section 22 0523.

L. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

M. PVC Pipe: Underground installation in compliance to ASTM D-2321. Make solvent-welded joints in accordance with ASTM D2855.

N. Sleeve pipes passing through partitions, walls and floors.

O. Inserts:
1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

P. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.
9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
10. Support cast iron drainage piping at every joint.

3.04 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Provide spring loaded check valves on discharge of water pumps.

D. Provide flow controls in water recirculating systems where indicated.

3.05 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/8 inch per foot slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system in accordance with Section 33 1300.

B. Prior to starting work, verify system is complete, flushed and clean.

C. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

E. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

F. Maintain disinfectant in system for 24 hours.

G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

I. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe Size: 1/2 inches to 1-1/4 inches:
         1) Maximum Hanger Spacing: 6.5 ft.
         2) Hanger Rod Diameter: 3/8 inches.
      b. Pipe Size: 1-1/2 inches to 2 inches:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 3/8 inch.
      c. Pipe Size: 2-1/2 inches to 3 inches:
         1) Maximum Hanger Spacing: 10 ft.
   2. Plastic Piping:
      a. All Sizes:

1) Maximum Hanger Spacing: 6 ft.
2) Hanger Rod Diameter: 3/8 inch.

END OF SECTION

SECTION 22 1006

PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Floor drains.

B. Cleanouts.

C. Hose bibbs.

D. Backflow preventers.

1.02 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.

B. Section 22 4000 - Plumbing Fixtures.

C. Section 22 3000 - Plumbing Equipment.

1.03 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor and Trench Drains; 2001 (R2007).

B. ASME A112.21.2M - Roof Drains; The American Society of Mechanical Engineers; 1983.

C. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; 2011.

D. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2011.

E. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).

F. NSF 372 - Drinking Water System Components - Lead Content; 2011.

G. PDI-WH 201 - Water Hammer Arresters; 2010.

1.04 SUBMITTALS

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

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS

A. Manufacturers:
   1. Mifab Manufacturing Inc.: www.mifab.com
   2. Josam Company: www.josam.com.
   3. Jay R. Smith Manufacturing Company.
   4. Zurn Industries, LLC: www.zurn.com.

B. Floor Drain (FD-1):
   1. ASME A112.21.1M; lacquered cast iron body with bottom outlet, combination invertible membrane clamp and adjustable collar with adjustable Type "B" polished nickel-bronze strainer .

2. Zurn Industries Model #Z-415 - 2" Outlet, 5" strainer.

2.03 CLEANOUTS (CO)

A. Manufacturers:
   1. Mifab Manufacturing Inc.: www.mifab.com
   2. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
   3. Josam Company: www.josam.com.
   4. Zurn Industries, Inc.:

B. Cleanouts at Exterior Surfaced Areas :
   1. Round cast nickel bronze access frame and non-skid cover.

C. Cleanouts at Exterior Unsurfaced Areas :
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

D. Cleanouts at Interior Finished Floor Areas:
   1. Adjustable floor cleanout, Lacquered cast iron body with agas and watertight ABS tapered thread plug, and round scoriated secured top (finish: polished nickel bronze) adjustable to floor finish. Coordinate floor finishes with architect prior to order.
   2. Zurn Industries, Inc.:; Model Z-1400

E. Cleanouts at Interior Finished Wall Areas :
   1. Lacquered cast iron body, gas and water tight ABS tapered thread plug, and round stainless steel access cover with vandal proof securing top.
   2. Zurn Industries, Inc.: Wall; Model Z-1441 or Z-1446

F. Cleanouts at Interior Unfinished Accessible Areas : Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.
   1. Zurn Industries, Inc.:

2.04 HOSE BIBBS

A. Manufacturers:
   1. Mifab Manufacturing Inc.: www.mifab.com
   2. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
   3. Watts Regulator Company: www.wattsregulator.com.
   4. Zurn Industries, LLC: www.zurn.com.
   5. Prier: www.prier.com

2.05 BACKFLOW PREVENTERS

A. Manufacturers:
   1. Conbraco Industries, Inc: www.apollovalves.com.
   2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com.

B. Reduced Pressure Backflow Preventers:
   1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

2.06 WATER HAMMER ARRESTORS

A. Manufacturers:
   1. Mifab Manufacturing Inc.: www.mifab.com
   2. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
   3. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com.
   4. Zurn Industries, LLC: www.zurn.com.

B. Water Hammer Arrestors:
   1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install approved potable water protection devices where contamination of domestic water may occur; This includes fire sprinkler system.

C. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, interior and exterior hose bibs.

D. Pipe relief from backflow preventer to nearest drain.

END OF SECTION

SECTION 221113 - FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for combined water service and fire-service mains.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.3 DEFINITIONS

A. EPDM: Ethylene propylene diene terpolymer rubber.

B. LLDPE: Linear, low-density polyethylene plastic.

C. PA: Polyamide (nylon) plastic.

D. PE: Polyethylene plastic.

E. PP: Polypropylene plastic.

F. PVC: Polyvinyl chloride plastic.

G. RTRF: Reinforced thermosetting resin (fiberglass) fittings.

H. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

B. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

E. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

G. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water-service piping.
2. Comply with NSF 61 Annex G for materials for water-service piping and specialties for domestic water.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.9 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of water-distribution service without Owner's written permission.

1.10 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A), water tube, annealed temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
2. Copper, Pressure-Seal Fittings:

    a. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
    b. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.

B. Hard Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A), water tube, drawn temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
2. Copper, Pressure-Seal Fittings:

    a. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
    b. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.

C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

D. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Gaskets: AWWA C111, rubber.

C. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.

1. Grooved-End, Ductile-Iron Pipe Appurtenances:

a. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
b. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

D. Flanges: ASME 16.1, Class 125, cast iron.

2.3 PE PIPE AND FITTINGS

A. PE, ASTM Pipe: ASTM D 2239, SIDR No. 5.3, 7, or 9; with PE compound number required to give pressure rating not less than 160 psig (1100 kPa).

1. Insert Fittings for PE Pipe: ASTM D 2609, made of PA, PP, or PVC with serrated male insert ends matching inside of pipe. Include bands or crimp rings.
2. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.

B. PE, AWWA Pipe: AWWA C906, DR No. 7.3, 9, or 9.3; with PE compound number required to give pressure rating not less than 160 psig (1100 kPa).

1. PE, AWWA Fittings: AWWA C906, socket- or butt-fusion type, with DR number matching pipe and PE compound number required to give pressure rating not less than 160 psig (1100 kPa).

C. PE, Fire-Service Pipe: ASTM F 714, AWWA C906, or equivalent for PE water pipe; FMG approved, with minimum thickness equivalent to FMG Class 150.

1. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.

2.4 PVC PIPE AND FITTINGS

A. PVC, Schedule 40 Pipe: ASTM D 1785.

1. PVC, Schedule 40 Socket Fittings: ASTM D 2466.

B. PVC, Schedule 80 Pipe: ASTM D 1785.

1. PVC, Schedule 80 Socket Fittings: ASTM D 2467.
2. PVC, Schedule 80 Threaded Fittings: ASTM D 2464.

C. PVC, AWWA Pipe: AWWA C900, Class 150, with bell end with gasket, and with spigot end.

1. Comply with UL 1285 for fire-service mains if indicated.
2. PVC Fabricated Fittings: AWWA C900, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
4. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

    a. Gaskets: AWWA C111, rubber.

5. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

    a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.5 FIBERGLASS PIPE AND FITTINGS

A. AWWA RTRP: AWWA C950, Class 150, Type I,, with bell-and-spigot ends for bonded joints. Liner is optional, unless otherwise indicated. Include FMG approval if used for fire-service mains.

1. RTRF: AWWA C950, similar to pipe in material, pressure class, and joining method.

B. UL RTRP: UL 1713, Class 150, with bell-and-spigot ends with gasket or seal for gasketed joints. Liner is optional, unless otherwise indicated.

1. RTRF: Similar to pipe in material, pressure class, and joining method.

2.6 SPECIAL PIPE FITTINGS

A. Ductile-Iron Rigid Expansion Joints:
1. Description: Three-piece, ductile-iron assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

    a. Pressure Rating: 250 psig (1725 kPa) minimum.

B. Ductile-Iron Flexible Expansion Joints:
1. Description: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

    a. Pressure Rating: 250 psig (1725 kPa) minimum.

C. Ductile-Iron Deflection Fittings:
1. Description: Compound, ductile-iron coupling fitting with sleeve and 1 or 2 flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with

AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

a. Pressure Rating: 250 psig (1725 kPa) minimum.

2.7 JOINING MATERIALS

A. Refer to Section 330500 "Common Work Results for Utilities" for commonly used joining materials.

B. Brazing Filler Metals: AWS A5.8, BCuP Series.

C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

D. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.8 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:
1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.

a. Standard: AWWA C219.
b. Center-Sleeve Material: Manufacturer's standard.
c. Gasket Material: Natural or synthetic rubber.
d. Pressure Rating: 150 psig (1035 kPa) minimum.
e. Metal Component Finish: Corrosion-resistant coating or material.

C. Split-Sleeve Pipe Couplings:
1. Description: Metal, bolted, split-sleeve-type, reducing or transition coupling with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.

a. Standard: AWWA C219.
b. Sleeve Material: Manufacturer's standard.
c. Sleeve Dimensions: Of thickness and width required to provide pressure rating.
d. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
e. Pressure Rating: 150 psig (1035 kPa) minimum.
f. Metal Component Finish: Corrosion-resistant coating or material.

D. Flexible Connectors:

1. Nonferrous-Metal Piping: Bronze hose covered with bronze wire braid; with copper-tube, pressure-type, solder-joint ends or bronze flanged ends brazed to hose.

2. Ferrous-Metal Piping: Stainless-steel hose covered with stainless-steel wire braid; with ASME B1.20.1, threaded steel pipe nipples or ASME B16.5, steel pipe flanges welded to hose.

E. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:

a. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:

a. Description:

1) Standard: ASSE 1079.
2) Factory-fabricated, bolted, companion-flange assembly.
3) Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

4. Dielectric-Flange Insulating Kits:

a. Description:

1) Nonconducting materials for field assembly of companion flanges.
2) Pressure Rating: 150 psig (1035 kPa).
3) Gasket: Neoprene or phenolic.
4) Bolt Sleeves: Phenolic or polyethylene.
5) Washers: Phenolic with steel backing washers.

5. Dielectric Nipples:

a. Description:

1) Standard: IAPMO PS 66
2) Electroplated steel nipple complying with ASTM F 1545.
3) Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
4) End Connections: Male threaded or grooved.
5) Lining: Inert and noncorrosive, propylene.

2.9 CORROSION-PROTECTION PIPING ENCASEMENT

A. Encasement for Underground Metal Piping:

1. Standards: ASTM A 674 or AWWA C105.
2. Form: Sheet or tube.
3. Material: LLDPE film of 0.008-inch (0.20-mm) minimum thickness.
4. Material: LLDPE film of 0.008-inch (0.20-mm) minimum thickness, or high-density, crosslaminated PE film of 0.004-inch (0.10-mm) minimum thickness.
5. Material: High-density, crosslaminated PE film of 0.004-inch (0.10-mm) minimum thickness.
6. Color: Black.

2.10 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Nonrising-Stem, Metal-Seated Gate Valves:

a. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.

1) Standard: AWWA C500.
2) Minimum Pressure Rating: 200 psig (1380 kPa).
3) End Connections: Mechanical joint.
4) Interior Coating: Complying with AWWA C550.

2. Nonrising-Stem, Resilient-Seated Gate Valves:

a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

1) Standard: AWWA C509.
2) Minimum Pressure Rating: 200 psig (1380 kPa).
3) End Connections: Mechanical joint.
4) Interior Coating: Complying with AWWA C550.

3. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves:

a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.

1) Standard: AWWA C509.
2) Minimum Pressure Rating: 250 psig (1725 kPa).
3) End Connections: Push on or mechanical joint.
4) Interior Coating: Complying with AWWA C550.

4. OS&Y, Rising-Stem, Metal-Seated Gate Valves:

a. Description: Cast- or ductile-iron body and bonnet, with cast-iron double disc, bronze disc and seat rings, and bronze stem.

1) Standard: AWWA C500.
2) Minimum Pressure Rating: 200 psig (1380 kPa).
3) End Connections: Flanged.

5. OS&Y, Rising-Stem, Resilient-Seated Gate Valves:

a. Description: Cast- or ductile-iron body and bonnet, with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.

1) Standard: AWWA C509.
2) Minimum Pressure Rating: 200 psig (1380 kPa).
3) End Connections: Flanged.

B. UL/FMG, Cast-Iron Gate Valves:

1. UL/FMG, Nonrising-Stem Gate Valves:

a. Description: Iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.

1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 175 psig (1207 kPa).
3) End Connections: Flanged.

2. OS&Y, Rising-Stem Gate Valves:

a. Description: Iron body and bonnet and bronze seating material.

1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 175 psig (1207 kPa).
3) End Connections: Flanged.

C. Bronze Gate Valves:

1. OS&Y, Rising-Stem Gate Valves:

a. Description: Bronze body and bonnet and bronze stem.

1) Standards: UL 262 and FMG approved.
2) Minimum Pressure Rating: 175 psig (1207 kPa).
3) End Connections: Threaded.

2. Nonrising-Stem Gate Valves:

a. Description: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.

1) Standard: MSS SP-80.

2.11 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:
1. Description: Sleeve and valve compatible with drilling machine.

a. Standard: MSS SP-60.
b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
c. Valve: AWWA, cast-iron, nonrising-stem, metal-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches (125 mm) in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.12 CHECK VALVES

A. AWWA Check Valves:
1. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.

a. Standard: AWWA C508.
b. Pressure Rating: 175 psig (1207 kPa).

B. UL/FMG, Check Valves:
1. Description: Swing-check type with pressure rating; rubber-face checks, unless otherwise indicated; and ends matching piping.

a. Standards: UL 312 and FMG approved.
b. Pressure Rating: 175 psig (1207 kPa).

2.13 DETECTOR CHECK VALVES

A. Detector Check Valves:
1. Description: Galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.

a. Standards: UL 312 and FMG approved.
b. Pressure Rating: 175 psig (1207 kPa).
c. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.

2. Description: Iron body, corrosion-resistant clapper ring and seat ring material, flanged ends, with connections for bypass and installation of water meter.

a. Standards: UL 312 and FMG approved.
b. Pressure Rating: 175 psig (1207 kPa).

2.14 BUTTERFLY VALVES

A. AWWA Butterfly Valves:
1. Description: Rubber seated.

a. Standard: AWWA C504.
b. Body: Cast or ductile iron.
c. Body Type: Wafer or flanged.
d. Pressure Rating: 150 psig (1035 kPa).

B. UL Butterfly Valves:
1. Description: Metal on resilient material seating.

a. Standards: UL 1091 and FMG approved.
b. Body: Cast or ductile iron.
c. Body Type: Wafer or flanged.
d. Pressure Rating: 175 psig (1207 kPa).

2.15 PLUG VALVES

A. Plug Valves:
1. Description: Resilient-seated eccentric.

a. Standard: MSS SP-108.
b. Body: Cast iron.
c. Pressure Rating: 175-psig (1207-kPa) minimum CWP.
d. Seat Material: Suitable for potable-water service.

2.16 CORPORATION VALVES AND CURB VALVES

A. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.

2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

B. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

C. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches (75 mm) in diameter.

1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.17 WATER METERS

A. Water meters will be furnished by utility company.

B. Displacement-Type Water Meters:

1. Description: With bronze main case.

a. Standard: AWWA C700.
b. Registration: Flow in gallons (liters).

C. Turbine-Type Water Meters:

1. Description:

a. Standard: AWWA C701.
b. Registration: Flow in gallons (liters).

D. Compound-Type Water Meters:

1. Description:

a. Standard: AWWA C702.
b. Registration: Flow in gallons (liters).

E. Remote Registration System:

1. Description: Utility company standard; direct-reading type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.

a. Standard: AWWA C706.
b. Registration: Flow in gallons (liters).

F. Remote Registration System:

1. Description: Utility company standard; encoder type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.

a. Standard: AWWA C707.
b. Registration: Flow in gallons (liters).
c. Data-Acquisition Units: Comply with utility company requirements for type and quantity.
d. Visible Display Units: Comply with utility company requirements for type and quantity.

2.18 DETECTOR-TYPE WATER METERS

A. Detector-Type Water Meters:

B. Description: Main line, proportional meter with second meter on bypass. Register flow in gallons (liters).

1. Standards: AWWA C703, UL listed, and FMG approved.
2. Pressure Rating: 150 psig (1035 kPa).
3. Bypass Meter: AWWA C701, turbine-type, bronze case.

a. Size: At least one-half nominal size of main-line meter.

C. Description: Main-line turbine meter with strainer and second meter on bypass. Register flow in gallons (liters).

1. Standards: AWWA C703, UL listed, and FMG approved.
2. Pressure Rating: 175 psig (1207 kPa).
3. Bypass Meter: AWWA C701, turbine-type, bronze case.

a. Size: At least NPS 2 (DN 50).

D. Remote Registration System:

1. Description: Utility company standard; direct-reading type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.

a. Standard: AWWA C706.
b. Registration: Flow in gallons (liters).

E. Remote Registration System:

1. Description: Utility company standard; encoder type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.

a. Standard: AWWA C707.

b. Registration: Flow in gallons (liters).
c. Data-Acquisition Units: Comply with utility company requirements for type and quantity.
d. Visible Display Units: Comply with utility company requirements for type and quantity.

2.19 PRESSURE-REDUCING VALVES

A. Water Regulators:
1. Standard: ASSE 1003.
2. Pressure Rating: Initial pressure of 150 psig (1035 kPa).
3. Body: Bronze with chrome-plated finish for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).
4. Valves for Booster Heater Water Supply: Include integral bypass.
5. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

B. Water Control Valves:
1. Description: Pilot-operation, diaphragm-type, single-seated main water control valve with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot control valve, restrictor device, specialty fittings, and sensor piping.

a. Pressure Rating: Initial pressure of 150 psig (1035 kPa) minimum.
b. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
1) Pattern: Angle-valve design.
2) Trim: Stainless steel.
c. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.

2.20 RELIEF VALVES

A. Air-Release Valves:
1. Description: Hydromechanical device to automatically release accumulated air.

a. Standard: AWWA C512.
b. Pressure Rating: 300 psig (2070 kPa).
c. Body Material: Cast iron.
d. Trim Material: Stainless steel, brass, or bronze.

B. Air/Vacuum Valves:
1. Description: Direct-acting, float-operated, hydromechanical device with large orifice to automatically release accumulated air or to admit air during filling of piping.

a. Standard: AWWA C512.
b. Pressure Rating: 300 psig (2070 kPa).
c. Body Material: Cast iron.

d. Trim Material: Stainless steel, brass, or bronze.

C. Combination Air Valves:
1. Description: Float-operated, hydromechanical device to automatically release accumulated air or to admit air.

a. Standard: AWWA C512.
b. Pressure Rating: 300 psig (2070 kPa).
c. Body Material: Cast iron.
d. Trim Material: Stainless steel, brass, or bronze.

2.21 VACUUM BREAKERS

A. Pressure Vacuum Breaker Assembly:
1. Standard: ASSE 1020.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.
4. Accessories: Ball valves on inlet and outlet.

2.22 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:
1. Standard: ASSE 1013 or AWWA C511.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 12 psig (83 kPa) maximum, through middle 1/3 of flow range.
4. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.
5. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
6. Configuration: Designed for horizontal, straight through flow.
7. Accessories:

a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.
b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.

B. Double-Check, Backflow-Prevention Assemblies:
1. Standard: ASSE 1015 or AWWA C510.
2. Operation: Continuous-pressure applications, unless otherwise indicated.
3. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.
4. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 (DN 65) and larger.
5. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
6. Configuration: Designed for horizontal, straight through flow.

7. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

C. Reduced-Pressure-Detector, Fire-Protection Backflow Preventer Assemblies:
1. Standards: ASSE 1047 and UL listed or FMG approved.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 12 psig (83 kPa) maximum, through middle 1/3 of flow range.
4. Body: Cast iron with interior lining complying with AWWA C550 or that is FDA approved.
5. End Connections: Flanged.
6. Configuration: Designed for horizontal, straight through flow.
7. Accessories:

a. Valves: UL 262, FMG-approved, OS&Y gate type with flanged ends on inlet and outlet.
b. Air-Gap Fitting: ASME A112.1.2, matching backflow preventer connection.
c. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

D. Double-Check, Detector-Assembly Backflow Preventers:
1. Standards: ASSE 1048 and UL listed or FMG approved.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.
4. Body: Cast iron with interior lining complying with AWWA C550 or that is FDA approved.
5. End Connections: Flanged.
6. Configuration: Designed for horizontal, straight through flow.
7. Accessories:

a. Valves: UL 262, FMG-approved, OS&Y gate type with flanged ends on inlet and outlet.
b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

E. Backflow Preventer Test Kits:
1. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.23 WATER METER BOXES

A. Description: Cast-iron body and cover for disc-type water meter, with lettering "WATER METER" in cover; and with slotted, open-bottom base section of length to fit over service piping.

1. Option: Base section may be cast-iron, PVC, clay, or other pipe.

B. Description: Cast-iron body and double cover for disc-type water meter, with lettering "WATER METER" in top cover; and with separate inner cover; air space between covers; and slotted, open-bottom base section of length to fit over service piping.

C. Description: Polymer-concrete body and cover for disc-type water meter, with lettering "WATER" in cover; and with slotted, open-bottom base section of length to fit over service piping. Include vertical and lateral design loadings of 15,000 lb minimum over 10 by 10 inches (6800 kg minimum over 254 by 254 mm) square.

2.24 CONCRETE VAULTS

A. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C 857 and made according to ASTM C 858.

1. Ladder: ASTM A 36/A 36M, steel or polyethylene-encased steel steps.
2. Manhole: ASTM A 48/A 48M Class No. 35A minimum tensile strength, gray-iron traffic frame and cover.

    a. Dimension: 24-inch (610-mm) minimum diameter, unless otherwise indicated.

3. Manhole: ASTM A 536, Grade 60-40-18, ductile-iron traffic frame and cover.

    a. Dimension: 24-inch- (610-mm-) minimum diameter, unless otherwise indicated.

4. Drain: ASME A112.6.3, cast-iron floor drain with outlet of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

2.25 PROTECTIVE ENCLOSURES

A. Freeze-Protection Enclosures:
1. Description: Insulated enclosure designed to protect aboveground water piping, equipment, or specialties from freezing and damage, with heat source to maintain minimum internal temperature of 40 deg F (4 deg C) when external temperatures reach as low as minus 34 deg F (minus 36 deg C).

    a. Standard: ASSE 1060.
    b. Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.
    c. Class I-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.

        1) Housing: Reinforced-aluminum or -fiberglass construction.

            a) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
            b) Drain opening for units with drain connection.
            c) Access doors with locking devices.

d) Insulation inside housing.
e) Anchoring devices for attaching housing to concrete base.

2) Electric heating cable or heater with self-limiting temperature control.

B. Weather-Resistant Enclosures:
1. Description: Uninsulated enclosure designed to protect aboveground water piping, equipment, or specialties from weather and damage.

a. Standard: ASSE 1060.
b. Class III: For equipment or devices other than pressure or atmospheric vacuum breakers.
c. Class III-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.

1) Housing: Reinforced-aluminum or -fiberglass construction.

a) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
b) Drain opening for units with drain connection.
c) Access doors with locking devices.
d) Anchoring devices for attaching housing to concrete base.

C. Expanded-Metal Enclosures:
1. Description: Enclosure designed to protect aboveground water piping, equipment, or specialties from damage.

a. Material: ASTM F 1267, expanded metal side and top panels, of weight and with reinforcement of same metal at edges as required for rigidity.
b. Type: Type I, expanded.
c. Class: Class 1, uncoated carbon steel.
d. Finish: Manufacturer's enamel paint.
e. Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
f. Locking device.
g. Lugs or devices for securing enclosure to base.

D. Enclosure Bases:

1. Description: 4-inch- (100-mm-) minimum thickness precast concrete, of dimensions required to extend at least 6 inches (150 mm) beyond edges of enclosure housings. Include openings for piping.

2.26 FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants:
1. Description: Freestanding, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, 5-1/4-inch (133-mm) main valve, drain valve, and NPS 6 (DN 150) mechanical-

joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.

a. Standard: AWWA C502.
b. Pressure Rating: 150 psig (1035 kPa) minimum.

2. Description: Freestanding, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, 5-1/4-inch (133-mm) main valve, drain valve, and NPS 6 (DN 150) mechanical-joint inlet. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.

a. Standards: UL 246, FMG approved.
b. Pressure Rating: 150 psig (1035 kPa) minimum.
c. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
d. Operating and Cap Nuts: Pentagon, 1-1/2 inches (38 mm) point to flat.
e. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
f. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

B. Wet-Barrel Fire Hydrants:
1. Description: Freestanding, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, NPS 6 (DN 150) threaded or flanged inlet, and base section with NPS 6 (DN 150) mechanical-joint inlet. Include interior coating according to AWWA C550.

a. Standard: AWWA C503.
b. Pressure Rating: 150 psig (1035 kPa) minimum.

2. Description: Freestanding, with one NPS 4-1/2 (DN 115) and two NPS 2-1/2 (DN 65) outlets, NPS 6 (DN 150) threaded or flanged inlet, and base section with NPS 6 (DN 150) mechanical-joint inlet.

a. Standards: UL 246 and FMG approved.
b. Pressure Rating: 150 psig (1035 kPa) minimum.
c. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
d. Operating and Cap Nuts: Pentagon, 1-1/2 inches (38 mm) point to flat.
e. Direction of Opening: Open hydrant valves by turning operating nut to left or counterclockwise.
f. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

2.27 FLUSHING HYDRANTS

A. Post-Type Flushing Hydrants:
1. Description: Nonfreeze and drainable, of length required for shutoff valve installation below frost line.

a. Pressure Rating: 150 psig (1035 kPa) minimum.
b. Outlet: One, with horizontal discharge.

c. Hose Thread: NPS 2-1/2 (DN 65), with NFPA 1963 external hose thread for use by local fire department, and with cast-iron cap with brass chain.
d. Barrel: Cast-iron or steel pipe with breakaway feature.
e. Valve: Bronze body with bronze-ball or plunger closure, and automatic draining.
f. Security: Locking device for padlock.
g. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.
h. Inlet: NPS 2 (DN 50) minimum.
i. Operating Wrench: One for each unit.

B. Ground-Type Flushing Hydrants:
1. Description: Nonfreeze and drainable, of length required for shutoff valve installation below frost line.

a. Pressure Rating: 150 psig (1035 kPa) minimum.
b. Outlet: One, with vertical discharge.
c. Hose Thread: NPS 2-1/2 (DN 65), with NFPA 1963 external hose thread for use by local fire department, and with cast-iron cap with brass chain.
d. Barrel: Cast-iron or steel pipe.
e. Valve: Bronze body with bronze-ball or plunger closure, and automatic draining.
f. Inlet: NPS 2 (DN 50) minimum.
g. Hydrant Box: Cast iron with cover, for ground mounting.
h. Operating Wrench: One for each unit.

C. Post-Type Sampling Station:
1. Description: Nonfreeze and drainable, of length required for shutoff valve installation below frost line.

a. Pressure Rating: 100 psig (690 kPa) minimum.
b. Sampling Outlet: One unthreaded nozzle with handle.
c. Valve: Bronze body with bronze-ball or plunger closure. Include operating handle.
d. Drain: Tubing with separate manual vacuum pump.
e. Inlet: NPS 3/4 (DN 20) minimum.
f. Housing: Weatherproof material with locking device. Include anchor device.
g. Operating Wrench: One for each unit.

2.28 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connections:
1. Description: Freestanding, with cast-bronze body, thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- (460-mm-) high brass sleeve; and round escutcheon plate.

a. Standard: UL 405.
b. Connections: Two NPS 2-1/2 (DN 65) inlets and one NPS 4 (DN 100) outlet.
c. Connections: Three NPS 2-1/2 (DN 65) inlets and one NPS 6 (DN 150) outlet.
d. Connections: Six NPS 2-1/2 (DN 65) inlets and one NPS 6 (DN 150) outlet.
e. Inlet Alignment: Inline, horizontal.
f. Finish Including Sleeve: Polished chrome-plated.

g. Escutcheon Plate Marking: "AUTO SPKR & STANDPIPE."

2.29 ALARM DEVICES

A. Alarm Devices, General: UL 753 and FMG approved, of types and sizes to mate and match piping and equipment.

B. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psig (1725-kPa) working pressure; designed for horizontal or vertical installation; with 2 single-pole, double-throw circuit switches to provide isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal when cover is removed.

C. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.

D. Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground water-service piping NPS 3/4 to NPS 3 (DN 20 to DN 80) shall be any of the following:

1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A); wrought-copper, solder-joint fittings; and brazed joints.
2. PE, ASTM pipe; insert fittings for PE pipe; and clamped joints.
3. PVC, Schedule 40 pipe; PVC, Schedule 40 socket fittings; and solvent-cemented joints.
4. NPS 1 to NPS 3 (DN 25 to DN 80) fiberglass, AWWA RTRP, Class 150; RTRF; and bonded joints.
5. Fiberglass, AWWA RTRP, Class 150; RTRF; and bonded joints.

F. Underground water-service piping NPS 4 to NPS 8 (DN 100 to DN 200) shall be any of the following:

1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M,Type A); wrought-copper, solder-joint fittings; and brazed joints.
2. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed joints.
3. PE, AWWA pipe; PE, AWWA fittings; and heat-fusion joints.
4. PVC, Schedule 40 pipe; PVC, Schedule 40 socket fittings; and solvent-cemented joints.
5. NPS 4 and NPS 6 (DN 100 and DN 150): NPS 6 (DN 150) PVC, AWWA Class 150 pipe; PVC, AWWA Class 150 fabricated or molded fittings; and gasketed joints.
6. NPS 8 (DN 200): PVC, AWWA Class 200 pipe; PVC, AWWA Class 200 fabricated push-on-joint, ductile-iron fittings; and gasketed joints.
7. Fiberglass, AWWA RTRP, Class 150; RTRF; and bonded joints.

G. Water Meter Box Water-Service Piping NPS 3/4 to NPS 2 (DN 20 to DN 50) shall be same as underground water-service piping.

H. Aboveground and Vault Water-Service Piping NPS 3/4 to NPS 3 (DN 20 to DN 80) shall be any of the following:

1. Hard copper tube, ASTM B 88, Type K (ASTM B 88M, Type A); wrought-copper, solder-joint fittings; and brazed joints.
2. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.
3. NPS 1 to NPS 2 (DN 25 to DN 50) fiberglass, AWWA RTRP, Class 150; RTRF; and bonded joints.

I. Aboveground and vault water-service piping NPS 4 to NPS 8 (DN 100 to DN 200) shall be any of the following:

1. Hard copper tube, ASTM B 88, Type K (ASTM B 88M, Type A); wrought-copper, solder-joint fittings; and brazed joints.
2. Ductile-iron, grooved-end pipe; ductile-iron, grooved-end appurtenances; and grooved joints.
3. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.
4. Fiberglass, AWWA RTRP, Class 150; RTRF; and bonded joints.

J. Underground Fire-Service-Main Piping NPS 4 to NPS 12 (DN 100 to DN 300) shall be any of the following:

1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed joints.
2. PE, Class 150, fire-service pipe; molded PE fittings; and heat-fusion joints.
3. PVC, AWWA Class 150 pipe listed for fire-protection service; PVC Class 150 fabricated or molded fittings; and gasketed joints.
4. PVC, AWWA Class 200 pipe listed for fire-protection service; PVC Class 200 fabricated fittings; and gasketed joints.
5. Fiberglass, AWWA, FMG-approved RTRP, Class 150; RTRF; and gasketed joints.
6. Fiberglass, UL RTRP, Class 150; RTRF; and gasketed joints.

K. Aboveground and Vault Fire-Service-Main Piping NPS 4 to NPS 12 (DN 100 to DN 300) shall be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.

L. Underground Combined Water-Service and Fire-Service-Main Piping NPS 6 to NPS 12 (DN 150 to DN 300) shall be any of the following:

1. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed joints.
2. PVC, AWWA Class 150 pipe listed for fire-protection service; PVC fabricated or molded fittings of same class as pipe; and gasketed joints.
3. Fiberglass, AWWA, FMG-approved RTRP, Class 150; RTRF; and gasketed joints.

M. Aboveground and Vault Combined Water Service and Fire-Service-Main Piping NPS 6 to NPS 12 (DN 150 to DN 300) shall be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 (DN 80) and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 (DN 50) and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Underground Valves, NPS 3 (DN 80) and Larger: AWWA, cast-iron, nonrising-stem, metal-seated gate valves with valve box.
2. Underground Valves, NPS 4 (DN 100) and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
3. Use the following for valves in vaults and aboveground:

    a. Gate Valves, NPS 2 (DN 50) and Smaller: Bronze, nonrising stem.
    b. Gate Valves, NPS 3 (DN 80) and Larger: AWWA, cast iron, OS&Y rising stem, metal seated.
    c. Check Valves: AWWA C508, swing type.

4. Pressure-Reducing Valves: Use for water-service piping in vaults and aboveground to control water pressure.
5. Relief Valves: Use for water-service piping in vaults and aboveground.

    a. Air-Release Valves: To release accumulated air.
    b. Air/Vacuum Valves: To release or admit large volume of air during filling of piping.
    c. Combination Air Valves: To release or admit air.

6. Detector Check Valves: Use for water-service piping in vaults and aboveground to detect unauthorized use of water.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

A. See Section 330500 "Common Work Results for Utilities" for piping-system common requirements.

3.5 PIPING INSTALLATION

A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 (DN 50) with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Make connections NPS 2 (DN 50) and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
4. Install corporation valves into service-saddle assemblies.
5. Install manifold for multiple taps in water main.
6. Install curb valve in water-service piping with head pointing up and with service box.

E. Comply with NFPA 24 for fire-service-main piping materials and installation.

1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.
2. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.

G. Install PE pipe according to ASTM D 2774 and ASTM F 645.

H. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

I. Install fiberglass AWWA pipe according to AWWA M45.

J. Bury piping with depth of cover over top at least 60 inches, with top at least 12 inches (300 mm) below level of maximum frost penetration, and according to the following:

1. Under Driveways: With at least 60 inches cover over top.
2. Under Railroad Tracks: With at least 72 inches cover over top.
3. In Loose Gravelly Soil and Rock: With at least 12 inches (300 mm) additional cover.

K. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

L. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

M. Sleeves are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

N. Mechanical sleeve seals are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

O. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

P. See Section 211200 "Fire-Suppression Standpipes," Section 211313 "Wet-Pipe Sprinkler Systems," and Section 211316 "Dry-Pipe Sprinkler Systems" for fire-suppression-water piping inside the building.

Q. See Section 221116 "Domestic Water Piping" for potable-water piping inside the building.

3.6 JOINT CONSTRUCTION

A. See Section 330500 "Common Work Results for Utilities" for basic piping joint construction.

B. Make pipe joints according to the following:

1. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.
2. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
3. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
4. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
5. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.

6. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
7. Fiberglass Piping Bonded Joints: Use adhesive and procedure recommended by piping manufacturer.
8. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

    a. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric nipples.
    b. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.
    c. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

3.7 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Heat-fused joints.
6. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.
4. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.8 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

D. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.

E. MSS Valves: Install as component of connected piping system.

F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

G. Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves.

H. Relief Valves: Comply with AWWA C512. Install aboveground with shutoff valve on inlet.

3.9 DETECTOR-CHECK VALVE INSTALLATION

A. Install in vault or aboveground.

B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.

C. Support detector check valves, meters, shutoff valves, and piping on brick or concrete piers.

3.10 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written instructions.

B. Water Meters: Install displacement-type water meters, NPS 2 (DN 50) and smaller, in meter boxes with shutoff valves on water meter inlets. Include valves on water meter outlets and valved bypass around meters unless prohibited by authorities having jurisdiction.

C. Water Meters: Install compound-type water meters, NPS 3 (DN 80) and larger, in meter vaults. Include shutoff valves on water meter inlets and outlets and valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

D. Water Meters: Install detector-type water meters in meter vault according to AWWA M6. Include shutoff valves on water meter inlets and outlets and full-size valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

3.11 ROUGHING-IN FOR WATER METERS

A. Rough-in piping and specialties for water meter installation according to utility company's written instructions.

3.12 VACUUM BREAKER ASSEMBLY INSTALLATION

A. Install pressure vacuum breaker assemblies of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install pressure vacuum breaker assemblies in vault or other space subject to flooding.

3.13 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

D. Support NPS 2-1/2 (DN 65) and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.14 WATER METER BOX INSTALLATION

A. Install water meter boxes in paved areas flush with surface.

B. Install water meter boxes in grass or earth areas with top 2 inches (50 mm) above surface.

3.15 CONCRETE VAULT INSTALLATION

A. Install precast concrete vaults according to ASTM C 891.

3.16 PROTECTIVE ENCLOSURE INSTALLATION

A. Install concrete base level and with top approximately 2 inches (50 mm) above grade.

B. Install protective enclosure over valves and equipment.

C. Anchor protective enclosure to concrete base.

3.17 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.

C. AWWA Fire Hydrants: Comply with AWWA M17.

D. UL/FMG Fire Hydrants: Comply with NFPA 24.

3.18 FLUSHING HYDRANT INSTALLATION

A. Install post-type flushing hydrants with valve below frost line and provide for drainage. Support in upright position. Include separate gate valve or curb valve and restrained joints in supply piping.

B. Install ground-type flushing hydrants with valve below frost line and provide for drainage. Install hydrant box flush with grade. Include separate gate valve or curb valve and restrained joints in supply piping.

C. Install sampling stations with valve below frost line and provide for drainage. Attach weather-resistant housing and support in upright position. Include separate curb valve in supply piping.

3.19 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire department connection to mains.

B. Install protective pipe bollards on two sides of each fire department connection. Pipe bollards are specified in Section 055000 "Metal Fabrications."

3.20 ALARM DEVICE INSTALLATION

A. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.

B. Supervisory Switches: Supervise valves in open position.

1. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.
2. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.

C. Locking and Sealing: Secure unsupervised valves as follows:

1. Valves: Install chain and padlock on open OS&Y gate valve.
2. Post Indicators: Install padlock on wrench on indicator post.

D. Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.

E. Water-Flow Indicators: Install in water-service piping in vault. Select indicator with saddle and vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.

F. Connect alarm devices to building fire alarm system. Wiring and fire-alarm devices are specified in Section 284621.11 "Addressable Fire-Alarm Systems" and Section 284621.13 "Conventional Fire-Alarm Systems."

3.21 CONNECTIONS

A. See Section 330500 "Common Work Results for Utilities" for piping connections to valves and equipment.

B. Connect water-distribution piping to existing water main. Use tapping sleeve and tapping valve.

C. Connect water-distribution piping to interior domestic water and fire-suppression piping.

D. Connect waste piping from concrete vault drains to sanitary sewerage system. See Section 221313 "Facility Sanitary Sewers" for connection to sanitary-sewer piping.

E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.22 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig (0 kPa). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.23 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."

B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Section 330500 "Common Work Results for Utilities" for identifying devices.

3.24 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 221113

SECTION 221313 - FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless cast-iron soil pipe and fittings.
3. Ductile-iron, gravity sewer pipe and fittings.
4. Ductile-iron, pressure pipe and fittings.
5. ABS pipe and fittings.
6. PVC pipe and fittings.
7. Fiberglass pipe and fittings.
8. Concrete pipe and fittings.
9. Nonpressure-type transition couplings.
10. Pressure-type pipe couplings.
11. Expansion joints and deflection fittings.
12. Backwater valves.
13. Cleanouts.
14. Encasement for piping.
15. Manholes.
16. Concrete.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Pipe and fittings.
2. Non-pressure and pressure couplings
3. Expansion joints and deflection fittings.
4. Backwater valves.
5. Cleanouts.

B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:

1. Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
2. Show system piping in profile. Draw profiles to horizontal scale of not less than 1 inch equals 50 feet (1:500) and to vertical scale of not less than 1 inch equals 5 feet (1:50). Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

B. Product Certificates: For each type of pipe and fitting.

C. Field quality-control reports.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

1.7 FIELD CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.1 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class and Extra-Heavy class.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.2 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI-Trademark, Shielded Couplings:

1. Description: ASTM C 1277 and CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Shielded Couplings:

1. Description: ASTM C 1277 and ASTM C 1540, with stainless-steel shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Cast-Iron, Shielded Couplings:

1. Description: ASTM C 1277 with ASTM A 48/A 48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

E. Unshielded Couplings:

1. Description: ASTM C 1277 and ASTM C 1461, rigid, sleeve-type, reducing- or transition-type mechanical coupling, with integral, center pipe stop, molded from ASTM C 1440, thermoplastic elastomer (TPE) material; with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.3 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS

A. Pipe: ASTM A 746, for push-on joints.

B. Standard Fittings: AWWA C110/A21.10, ductile or gray iron, for push-on joints.

C. Compact Fittings: AWWA C153/A21.53, ductile iron, for push-on joints.

D. Gaskets: AWWA C111/A21.11, rubber.

2.4 DUCTILE-IRON, PRESSURE PIPE AND FITTINGS

A. Push-on-Joint Piping:

1. Pipe: AWWA C151/A21.51.
2. Standard Fittings: AWWA C110/A21.10, ductile or gray iron.
3. Compact Fittings: AWWA C153/A21.53.
4. Gaskets: AWWA C111/A21.11, rubber, of shape matching pipe and fittings.

B. Mechanical-Joint Piping:

1. Pipe: AWWA C151/A21.51, with bolt holes in bell.
2. Standard Fittings: AWWA C110/A21.10, ductile or gray iron, with bolt holes in bell.
3. Compact Fittings: AWWA C153/A21.53, with bolt holes in bells.
4. Glands: Cast or ductile iron; with bolt holes and high-strength, cast-iron or high-strength, low-alloy steel bolts and nuts.
5. Gaskets: AWWA C111/A21.11, rubber, of shape matching pipe, fittings, and glands.

2.5 ABS PIPE AND FITTINGS

A. ABS Sewer Pipe and Fittings: ASTM D 2661, with bell-and-spigot ends for gasketed joints.

1. NPS 3 to NPS 6 (DN 80 to DN 150): SDR 35.
2. NPS 8 to NPS 12 (DN 200 to DN 300): SDR 42.

B. Gaskets: ASTM F 477, elastomeric seals.

2.6 PVC PIPE AND FITTINGS

A. PVC Cellular-Core Sewer Piping:

1. Pipe: ASTM F 891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
2. Fittings: ASTM D 3034, SDR 35, PVC socket-type fittings.

B. PVC Corrugated Sewer Piping:

1. Pipe: ASTM F 949, PVC corrugated pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM F 949, PVC molded or fabricated, socket type.
3. Gaskets: ASTM F 477, elastomeric seals.

C. PVC Profile Sewer Piping:

1. Pipe: ASTM F 794, PVC profile, gravity sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

D. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

E. PVC Gravity Sewer Piping:

1. Pipe and Fittings: ASTM F 679, T-1 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F 477, elastomeric seals for gasketed joints.

F. PVC Pressure Piping:

1. Pipe: AWWA C900, Class 100 PVC pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: AWWA C900, Class 100 PVC pipe with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

G. PVC Water-Service Piping:

1. Pipe: ASTM D 1785, Schedule 40 PVC, with plain ends for solvent-cemented joints.
2. Fittings: ASTM D 2466, Schedule 40 PVC, socket type.

2.7 FIBERGLASS PIPE AND FITTINGS

A. Fiberglass Sewer Pipe: ASTM D 3262, RTRP, for gasketed joints fabricated with Type 2, polyester or Type 4, epoxy resin.

1. Liner: Reinforced thermoset.
2. Grade: Reinforced, surface layer matching pipe resin.
3. Stiffness: 9 psig (62 kPa).

B. Fiberglass Nonpressure Fittings: ASTM D 3840, RTRF, for gasketed joints.

1. Laminating Resin: Type 1, polyester or Type 2, epoxy resin.
2. Reinforcement: Grade with finish compatible with resin.

C. Gaskets: ASTM F 477, elastomeric seals.

2.8 CONCRETE PIPE AND FITTINGS

A. Nonreinforced-Concrete Sewer Pipe and Fittings: ASTM C 14 (ASTM C 14M), Class 1, with bell-and-spigot or tongue-and-groove ends for gasketed joints with ASTM C 443 (ASTM C 443M), rubber gaskets.

B. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76 (ASTM C 76M).

1. Bell-and-spigot or tongue-and-groove ends for gasketed joints, with ASTM C 443 (ASTM C 443M), rubber gaskets.
2. Class II, Wall A.
3. Class III, Wall A.
4. Class IV, Wall A.
5. Class V, Wall A.

2.9 NONPRESSURE-TYPE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling; for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and include corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2. For Concrete Pipes: ASTM C 443 (ASTM C 443M), rubber.
3. For Fiberglass Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
4. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
5. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:

1. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, Flexible Couplings:

1. Description: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, Flexible Couplings:

1. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

F. Nonpressure-Type, Rigid Couplings:

1. Description: ASTM C 1461, sleeve-type, reducing- or transition-type mechanical coupling; molded from ASTM C 1440, TPE material; with corrosion-resistant-metal tension band and tightening mechanism on each end.

2.10 PRESSURE-TYPE PIPE COUPLINGS

A. Tubular-Sleeve Couplings: AWWA C219, with center sleeve, gaskets, end rings, and bolt fasteners.

B. Metal, bolted, sleeve-type, reducing or transition coupling; for joining underground pressure piping. Include 150-psig (1035-kPa) minimum pressure rating and ends of same sizes as piping to be joined.

C. Center-Sleeve Material: Manufacturer's standard.

D. Gasket Material: Natural or synthetic rubber.

E. Metal Component Finish: Corrosion-resistant coating or material.

2.11 EXPANSION JOINTS AND DEFLECTION FITTINGS

A. Ductile-Iron, Flexible Expansion Joints:

1. Description: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110/A21.10 or AWWA C153/A21.53. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psig (1725-kPa) minimum working pressure and for offset and expansion indicated.

B. Ductile-Iron Expansion Joints:

1. Description: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110/A21.10 or AWWA C153/A21.53. Include rating for 250-psig (1725-kPa) minimum working pressure and for expansion indicated.

C. Ductile-Iron Deflection Fittings:

1. Description: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C110/A21.10 or AWWA C153/A21.53. Include rating for 250-psig (1725-kPa) minimum working pressure and for up to 15 degrees of deflection.

2.12 BACKWATER VALVES

A. Cast-Iron Backwater Valves:

1. Description: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.

2. Horizontal type; with swing check valve and hub-and-spigot ends.
3. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.
4. Terminal type; with bronze seat, swing check valve, and hub inlet.

B. PVC Backwater Valves:

1. Description: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

2.13 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

2. Top-Loading Classification(s): Heavy Duty and Extra-Heavy Duty.
3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts:

1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.14 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105/A21.5.

B. Material: Linear low-density polyethylene film of 0.008-inch (0.20-mm) or high-density, cross-laminated polyethylene film of 0.004-inch (0.10-mm) minimum thickness.

C. Form: Sheet or tube.

D. Color: Black or natural.

2.15 MANHOLES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478 (ASTM C 478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
4. Base Section: 6-inch (150-mm) minimum thickness for floor slab and 4-inch (100-mm) minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
5. Riser Sections: 4-inch (100-mm) minimum thickness, of length to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990 (ASTM C 990M), bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
9. Steps: Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit

steps if total depth from floor of manhole to finished grade is less than 60 inches (1500 mm).

10. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Precast Concrete Manholes:

1. Description: ASTM C 913; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44 in AASHTO HL), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
3. Joint Sealant: ASTM C 990 (ASTM 990M), bitumen or butyl rubber.
4. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
5. Steps: Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch (13-mm) steel reinforcing rods encased in ASTM D 4101, PP; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches (1500 mm).
6. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
7. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

C. Fiberglass Manholes:

1. Description: ASTM D 3753.

2. Diameter: 48 inches (1200 mm) minimum unless otherwise indicated.
3. Ballast: Increase thickness of concrete base as required to prevent flotation.
4. Base Section: Concrete, 6-inch (150-mm) minimum thickness.
5. Resilient Pipe Connectors: ASTM C 923 (ASTM C 923M), cast or fitted into manhole walls, for each pipe connection.
6. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches (1500 mm).
7. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust

manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.

8. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

D. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-mm) riser, with 4-inch- (100-mm-) minimum-width flange and 26-inch- (660-mm-) diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
2. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.

E. Manhole-Cover Inserts:

1. Description; Manufactured, plastic form, of size to fit between manhole frame and cover and designed to prevent stormwater inflow. Include handle for removal and gasket for gastight sealing.

2. Type: Solid.

2.16 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350 (ACI 350M), and the following:

1. Cement: ASTM C 150/C 150M, Type II.
2. Fine Aggregate: ASTM C 33/C 33M, sand.
3. Coarse Aggregate: ASTM C 33/C 33M, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A 1064/A 1064M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420-MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

a. Invert Slope: 1 percent through manhole.

2. Benches: Concrete, sloped to drain into channel.

a. Slope: 4 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi (20.7 MPa) minimum, with 0.58 maximum water/cementitious materials ratio.

1. Reinforcing Fabric: ASTM A1064/A 1064M, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420-MPa) deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details to indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
2. Install piping NPS 6 (DN 150) and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
3. Install piping with 60-inch (1520-mm) minimum cover.
4. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
5. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."

6. Install ductile-iron, gravity sewer piping according to ASTM A 746.
7. Install ABS sewer piping according to ASTM D 2321 and ASTM F 1668.
8. Install PVC cellular-core sewer piping according to ASTM D 2321 and ASTM F 1668.
9. Install PVC corrugated sewer piping according to ASTM D 2321 and ASTM F 1668.
10. Install PVC profile sewer piping according to ASTM D 2321 and ASTM F 1668.
11. Install PVC Type PSM sewer piping according to ASTM D 2321 and ASTM F 1668.
12. Install PVC gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
13. Install fiberglass sewer piping according to ASTM D 3839 and ASTM F 1668.
14. Install nonreinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."
15. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

G. Install force-main, pressure piping according to the following:

1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
2. Install piping with 60-inch (1520-mm) minimum cover.
3. Install ductile-iron pressure piping according to AWWA C600 or AWWA M41.
4. Install ductile-iron special fittings according to AWWA C600.
5. Install PVC pressure piping according to AWWA M23 or to ASTM D 2774 and ASTM F 1668.
6. Install PVC water-service piping according to ASTM D 2774 and ASTM F 1668.

H. Install corrosion-protection piping encasement over the following underground metal piping according to ASTM A 674 or AWWA C105/A21.5:

1. Hub-and-spigot, cast-iron soil pipe.
2. Hubless cast-iron soil pipe and fittings.
3. Ductile-iron pipe and fittings.
4. Expansion joints and deflection fittings.

I. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:

1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
3. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
4. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.
5. Join ABS sewer piping according to ASTM D 2321 for elastomeric-seal joints.

6. Join PVC cellular-core sewer piping according to ASTM D 2321 and ASTM F 891 for solvent-cemented joints.
7. Join PVC corrugated sewer piping according to ASTM D 2321.
8. Join PVC profile sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
9. Join PVC Type PSM sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
10. Join PVC gravity sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
11. Join fiberglass sewer piping according to ASTM D 4161 for elastomeric-seal joints.
12. Join nonreinforced-concrete sewer piping according to ASTM C 14 (ASTM C 14M) and ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
13. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
14. Join dissimilar pipe materials with nonpressure-type, flexible or rigid couplings.

B. Join force-main, pressure piping according to the following:

1. Join ductile-iron pressure piping according to AWWA C600 or AWWA M41 for push-on joints.
2. Join ductile-iron special fittings according to AWWA C600 or AWWA M41 for push-on joints.
3. Join PVC pressure piping according to AWWA M23 for gasketed joints.
4. Join PVC water-service piping according to ASTM D 2855.
5. Join dissimilar pipe materials with pressure-type couplings.

C. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.

    a. Shielded flexible or rigid couplings for pipes of same or slightly different OD.
    b. Unshielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD.
    c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

2. Use pressure pipe couplings for force-main joints.

3.4 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Install FRP manholes according to manufacturer's written instructions.

D. Form continuous concrete channels and benches between inlets and outlet.

E. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches (76 mm) above finished surface elsewhere unless otherwise indicated.

F. Install manhole-cover inserts in frame and immediately below cover.

3.5 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.6 BACKWATER VALVE INSTALLATION

A. Install horizontal-type backwater valves in piping manholes or pits.

B. Install combination horizontal and manual gate-type valves in piping and in manholes.

C. Install terminal-type backwater valves on end of piping and in manholes. Secure units to sidewalls.

3.7 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts, and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches (450 by 450 by 300 mm) deep. Set with tops 1 inch (25 mm) above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.8 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 221316 "Sanitary Waste and Vent Piping."

B. Connect force-main piping to building's sanitary force mains specified in Section 221316 "Sanitary Waste and Vent Piping." Terminate piping where indicated.

C. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch (150-mm) overlap with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).
3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of, and be flush with, inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches (150 mm) of concrete for minimum length of 12 inches (300 mm) to provide additional support of collar from connection to undisturbed ground.

    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi (20.7 MPa) unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.9 CLOSING ABANDONED SANITARY SEWER SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8-inch- (203-mm-) thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes: Excavate around manhole as required and use either procedure below:

1. Remove manhole and close open ends of remaining piping.
2. Remove top of manhole down to at least 36 inches (915 mm) below final grade. Fill to within 12 inches (300 mm) of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Section 312000 "Earth Moving."

3.10 IDENTIFICATION

A. Comply with requirements in Section 312000 "Earth Moving" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.11 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches (600 mm) of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

    a. Fill sewer piping with water. Test with pressure of at least 10-foot (3-m) head of water, and maintain such pressure without leakage for at least 15 minutes.
    b. Close openings in system and fill with water.
    c. Purge air and refill with water.
    d. Disconnect water supply.
    e. Test and inspect joints for leaks.

6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

   a. Test plastic gravity sewer piping according to ASTM F 1417.
   b. Test concrete gravity sewer piping according toASTM C 1628.

7. Force Main: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig (1035 kPa).

   a. Ductile-Iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.
   b. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.

8. Manholes: Perform hydraulic test according to ASTM C 969 (ASTM C 969M).

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.12 CLEANING

A. Clean dirt and superfluous material from interior of piping.

END OF SECTION 221313

SECTION 22 3000
PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water heaters.

1.02 REFERENCE STANDARDS

A. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters; Current Edition, Including All Revisions.

B. ANSI Z21.10.3

C. CSA 4.3

D. ASME, Section IV

E. ANSI/ASHRAE 15-1994, Section 8.13.6

F. NEC

1.03 SUBMITTALS

A. Product Data (Water Heaters):
   1. Provide data sheet including dimensions, rated capacities, shipping weights, and accessories.
   2. Wiring diagram.
   3. Warranty information.
   4. Installation and operating instructions.

B. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Performance (Pumps): Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.05 CERTIFICATIONS

A. Water Heaters: NSF approved.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.06 WARRANTY

A. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.01 WATER HEATER MANUFACTURERS

A. Lochinvar Corporation: www.lochinvar.com.

B. A.O. Smith Water Products Co: www.hotwater.com.

C. Bradford White: www.bradfordwhite.com

D. EEMAX: www.eemax.com

2.02 GAS FIRED WATER HEATERS

A. Type: Automatic, natural gas-fired, vertical storage.

B. Performance:
   1. See schedules
   2. Maximum working pressure: 150 psig.

C. Burner: 360 degree low NOx aluminized steel construction.

D. Tank: Heat horder flue baffle; thermally insulated with closed cell foam R-value 8.33, glass fiber lined tank encased in a heavy duty steel jacket with durable acrylic enamel finish; floor shield and legs, and large access door.

E. Controls: Automatic over heat safety device water thermostat and built-in gas pressure regulator; temperature range adjustable from 120 to 170 degrees F, safety pilot and thermocouple.

F. Accessories: Dielectric nipples, brass water connections and dip tube, brass drain valve, magnesium anode, and ASME temperature and side relief valve tapping.

2.03 ELECTRIC WATER HEATERS

A. Type: Automatic, electric, vertical storage.

B. Performance:
   1. See schedule
   2. Maximum working pressure: 150 psig.

C. Tank: Glass lined welded steel, thermally insulated with one inch thick glass fiber; encased in corrosion-resistant steel jacket; baked-on enamel finish.

D. Controls: Automatic water thermostat with externally adjustable temperature range from 120 to 170 degrees F, flanged or screw-in nichrome elements, enclosed controls and electrical junction box and operating light.

E. Accessories: Provide:

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.

END OF SECTION

SECTION 22 4000
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water closets

B. Urinals

C. Lavatories

D. Sinks

E. Service Sinks

F. Garbage Disposals

G. Drinking Fountains

1.02 SUBMITTALS

A. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

B. Manufacturer's Instructions: Indicate installation methods and procedures.

C. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.03 QUALITY ASSURANCE

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

1.04 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.06 WARRANTY

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

B. Supply two sets of faucet washers.

PART 2 PRODUCTS

2.01 GENERAL

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 FLUSH VALVE WATER CLOSETS (WALL MOUNTED)

A. Bowl:
   1. Manufacturers:
      a. Sloan
      b. American Standard Inc.
      c. Kohler.
      d. Zurn.
   2. ASME A112.19.2M; wall hung, siphon jet vitreous china closet bowl, with elongated rim, 1-1/2 inch top spud, china bolt caps.

B. Flush Valve Manufacturers:

1. Delta Tech; Model 81T201
2. Sloan Valve Company; Model "Optima Plus" 8111..
3. Zurn Industries, Inc..

C. Exposed Flush Valve:
1. ASME A112.18.1M; exposed chrome plated, diaphragm type with oscillating handle, escutcheon, seat bumper, integral screwdriver stop and vacuum breaker; maximum 1.6 gallon flush volume.

D. Seat:
1. Manufacturers:
a. Beneke.
b. Church; Model 9500c.
c. Centoco.
d. Substitutions: See Section 01600 - Product Requirements.
2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover.

E. Water Closet Carrier:
1. Manufacturers:
a. JOSAM Company.
b. MiFab
c. Wade
d. Watts Drainage; Model CA-101, CA-121 and/or CA-131.
e. Jay R. Smith
2. ASME A112.6.1M; adjustable cast iron frame, horizontal or vertical siphon jet, integral drain hub and 2" vent adjustable gasket face plate, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers, and rear anchor tie down and bonded neo-seal gasket.

2.03 FLUSH VALVE WATER CLOSETS (FLOOR MOUNTED)

A. Bowl:
1. Manufacturers:
a. Sloan
b. Sloan
c. American Standard.
d. Kohler.
e. Zurn.
2. ASME A112.19.2M; floor mounted, siphon jet vitreous china closet bowl, with elongated rim, 1-1/2 inch top spud, china bolt caps.

B. Flush Valve Manufacturers:
1. Delta Tech
2. Sloan Valve Company
3. Zurn Industries, Inc..

C. Exposed Flush Valve:
1. ASME A112.18.1M; exposed chrome plated, diaphragm type with oscillating handle, escutcheon, seat bumper, integral screwdriver stop and vacuum breaker; maximum 1.6 gallon flush volume.

D. Seat:
1. Manufacturers:
a. Beneke.
b. Churchc. Centoco.
d. Substitutions: See Section 01600 - Product Requirements.
2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover.

2.04 TANK TYPE WATER CLOSETS

A. Tank Type Water Closet Manufacturers:
   1. American Standard Inc;: www.americanstandard-us.com.
   2. Sloan.
   3. Crane; .
   4. Kohler.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Bowl:
   1. ASME A112.19.2; wall hung, vitreous china, reverse trap, whirlpool action close-coupled closet combination with regular rim, insulated vitreous china closet tank with fittings and lever flushing valve, chrome plated bolt caps.

C. Bowl: (WC- 2)
   1. ASME A112.19.2M; floor mounted, siphon jet, vitreous china, 18 inches high, close-coupled closet combination with elongated rim, insulated vitreous china closet tank with fittings and lever flushing valve, bolt caps, vandalproof cover locking device.

D. Water Consumption:
   1. Maximum 1.6 gallon per flush.

E. Seat Manufacturers:
   1. American Standard
   2. Bemis Manufacturing Company: www.bemismfg.com.
   3. Church Seat Company: www.churchseats.com.
   4. Olsonite: www.olsonite.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

F. Seat:
   1. Solid white high gloss molded plastic, closed front, brass bolts, elongated seat with cover.

G. Seat:
   1. Solid white plastic, open front, extended back, less cover, complete with self-sustaining hinge.

H. Water Closet Carrier:
   1. Manufacturers:
      a. JOSAM Company: www.josam.com.
      b. MiFab
      c. Wade
      d. J.R. Smith.
      e. Zurn Industries, Inc: www.zurn.com.
      f. Substitutions: See Section 01 6000 - Product Requirements.
   2. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.05 WALL HUNG URINALS (UR-1)

A. Wall Hung Urinal Manufacturers:
   1. Sloan.
   2. American Standard Inc.
   3. Kohler.

B. Urinals: Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
   1. Flush Volume: 1.0 gallons, maximum.
   2. Flush Valve: Exposed (top spud).
   3. Flush Operation: Sensor operated.
   4. Trap: Integral.

C. Urinal:

1. ASME A112.19.2M; vitreous china, wall hung siphon jet flushing rim urinal with shields, integral trap, tamper proof removable stainless steel strainer, top spud, steel supporting hanger.

D. Flush Valve Manufacturers:
   1. Delta
   2. Sloan Valve Company
   3. Zurn Industries, Inc: www.zurn.com.
   4. ASME A112.18.1M; exposed chrome plated, diaphragm type with oscillating handle, escutcheon, integral screwdriver stop, vacuum breaker; maximum 1 gallon flush volume.

E. Carriers:
   1. Manufacturers:
      a. JOSAM Company: www.josam.com.
      b. MiFab.
      c. J.R. Smith.
      d. Wade.
      e. Watts Drainage.
   2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

2.06 LAVATORIES

A. Manufacturers:
   1. American Standard
   2. Kohler.
   3. Zurn.
   4. Sloan

B. Vitreous China Wall Hung Basin:

C. Supply Faucet Manufacturers:
   1. American Standard Inc
   2. Delta
   3. Elkay.
   4. Kohler.
   5. Symmons;.

D. Supply Faucet:
   1. ASME A112.18.1M; chrome plated supply fitting with open grid strainer, water economy aerator with maximum 1.0 GPM flow, single lever handle.

E. Accessories:
   1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.
   2. Offset waste with perforated open strainer.
   3. Screwdriver stops.
   4. Rigid supplies.
   5. Carrier:
      a. Manufacturers:
         1) JOSAM Company.
         2) J.R. Smith.
         3) Wade.
         4) Sloan Valve Company.
         5) Zurn Industries, Inc..
      b. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.

2.07 SINKS

A. Manufacturers:
   1. American Standard.

2. Just.
3. Elkay
4. Substitutions: See Section 01600 - Product Requirements.

B. Single Compartment Bowl: ADA Compliant

C. Supply Faucet Manufacturers:
1. Elkay
2. Kohler
3. Delta
4. Just

D. Supply Faucet:
1. ASME A112.18.1M; chrome plated supply fitting with water economy aerator with maximum 1.5 gpm flow, wrist blade handles, 6 inch radius goosneck 10.5 inch height, .090 inch spout wall thickness. Include vandal resistant features and screws.

E. Accessories: Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon, screwdriver stop, rigid supplies.

F. Garbage Disposal
1. Provide Garbage Disposal for SK-1. Coordinate which drain to install dispoal in with Architect.
a. Garbage disposal shall have stainless steel grind chamber, continuous feed, automatic reversing action with 1.0 HP 120V split phase motor and 7 year parts and service warranty.
b. Approved manufacturer:
1) In-Sink-Erator Model "Evolution Excel"

2.08 GARBAGE DISPOSAL

A. Gargabe Disposal
1. Provide Garbage Disposal for each SK where scheduled. Coordinate which side of a double compartment sink shall receive the garbage disposal with Architect.
2. Garbage disposal shall have stainless steel grind chamber, continuous feed, automatic reversing action with 1/2 HP 120V split phase motor and 7 year parts and service warranty.
3. Approved manufacturer:
a. In-Sink-Erator
4. Substitutions: See Section 01600 - Product Requirements.

2.09 DRINKING FOUNTAINS

A. Drinking Fountain Manufacturers:
1. Acorn: www.acorn.com.
2. Most Dependable Fountain.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Outdoor Fountain:
1. One piece weld construction with MDF standard 3/16” wall thickness.
2. 18 gauge electro-polished stainless steel bowl. Bowl overlaps pedestal. Sanitary recessed nozzle.
3. Stainless steel anti-squirt head mounted with a lock nut and washer. MDF bubbler head. Stainless steel bubbler housing.
4. Maintenance free reinforced nylobraid tubing that is NSF-61 certified. It is supplied with a 1/2” MIP threaded inlet with stainless steel strainer. Union fittings at every connection. Supply line stops above grade.
5. 1 ½” schedule 40 PVC drain pipe.
6. Oven baked powder coat. Stainless steel models are powder coated for added protection.
7. Surface Mount installation
a. access door with vandal resistant stainless steel screws. Surface mount carrier for all surface mount installations.

2.10 SERVICE SINKS (SS-1)

A. Manufacturers:
   1. Commercial Enameling Company.
   2. Elkay Manufacturing Company.
   3. Just Manufacturing Company.
   4. Fiat Products; Model MSB-2424

B. Bowl:
   1. ASME A112.19.1M; 22 x 18 x 12 inch deep, porcelain enamelled (inside only) cast iron roll-rim sink, with 12 inch high back, concealed hanger, chrome plated strainer, stainless steel rim guard, cast iron P-trap with adjustable floor flange.

C. Trim:
   1. ASME A112.18.1M exposed wall type supply with cross handles, spout wall brace, vacuum breaker, hose end spout, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges. Equivalent to Delta model 28T9.

D. Accessories:
   1. 5 feet of 1/2 inch diameter plain end reinforced rubber hose.
   2. Hose clamp hanger.
   3. Mop hanger.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install each fixture with trap, easily removable for servicing and cleaning.

C. Provide chrome plated rigid or flexible supplies to fixtures with screwdriver stops, reducers, and escutcheons.

D. Install components level and plumb.

E. Install and secure fixtures in place with wall supports and bolts.

F. Seal fixtures to wall and floor surfaces with sealant color to match fixture.

G. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

A. Clean plumbing fixtures and equipment.

3.07 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 23 0553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

1.02 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Champion America, Inc: www.Champion-America.com.

C. Seton Identification Products: www.seton.com/aec.

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

A. Color: Conform to ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

E. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

F. Identify control panels and major control components outside panels with plastic nameplates.

G. Identify thermostats relating to terminal boxes or valves with nameplates.

H. Identify valves in main and branch piping with tags.

I. Identify air terminal units and radiator valves with numbered tags.

J. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

SECTION 23 0593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Measurement of final operating condition of HVAC systems.

1.02 SUBMITTALS

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

B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Include at least the following in the plan:
      a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      d. Final test report forms to be used.
      e. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Revise TAB plan to reflect actual procedures and submit as part of final report.
   2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Strategic Energy Solutions, Inc. and for inclusion in operating and maintenance manuals.
   3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   5. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.

3.02 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Measure air quantities at air inlets and outlets.

C. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

END OF SECTION

SECTION 23 0713
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct Liner.

1.02 RELATED REQUIREMENTS

A. Section 23 3100 - HVAC Ducts and Casings: Glass fiber ducts.

1.03 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

C. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2014.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified in this section and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE WRAP

A. Manufacturer:
   1. Knauf Insulation: www.knaufusa.com.
   2. Johns Manville: www.jm.com.
   3. Owens Corning Corporation: www.ocbuildingspec.com.

4. CertainTeed Corporation: www.certainteed.com.

B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. 'K' value: 0.31 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 1200 degrees F.
   3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Insulation shall be 1.5 lb/cu. ft. density. Refer to Schedule below for thickness.

D. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Secure with pressure sensitive tape.

E. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

F. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter.

2.03 DUCT LINER

A. Manufacturers:
   1. Knauf Insulation: www.knaufusa.com.
   2. Johns Manville: www.jm.com.
   3. Owens Corning Corp; Model Fiberglas Duct Liner Board: www.owenscorning.com.
   4. CertainTeed Corporation: www.certainteed.com.

B. Insulation: ASTM C 1071; flexible, noncombustible blanket with poly vinyl acetate polymer impregnated surface and edge coat.
   1. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
   2. Service Temperature: Up to 250 degrees F.
   3. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
   4. Maximum Velocity on Coated Air Side: 5,000 fpm.
   5. Minimum Noise Reduction Coefficients:
   6. 1 inch Thickness: 0.45.

C. Adhesive: Waterproof, fire-retardant type, ASTM C916.

D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.
   1. Density: 1.5 lb/cu ft
   2. Liner shall meet Anti-Bacterial Requirements of ASTM C 1071, ASTM G 21 and ASTM G 22
   3. Liner shall be cleanable in accordance with NAIMA "Duct Cleaning Guide."

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that ducts have been pressure and leak tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated ducts conveying air below ambient temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls penetrtions and at hanger connections.
   4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. External Duct Insulation Application:

1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
2. Secure insulation without vapor barrier with staples, tape, or wires.
3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

E. Duct and Plenum Liner Application:
1. Adhere insulation with adhesive for 90 percent coverage.
2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.
6. Provide nosing on all exposed fibergalss edges.

3.03 SCHEDULES

A. Exhaust Ducts Within 10 ft of Exterior Openings:
1. Flexible Glass Fiber Duct Insulation: 1 inches thick.

B. Relief Ducts Within 10 ft of Exterior Openings:
1. Flexible Glass Fiber Duct Insulation: 1 inches thick.

C. Outside Air Intake Ducts:
1. Flexible Glass Fiber Duct Insulation: 1 inches thick.

D. Outside Air and Exhaust Air Plenums:
1. Flexible Glass Fiber Duct Insulation: 1 inches thick.
2. Rigid Glass Fiber Duct Insulation: 1 inch thick.

E. Return Air Ductwork (located in plenum/conditioned space):
1. Duct Liner: 1 inches thick (first ten feet only) from unit.

F. Supply Ductwork (located in plenum or unconditioned spaces):
1. Flexible Glass Fiber Duct Insulation: 1 inches thick.

G. Supply Ductwork (located exposed in conditioned space):
1. No Insulation Required

END OF SECTION

SECTION 23 0719

HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 22 1005 - Plumbing Piping: Placement of hangers and hanger inserts.

C. Section 23 2113 - Hydronic Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.

B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).

C. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.

D. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

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

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER

A. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com.
   2. Knauf Insulation: www.knaufinsulation.com.
   3. Johns Manville Corporation: www.jm.com.

4. Owens Corning Corp: www.owenscorning.com.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.
   1. Compatible with insulation.

E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
   1. ASTM C195; hydraulic setting on mineral wool.

F. Indoor Vapor Barrier Finish:
   1. Vinyl emulsion type acrylic, compatible with insulation, black color.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints. Maintain continuous thermal and vapor-retarder integrity, unless otherwise noted.

E. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

F. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
   3. Do not bury hangers in the insulation. Insulation vapor barrier shall not be broken.

G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 8400.

H. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

3.03 SCHEDULE

A. HVAC Equipment Condensate Drains:
   1. Pipe Size Range: 3/4-4 inch
      a. Thickness: 1 inch

END OF SECTION

SECTION 23 3100
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single-wall rectangular ducts and fittings.

B. Single-wall round ducts and fittings.

C. Sheet metal materials.

D. Sealants and gaskets.

E. Hangers and supports.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

C. Section 23 0713 - Duct Insulation: External insulation and duct liner.

D. Section 23 3300 - Air Duct Accessories.

E. Section 23 3700 - Air Outlets and Inlets.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2016.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

D. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2014.

E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

G. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2014.

H. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2012, 2nd Edition.

I. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

J. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

K. UL 1978 - Grease Ducts; Current Edition, Including All Revisions.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.05 SUBMITTALS

A. Product Data: Provide data for duct materials, duct liner, duct connections, and factory fabricated fittings.

B. Shop Drawings: Submit 1/4 scale, double line shop drawings that indicate duct fittings, duct size, bottom of duct elevations, necessary offsets to accomodate building structure, particulars such as gages, sizes, welds, elevations, all fittings, and configuration prior to start of work for all systems.

1.06 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A standards.

B. Construct ductwork to SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 1995, Second Edition with Addendum No. 1.

PART 2 PRODUCTS

2.01 SINGLE-WALL RECTANGULAR DUCT AND FITTING ASSEMBLIES

A. Regulatory Requirements: Construct ductwork to NFPA 90A standards.

B. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 SINGLE-WALL ROUND DUCT AND FITTING ASSEMBLIES

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

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. McGill AirFlow LLC.
    b. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inchesin Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for

static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

C. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

D. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

E. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

G. Tie Rods: Galvanized steel, 1/4-inchminimum diameter for lengths 36 inches or less; 3/8-inchminimum diameter for lengths longer than 36 inches.

2.04 SEALANTS AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:
1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:
   1. Application Method: Brush on.
   2. Solids Content: Minimum 65 percent.
   3. Shore A Hardness: Minimum 20.
   4. Water resistant.
   5. Mold and mildew resistant.
   6. VOC: Maximum 75 g/L (less water).
   7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
   8. Service: Indoor or outdoor.
   9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.
   1. General: Single-component, acid-curing, silicone, elastomeric.
   2. Type: S.
   3. Grade: NS.
   4. Class: 25.
   5. Use: O.
   6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:
   1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wgand shall be rated for

2.05 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible, "Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:
   1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
   2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
   3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.06 DUCTWORK FABRICATION

A. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Provide turning vanes in all mitered elbows.

C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

D. T's, bends, and elbows: Construct according to SMACNA (DCS).

E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

F. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

G. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

H. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

I. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.07 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages,reinforcing, and sealing for operating pressures indicated.

B. Flat Oval Ducts: Machine made from round spiral lockseam duct.
   1. Manufacture in accordance with SMACNA (DCS).
   2. Fittings: Manufacture at least two gages heavier metal than duct.
   3. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Flexible Ducts: Black polymer film supported by helically wound spring steel wire.
   1. UL labeled.
   2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   3. Pressure Rating: 4 inches WG positive and 0.5 inches WG negative.
   4. Maximum Velocity: 4000 fpm.
   5. Temperature Range: Minus 20 degrees F to 175 degrees F.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install in accordance with manufacturer's instructions.

C. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

D. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

E. Install round ducts in maximum practical lengths.

F. Install ducts with fewest possible joints.

G. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

H. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

I. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

J. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

K. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

L. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

M. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

N. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

O. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

P. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

Q. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

R. Use double nuts and lock washers on threaded rod supports.

3.02 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Where practical, install concrete inserts before placing concrete.
   2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
   4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
   5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inchesof each elbow and within 48 inchesof each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.03 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.04 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
   1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   2. Outdoor, Supply-Air Ducts: Seal Class A.
   3. Outdoor, Exhaust Ducts: Seal Class C.
   4. Outdoor, Return-Air Ducts: Seal Class C.
   5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wgand Lower: Seal Class B.
   6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
   7. Unconditioned Space, Exhaust Ducts: Seal Class C.
   8. Unconditioned Space, Return-Air Ducts: Seal Class B.
   9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wgand Lower: Seal Class C.
   10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
   11. Conditioned Space, Exhaust Ducts: Seal Class B.
   12. Conditioned Space, Return-Air Ducts: Seal Class C.
   13. All locations, Laboratory Exhaust Ducts: Seal Class A.

3.05 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.
   1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
   2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
   3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:
   1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
   2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:
   1. Air outlets and inlets (registers, grilles, and diffusers).
   2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.

3.06 SCHEDULES

A. Supply Ducts:
   1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
      a. Pressure Class: Positive 1-inch wg.
      b. Minimum SMACNA Seal Class: C.
      c. SMACNA Leakage Class for Rectangular: 12.
      d. SMACNA Leakage Class for Round and Flat Oval: 6.

B. Return Ducts:
   1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
      a. Pressure Class: Positive or negative 1-inch wg.
      b. Minimum SMACNA Seal Class: B.
      c. SMACNA Leakage Class for Rectangular: 12.
      d. SMACNA Leakage Class for Round and Flat Oval: 6.

C. Exhaust Ducts:
   1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
      a. Pressure Class: Negative 2-inch wg.
      b. Minimum SMACNA Seal Class: C if negative pressure, and A if positive pressure.
      c. SMACNA Leakage Class for Rectangular: 24.
      d. SMACNA Leakage Class for Round and Flat Oval: 12.

D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
   1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
      a. Pressure Class: Positive or negative 2-inch wg.
      b. Minimum SMACNA Seal Class: B.
      c. SMACNA Leakage Class for Rectangular: 12.
      d. SMACNA Leakage Class for Round and Flat Oval: 6.

E. Elbow Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
      a. Velocity 1000 fpmor Lower:
         1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
         2) Mitered Type RE 4 without vanes.
   2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
      a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
   3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
      a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
         1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90 degree elbow.

2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90 degree elbow.
3) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inchesand Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inchesand Larger in Diameter: Welded.

F. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.
1) Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
c. Velocity 1000 fpm or Lower: 90-degree tap.
d. Velocity 1000 to 1500 fpm: Conical tap.

END OF SECTION

SECTION 23 3300

AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct access doors.

B. Duct test holes.

C. Flexible duct connections.

D. Volume control dampers.

1.02 SUBMITTALS

A. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

PART 2 PRODUCTS

2.01 BACKDRAFT DAMPERS

A. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.02 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

2.03 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.04 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.

2.05 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Single Blade Dampers: Fabricate for duct sizes up to 6 by 30 inch.
   1. Blade: 24 gage, 0.0239 inch, minimum.

C. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
   1. Blade: 18 gage, 0.0478 inch, minimum.

D. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

E. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
   3. Where rod lengths exceed 30 inches provide regulator at both ends.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 3100 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 by 8 inch size for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

F. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

G. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 23 3423
POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof exhausters.

B. Ceiling exhaust fans.

1.02 SUBMITTALS

A. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

1.03 FIELD CONDITIONS

A. Permanent ventilators may not be used for ventilation during construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Greenheck: www.greenheck.com.

B. Loren Cook Company: www.lorencook.com.

C. PennBarry: www.pennbarry.com.

D. Panasonic: business.panasonic.com/products-hvac-ventilationproducts

2.02 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.

B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.

D. Fabrication: Conform to AMCA 99.

E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.03 ROOF EXHAUSTERS

A. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.

B. Roof Curb: 8 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips.

C. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor and wall mounted multiple speed switch.

D. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.

E. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.04 CEILING EXHAUST FANS

A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.

C. Grille: Molded white plastic.

D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.

C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

D. Hung Cabinet Fans:
   1. Install fans with resilient mountings and flexible electrical leads. Refer to Section 22 0548.
   2. Install flexible connections specified in Section 23 3300 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

E. Provide sheaves required for final air balance.

F. Install backdraft dampers on inlet to roof and wall exhausters.

G. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

END OF SECTION

SECTION 23 3700

AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Louvers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Krueger: www.krueger-hvac.com.

B. Price Industries: www.price-hvac.com.

C. Titus: www.titus-hvac.com.

2.02 LOUVERS

2.03 INTAKE AND RELIEF LOUVERS

A. Louver Manufacturers:
   1. Greenheck; Model ESD-603.
   2. Ruskin.

B. Quality Assurance:
   1. Louvers licensed to bear AMCA Certified Ratings Seal. Ratings based on tests and procedures performed in accordance with AMCA 511 and comply with AMCA Certified Ratings Program. AMCA Certified Ratings Seal applies to air performace and water penetration ratings.

C. Fabrication:
   1. Frame:
      a. Material: Extruded aluminum, Alloy 6063-T5.
      b. Wall Thickness: 0.081 inch (2.1mm), nominal.
      c. Depth: 6 inches.
      d. Downspouts and caulking surfaces.
   2. Blades:
      a. Style: Drainable.
      b. Material: Extruded aluminum, Alloy 6063-T5.
      c. Wall Thickness: 0.081 inch (2.1mm), nominal.
      d. Angle: 37 degrees.
      e. Centers: 6 inches.
   3. Bird Screen:
      a. Material: Aluminum, 3/4 inch x 0.51 inch expaned, flattened.
      b. Frame: Removeable, rewireable.
   4. Gutters: Drain gutters in head frame at each blade.
   5. Downspouts: Downspouts in jambs to drain water from louver for minimum water cascade from blade to blade.
   6. Vertical Supports: Hidden vertical supports to allow continuous line appearance up to 120 inches.
   7. Sill: Steeply angles integral sill eliminating areas of standing or trapped moisture where mold or mildew may thrive and effect indoor air quality.
   8. Assembly: Factory assemble louver components.

D. Perforamce Data:
   1. Design Load: Incorporate structural supports required to withstand wind load of 25 pounds per square foot (100 mph wind equivalent).

E. Accessories:
   1. Insect Screen: Aluminum mech construction.

F. Factory Finish:

1. Baked Enamel Finish:
    a. Color shall be as selected by architect.
    b. Finish to be applied after a thourough cleaning and preparation of the metal surface.
    c. Total dry film thickness: 1.2 mils.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 9123.

END OF SECTION

SECTION 23 6313

AIR COOLED REFRIGERANT CONDENSERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refrigerant condenser package.

B. Charge of refrigerant and oil.

C. Controls and control connections.

D. Motor starters.

E. Electrical power connections.

1.02 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008.

B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.

C. ASHRAE Std 20 - Methods of Testing for Rating Remote Mechanical-Draft Air-Cooled Refrigerant Condensers; 1997 (R2006).

D. ASHRAE Std 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013, Including All Addenda.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

F. NEMA MG 1 - Motors and Generators; 2014.

G. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Product Data: Provide rated capacities, weights, accessories, electrical requirements, and wiring diagrams.

B. Shop Drawings: Indicate components, assembly, dimensions, weights and loading, required clearances, and location and size of field connections. Include schematic layouts showing condenser, refrigeration compressors, cooling coils, refrigerant piping and accessories required for complete system.

C. Manufacturer's Instructions: Submit manufacturer's complete installation instructions.

D. Operation and Maintenance Data: Include start-up instructions, maintenance instructions, parts lists, controls, and accessories.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's installation instruction for rigging, unloading and transporting units.

B. Protect units on site from physical damage. Protect coils.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 PERFORMANCE REQUIREMENTS

END OF SECTION

SECTION 23 8127

SMALL SPLIT-SYSTEM HEATING AND COOLING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air-source heat pumps.

B. Forced air furnaces.

C. Air cooled condensing units.

D. Indoor air handler (fan & coil) units for duct connection.

E. Controls.

1.02 RELATED REQUIREMENTS

A. Section 23 1123 - Facility Natural-Gas Piping.

B. Section 23 3100 - HVAC Ducts and Casings.

1.03 SUBMITTALS

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

B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

1.04 QUALITY ASSURANCE

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

B. Installer Qualifications: Company specializing in performing the work of this section and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carrier Corporation: www.carrier.com.

B. Lennox: www.Lennox.com.

C. LG: www.lg.com

D. York International Corporation / Johnson Controls: www.york.com.

2.02 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.

1. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

2.03 INDOOR UNITS FOR DUCTED SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling element(s), controls, and accessories; wired for single power connection with control transformer.

1. Air Flow Configuration: Horizontal.
2. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.

B. Supply Fan: Centrifugal type rubber mounted with direct or belt drive with adjustable variable pitch motor pulley.

1. Motor: NEMA MG 1;multiple speed, permanently lubricated, hinge mounted.
2. Motor Electrical Characteristics:

C. Air Filters: 1 inch thick urethane, washable type arranged for easy replacement.

D. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
   2. Manufacturers: System manufacturer.

2.04 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
   1. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1 and UL 207.

B. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gage ports, thermometer well (in liquid line).
   1. Provide thermostatic expansion valves.

C. Operating Controls:
   1. Control by room thermostat to maintain room temperature setting.

2.05 GAS FURNACE COMPONENTS

A. Burner: Atmospheric type with adjustable combustion air supply,
   1. Gas valve, two stage provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, automatic electric valve.
   2. Combustion air damper with synchronous spring return damper motor.
   3. Non-corrosive combustion air blower with permanently lubricated motor.

B. Burner Safety Controls:
   1. Thermocouple Sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.
   2. Flame Rollout Switch: Installed on burner box and prevents operation.
   3. Vent Safety Shutoff Sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.
   4. Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on excessive bonnet temperature, automatic resets.

C. Operating Controls:
   1. Cycle burner by room thermostat to maintain room temperature setting.
   2. Supply fan energized from bonnet temperature independent of burner controls, with adjustable timed off delay and fixed timed on delay, with manual switch for continuous fan operation.

2.06 ACCESSORY EQUIPMENT

A. Room Thermostat: Wall-mounted, electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:
   1. Automatic switching from heating to cooling.
   2. Preferential rate control to minimize overshoot and deviation from setpoint.
   3. Thermostat Display:
      a. Actual room temperature.
      b. System Mode Indication: Heating, Cooling, Fan Auto, Off, and On, Auto or On, Off.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with NFPA 90A and NFPA 90B.

END OF SECTION

SECTION 26 0500

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions, Special Conditions and Division 1 specification sections, apply to work of this section.

B. Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on drawings and/or herein, including all labor, materials, equipment and incidentals necessary and required for their completion.

C. The items in this section are supplementary to the requirements set forth in other portions of the specifications as indicated under Item "A" above.

1.02 DRAWINGS

A. The drawings show the location and general arrangement of equipment, electrical systems and related items. They shall be followed as closely as elements of the construction will permit.

B. Examine the drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly, providing such fittings, conduit, junction boxes and accessories as may be required to meet such conditions.

C. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.

D. The architectural and structural drawings take precedence in all matters pertaining to the building structure, mechanical drawings in all matters pertaining to mechanical trades and electrical drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.

1.03 INSPECTION OF SITE

A. Visit the site, examine and verify the conditions under which the work must be conducted before submitting proposal.

B. The submitting of a proposal implies that the contractor has visited the site and understands the conditions under which the work must be conducted.

1.04 CONTRACT BREAKDOWN

A. Within two (2) weeks following award of contract, submit to the Architect/Engineer for approval a contract amount breakdown. Breakdown shall be submitted on a form similar to the form available at the Architect/Engineer's office. All requests for payment shall be based on the approved breakdown.

1.05 TEMPORARY FACILITIES

A. Provide and remove upon completion of the project, in accordance with the general conditions, a complete temporary electrical and telephone service during construction.

1.06 ALTERNATES

A. See Alternate Section and other applicable parts of the specifications.

1.07 GUARANTEE

A. Contractor guarantees that the installation is free from defects and agrees to replace or repair, any part of this installation which becomes defective within a period of one year following final acceptance, unless noted otherwise, provided that such failure is due to defects in the equipment, material or installation or to follow the specifications and drawings. File with the Owner any and all guarantees from the equipment manufacturers.

1.08 CODES, PERMITS AND FEES

A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for electrical work shall be secured and paid for by the contractor. All work shall conform to all applicable codes, rules and regulations.

B. Rules of local utility companies shall be complied with. Check with the utility company supplying service to the installation and determine all devices including, but not limited to, all current and potential transformers, meter boxes, C.T. cabinets and meters which will be required and include the cost of all such items in proposal.

C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.

1.09 STANDARDS OF MATERIAL AND WORKMANSHIP:

A. All materials shall be new. The electrical and physical properties of all materials, and the design, performance characteristics, and methods of construction of all items of equipment, shall be in accordance with the latest issue of the various, applicable Standard Specifications of the following recognized authorities:
   1. A.N.S.I.American National Standards Institute
   2. A.S.T.M.American Society for Testing Materials
   3. I.C.E.A.Insulated Cable Engineers Association
   4. I.E.E.E.Institute of Electrical and Electronics Engineers
   5. N.E.C.National Electrical Code
   6. N.E.M.A.National Electrical Manufacturer's Association
   7. U.L.Underwriters Laboratories, Inc.

B. Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the Trades involved.

C. All equipment of the same or similar systems shall be by the same manufacturer.

1.10 RECORD DRAWINGS

A. Provide complete operating and maintenance instruction manuals covering all electrical equipment herein specified, together with parts lists. All literature shall be furnished in triplicate for Owner and shall be bound in book or ring binder form as directed by Architect/ Engineer.

B. The operating and maintenance instructions shall include a brief, general description for all electrical systems including, but not limited to:

C. Routine maintenance procedures.

D. Trouble-shooting procedures.

E. Shop Drawings

F. Any equipment offered as a substitution shall be equal in quality, durability, appearance, ampacity, and efficiency through all ranges of operation, shall conform with arrangements and space limitations of the equipment shown on the plans and/or specified, shall be compatible with the other components of the system. All costs to make these items of equipment comply with these requirements including, but not limited to, conduit, wiring, bus work, enclosures and building alterations shall be included in the original bid. Similar equipment shall be by one manufacturer.

1.11 SHOP DRAWINGS/SUBMITTALS

A. All shop drawings shall be submitted in groupings of similar and/or related items (lighting fixtures, switchgear, etc.). Incomplete submittal groupings will be returned unchecked.

B. Submit for approval eight (8) copies of shop drawings for all electrical systems or equipment but not limited to the items listed below. Where items are referred to by symbolic designation on the drawings and specifications, all submittals shall bear the same designation (light fixtures). Refer to other sections of the electrical specifications for additional requirements.

1. Panelboards
2. Disconnect Switches
3. Contactors
4. Time Switches
5. Wiring Devices
6. Lighting Fixtures

1.12 MANUFACTURERS LISTED

A. The listing of specific manufacturers does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed are not relieved from meeting these specifications in their entirety.

B. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

1.13 USE OF EQUIPMENT

A. The use of any equipment, or any part thereof for purposes other than testing even with the Owner's consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor be construed to obligate the Owner in any way to accept improper work or defective materials.

B. Do not use Owner's lamps for temporary lighting except as allowed and directed by the Owner. Equip lighting fixtures with new lamps when the project is turned over to the Owner.

PART 2 EXECUTION

2.01 INSTALLATION OF EQUIPMENT

A. Install all equipment in strict accordance with all directions and recommendations furnished by the manufacturer. Where such directions are in conflict with the drawings and specifications, report such conflicts to the Architect/Engineer for resolution.

2.02 COORDINATION

A. Install work to avoid interference with work of other trades including, but not limited to, architectural and mechanical trades. Remove and relocate any work that causes an interference at contractor's expense. Disputes regarding the cause of an interference will be resolved by the Construction Manager or Architect/Engineer.

2.03 CHASES AND RECESSES

A. Provided by the architectural trades, but the contractor shall be responsible for their accurate location and size.

2.04 CUTTING, PATCHING AND DAMAGE TO OTHER WORK

A. Refer to General Conditions for requirements.

B. All cutting, patching and repair work shall be performed by the contractor through approved, qualified subcontractors. Contractor shall include full cost of same in bid.

2.05 EXCAVATION AND BACKFILLING

A. Provide all excavation, trenching, tunneling, dewatering and backfilling required for the electrical work. Coordinate the work with other excavating and backfilling in the same area.

B. Where conduit is installed less than 2''6" below the surface of pavement, provide concrete encasement, 4" minimum coverage, all around or as shown on the electrical drawings.

C. Backfill all excavations inside building, under drives and parking areas with well-tamped granular material. Backfill all excavations under wall footings with lean mix concrete up to underside of footings and extend concrete within excavation a minimum of four (4) feet each side of footing. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.

D. Backfill outside building with granular material to a height 12 inches over top of pipe compacted to 95 percent compaction as specified above. Backfill remainder of excavation with unfrozen, excavated material in such a way to prevent settling. Tamp, roll as required.

2.06 EQUIPMENT FOUNDATION AND SUPPORTS

A. Shall be as required or as shown on plans or specified.

B. Provide concrete bases and supports for floor mounted electrical equipment.

C. Provide concrete house keeping bases 4" above finished floor, with leveling channels, where noted, for floor-mounted equipment.

D. For equipment suspended from ceilings or walls, furnish and install all inserts, rods, structural steel frames, brackets and platforms required.

2.07 EQUIPMENT CONNECTIONS

A. Make connections to equipment, motors, lighting fixtures, and other items included in the work in accordance with the approved shop drawings and rough-in measurements furnished by the manufacturers of the particular equipment furnished. All additional connections not shown on the drawings, but called out by the equipment manufacturer's shop drawings shall be provided.

2.08 ACCESS DOORS

A. Provide access doors for installation by architectural trades. In the walls, provide Milcor No. "DW" or "M" as required to make all controls, electrical boxes and other equipment installed by the contractor accessible. Minimum size 12 inches x 12 inches. In the ceiling, provide Milcor No. 3210, 3105 or 3206 for accessibility as mentioned above, 24 inches x 24 inches minimum size. The plaster or acoustical tile insert shall be by the architectural trades. Areas with accessible ceilings (ceilings where tiles are not fastened in place and can be individually removed without removal of adjacent tiles) will not require access doors.

B. When access doors are in fire resistant wall or ceilings, they must bear the Underwriter's' Laboratories, Inc., Label, with time design rating equal to or exceeding that of the wall or ceiling unless they were a part of the tested assembly.

2.09 CLEANING

A. All debris shall be removed daily as required to maintain the work area in a neat, orderly condition.

B. Final cleanup shall include, but not be limited to, washing of fixture lenses or louvers, switchboards, substations, motor control centers, panels, etc. Fixture reflectors and lenses or louvers shall be left with no water marks or cleaning streaks.

2.10 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS

A. Equipment and materials shall be protected from theft, injury or damage.

B. Protect conduit openings with temporary plugs or caps.

C. Provide adequate storage for all equipment and materials delivered to the job site. Location of the space will be designated by the Construction Manager or Architect/Engineer. Equipment set in place in unprotected areas must be provided with temporary protection.

2.11 NAMEPLATES AND DIRECTORIES

A. Identify switchgear, motor controls, panelboards, safety switches, etc., with manufacturer's nameplate, shop order, where applicable on composite assemblies, and designations used on the Drawings. Nameplates shall be laminated phenolic plastic, beveled edged white with engraved black letters. Except where impractical, letters and numerals shall be a minimum of 1/4 inch high. Nameplates shall be mechanically secured. Pressure sensitive nameplates are not acceptable. Panel directories shall be neatly typed, showing equipment served and location for each breaker or switch with a clear plastic protective cover.

B. For detailed requirements refer to Section 26 0553 IDENTIFICATION FOR ELECTRICAL SYSTEMS.

2.12 EXTRA WORK

A. For any extra electrical work which may be proposed, this Contractor shall furnish to the Construction Manager, an itemized breakdown of the estimated cost of the materials and labor required to complete this work. The Contractor shall proceed only after receiving a written order from the Construction Manager establishing the agreed price and describing the work to be done.

2.13 DRAWINGS AND MEASUREMENTS

A. These Specifications and accompanying Drawings are intended to describe and provide for finished work. They are intended to be cooperative, and what is called for by either shall be as binding as if call for by both. The Contractor will understand that the work herein described shall be complete in every detail.

B. The Drawings are not intended to be scaled for rough-in measurements nor to serve as Shop Drawings. Field measurements necessary for ordering materials and fitting the installation to the building construction and arrangement shall be taken by the Contractor. The Contractor shall check latest Architectural drawings and locate light switches from same where door swings are different from Electrical Drawings.

END OF SECTION

SECTION 26 0526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

1.02 RELATED REQUIREMENTS

A. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

B. Section 26 5600 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.03 REFERENCE STANDARDS

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

B. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
   1. Use insulated copper conductors unless otherwise indicated.
      a. Exceptions:
         1) Use bare copper conductors where installed underground in direct contact with earth.
         2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
   2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
   3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

END OF SECTION

SECTION 26 0529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 26 0534 - Conduit: Additional support and attachment requirements for conduits.

B. Section 26 0537 - Boxes: Additional support and attachment requirements for boxes.

C. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

D. Section 26 5600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

E. Construction requirements for concrete bases

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. MFMA-4 - Metal Framing Standards Publication; 2004.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

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

F. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.04 SUMMARY

A. ASTM A682 Standard Specification for Steel, Strip, High-Carbon, Cold-Rolled, Spring Quality.

B. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, and services to completely execute the system of conduit hangers and supports as described in this specification.

C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this project, with a minimum structural safety factor of five times the applied force.

1.05 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

1.07 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
   1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   2. Conduit Clamps: Bolted type unless otherwise indicated.
   3. Manufacturers:
      a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
      b. Erico International Corporation: www.erico.com.
      c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
      d. Thomas & Betts Corporation: www.tnb.com.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
   1. Manufacturers:
      a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
      b. Erico International Corporation: www.erico.com.
      c. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
      d. Thomas & Betts Corporation: www.tnb.com.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
   1. Comply with MFMA-4.
   2. Channel (Strut) Used as Raceway (only where specifically indicated): Listed and labeled as complying with UL 5B.
   3. Manufacturers:
      a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
      b. Thomas & Betts Corporation: www.tnb.com.
      c. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.
      e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
   1. Minimum Size, Unless Otherwise Indicated or Required:
      a. Equipment Supports: 1/2 inch diameter.

b. Single Conduit up to 1 inch (27mm) trade size: 1/4 inch diameter.

F. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Manufacturers - Powder-Actuated Fastening Systems:
a. Hilti, Inc: www.us.hilti.com.
b. ITW Ramset, a division of Illinois Tool Works, Inc: www.ramset.com.
c. Powers Fasteners, Inc: www.powers.com.
d. Simpson Strong-Tie Company Inc: www.strongtie.com.

G. Power-Strut, Division of Allied Support Systems

H. Hilti Corporation

I. ERICO, International Corporation.

J. Hangers, Supports, Anchors, and Fasteners - General: Protective zinc coating either Electro-Plated (ASTM B633 SCI or SC3), Pre-Galvanized (ASTM a525 coating designation G90) or Hot-Dip Galvanized after fabrication (ASTM A123). The minimum thickness of zinc coating shall be 0.2 mill (5 micrometers)..

K. Provide materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
1. Product: Pre-galvanized strut.
2. Product: Hilti DX Series

L. Conduit Hangers:
1. Shall have a vertical load limit of 100 lbs, and a horizontal load limit of 25 lbs..
2. Shall be available with either a plain hole for 1/4” bolt or a 1/4-20 thread impression.
3. Shall be available for 3/8” through 2” EMT, rigid, and aluminum conduit.
4. Shall be available pre-assembled with manufacturer's specialty fasteners for connection to building structures like beam, flange, drop wire/rod, wood structure, concrete and acoustical tee grid.

M. Wire Rope Hangers:
1. Wire rope hanger assemblies shall be made of galvanized steel.
2. Hanger shall meet the fire rating requirements for DIN 4102-2 for 30 minutes at 30 percent of rated load.
3. Rope hangers shall have a minimum safety factor of 5:1.
4. Rope hangers are not permitted to support conduits.
5. Rope hangers are permitted to hang light fixtures, were applicable.
6. Hangers shall be fully adjustable.
7. Manufacturer of wire rope hangers shall be:
a. ERICO, INC., Speed Link series.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install support and attachment components in a neat and workmanlike manner in accordance with NECA 1.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Strategic Energy Solutions, Inc., do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Strategic Energy Solutions, Inc., do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Secure fasteners according to manufacturer's recommended torque settings.

I. Remove temporary supports.

END OF SECTION

SECTION 26 0534

CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible metal conduit (FMC).

B. Electrical metallic tubing (EMT).

C. Electrical nonmetallic tubing (ENT).

D. Conduit fittings.

E. Conduit, fittings and conduit bodies.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0553 - Identification for Electrical Systems.

E. Section 26 0537 - Boxes.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.

B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

D. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.

E. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2003.

F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.

G. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.

H. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2015.

I. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT); 2014.

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

K. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

L. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

M. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

N. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

O. UL 1653 - Electrical Nonmetallic Tubing; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. Shop Drawings:
   1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
   2. Include proposed locations of roof penetrations and proposed methods for sealing.

D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.

E. Product Data: Provide for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, metallic tubing, nonmetallic conduit, flexible nonmetallic conduit, nonmetallic tubing, fittings, and conduit bodies.

F. Project Record Documents: Accurately record actual routing of conduits larger than 2 inches.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

PART 2 PRODUCTS

2.01 CONDUIT REQUIREMENTS

A. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.02 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
   1. AFC Cable Systems, Inc: www.afcweb.com.
   2. Electri-Flex Company: www.electriflex.com.
   3. International Metal Hose: www.metalhose.com.

B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

D. Description: Interlocked steel construction.

E. Fittings: NEMA FB 1.

2.03 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Allied Tube & Conduit: www.alliedeg.com.
   2. Beck Manufacturing, Inc: www.beckmfg.com.
   3. Wheatland Tube Company: www.wheatland.com.

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.

3. Connectors and Couplings: Use compression (gland) or set-screw type.
    a. Do not use indenter type connectors and couplings.

D. Description: ANSI C80.3; galvanized tubing.

E. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron compression type.

2.04 ELECTRICAL NONMETALLIC TUBING (ENT)

A. Manufacturers:
1. Beck Manufacturing, Inc: www.beckmfg.com.
2. Cantex Inc: www.cantexinc.com.
3. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com.

B. Description: NFPA 70, Type ENT electrical nonmetallic tubing complying with NEMA TC 13 and listed and labeled as complying with UL 1653.

C. Fittings:
1. Manufacturer: Same as manufacturer of ENT to be connected.
2. Use solvent-welded type fittings.
3. Solvent-Welded Fittings: Rigid PVC fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; suitable for use with ENT.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify routing and termination locations of conduit prior to rough-in.

E. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.

C. Install electrical nonmetallic tubing (ENT) in accordance with NECA 111.

D. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Connections and Terminations:
1. Use suitable adapters where required to transition from one type of conduit to another.
2. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
3. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

F. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.

6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

G. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where conduits are subject to earth movement by settlement or frost.

H. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

I. Provide grounding and bonding in accordance with Section 26 0526.

END OF SECTION

SECTION 26 0537
BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Underground boxes/enclosures.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 2726 - Wiring Devices:
   1. Wall plates.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.

E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

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

H. SCTE 77 - Specification for Underground Enclosure Integrity; 2013.

I. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.
   1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.

C. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Keys for Lockable Enclosures: Two of each different key.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.

3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use suitable concrete type boxes where flush-mounted in concrete.
4. Use suitable masonry type boxes where flush-mounted in masonry walls.
5. Use raised covers suitable for the type of wall construction and device configuration where required.
6. Use shallow boxes where required by the type of wall construction.
7. Do not use "through-wall" boxes designed for access from both sides of wall.
8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
12. Wall Plates: Comply with Section 26 2726.

C. Underground Boxes/Enclosures:
1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
2. Size: As indicated on drawings.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
4. Applications:
a. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.

D. The Wiremold Company: www.wiremold.com.

E. Thomas & Betts Corporation.

F. Raco. A Hubbell Company.
1. Minimum size for communications, fire alarm, sound system and security system rough-ins shall be 4" square, 3-1/2" deep unless otherwise noted.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

E. Install boxes plumb and level.

F. Flush-Mounted Boxes:
   1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
   2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
   3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

G. Install boxes as required to preserve insulation integrity.

H. Underground Boxes/Enclosures:
   1. Install enclosure on gravel base, minimum 6 inches deep.
   2. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

I. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

J. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

K. Close unused box openings.

L. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

M. Provide grounding and bonding in accordance with Section 26 0526.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

END OF SECTION

SECTION 26 0553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Warning signs and labels.

F. Field-painted identification of conduit.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting.

B. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

C. Section 26 0573 - Power System Studies: Arc flash hazard warning labels.

1.03 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.

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

D. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

B. Product Data: Provide catalog data for nameplates, labels, and markers.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
   2. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70, including but not limited to the following.
      a. Service equipment.
   3. Arc Flash Hazard Warning Labels: Comply with Section 26 0573.

B. Identification for Conductors and Cables:
   1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
   2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
   1. Materials:
   2. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
   1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Nameplates: Engraved three-layer laminated plastic, black letters on white background.

D. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background. Use only for identification of individual wall switches and receptacles, control device stations, and _____.

2.03 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Minimum Text Height: 1/8 inch.

F. Color: Black text on white background unless otherwise indicated.

G. Description: Vinyl cloth type self-adhesive wire markers.

2.04 VOLTAGE MARKERS

A. Minimum Size:

B. Legend:

C. Color: Black text on orange background unless otherwise indicated.

2.05 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
   1. Materials:
   2. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
   3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

B. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.
   2. Flush-Mounted Equipment: Inside of equipment door.
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Interior Components: Legible from the point of access.
   6. Conductors and Cables: Legible from the point of access.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

END OF SECTION

SECTION 26 0923

LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outdoor Photoelectric switches.

B. Occupancy sensors.

C. Lighting contactors

1.02 RELATED REQUIREMENTS

A. Section 26 2726 - Wiring Devices for wall-box dimmers and line voltage light switches.

B. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

C. Section 01 7000 - Execution Requirements: Examination, preparation, and general installation procedures; preinstallation meetings; cutting and patching; cleaning and protection; starting of systems; demonstration and instruction; closeout procedures except payment procedures; requirements for alterations work.

D. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance (O&M) data, warranties and bonds.

E. Section 01 7900 - Demonstration and Training: Detailed requirements.

1.03 REFERENCE STANDARDS

A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.04 SUBMITTALS

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

B. Product data: For each type of product indicated.

C. Shop Drawings: Show installation details for occupancy and light-level sensors.
   1. Interconnection diagrams showing field installed wiring.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in LOCATION.

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

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.06 WARRANTY

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

B. Correct defective Work within a One year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, outdoor photoelectric switches shall be provided by the manufacturer of the light fixture or by the manufacturer of the lighting control panel.

1. Light level monitoring range: 0 to 200 fc.
2. Operating temperature: -40 degrees F to 140 degrees F.
3. Time delay: Programmable at the lighting control panel.
4. Mounting: 1/2" threaded conduit fitting.
5. Housing: Weatherproof, UV-stabilizing plastic, with hooded lens.

2.02 OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, occupancy sensors shall be provided by the manufacturer of the light fixture or by the manufacturer of the lighting control panel.

B. General Description: Wall-or ceiling mounting, solid state units with seperate relay unit.
   1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, manually adjustable for aminimum range of 1 to 30 minutes. Set all sensors to a fixed 20-minute time delay.
   2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
   3. Relay unit: Dry contacts rated for 20A ballast load at 120 and 277 V ac, for 13A tungsten at 120 Vac, and for 1 hp at 120 Vac. Power supply to sensor shall be 24 V dc, 150 mA, class 2 power source as defined by NFPA 70.
   4. Indicator: LED's to show when motion is being detected during testing and normal operation of the sensor.
   5. Bypass Switch: Override the on function in case of sensor failure.

C. Dual-Technology Type: Ceiling or wall mounted as indicated; detect occupancy by using a combination of PIR (Passive Infrared) and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on/off functions shall be selectable in the field by operating controls on the unit.
   1. Sensor specifications: Exact motion coverage area, sensor style and mounting type shall be selected by manufacturer to insure proper operation. manufacturer shall submitt floor plans showing sensor location, quantity and style for approval.

2.03 LIGHTING CONTACTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Square D; Schneider Electric.
   2. Eaton Electrical Inc.; Cutler Hammer Products.
   3. Watt Stopper
   4. GE Industrial Systems.

B. Description: Electrically operated and electrically held, combination type with non-fused disconnect, complying with NEMA ICS 2 and UL 508.
   1. Current rating for switching: Listing or rating consistent with type of load served, includng tungsten filament, inductive, and high-in rush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
   2. fault current withstand rating: Equal to or exceeding the available fault current at the point of installation.
   3. Provide with control and pilot devices as indicated on drawings, matching the NEMA type specified for the enclosure.

PART 3 EXECUTION

3.01 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.02 WIRING INSTALLTION

A. Wiring method: Comply with division 26 section " Low Voltage Electrical Power Conductors and Cables" Minimum conduit size shall be 1/2 inch.

B. Wiring within enclosures: Comlpy with NECA 1. Seperate power-limited and non-power limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets, and equipment enclosures.

3.03 IDENTIFICATION

A. Identify components, power and control wiring according to Division 26 Section " Identification for Electrical System."
   1. Identify controlled circuits in lighting contactors.
   2. Identify circuits or luminares controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.04 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of substantial completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to project during other-than normal occupancy hours for this purpose.

3.05 FIELD QUALITY CONTROL

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

B. Perform the following field tests and inspections and prepare test reports:
   1. After installing time switches and sensors, and after electrical circuiting has been energized, adjust and test for compliance with requirements.
   2. Operational test: Verify operation of each lighting control device, and adjust time delays.

C. Lighting control devices that fail tests and inspections are defective and shall be replaced.

3.06 SYSTEM STARTUP

A. Provide manufacturer's field representative to perform systems startup.

B. Prepare and start equipment and systems in accordance with manufacturers' instructions and recommendations.

C. Adjust for proper operation within manufacturer's published tolerances.

END OF SECTION

SECTION 26 2200

LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General purpose transformers.

B. K-factor transformers rated for nonlinear loads.

PART 2 PRODUCTS

2.01 TRANSFORMERS - GENERAL REQUIREMENTS

A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.

B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
   1. Altitude: Less than 3,300 feet.
   2. Ambient Temperature:
      a. Greater than 10 kVA: Not exceeding 104 degrees F.
      b. Less than 10 kVA: Not exceeding 77 degrees F.
   3. Ambient Temperature: Not exceeding 86 degrees F average or 104 degrees F maximum measured during any 24 hour period.

C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.

D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.

E. Basic Impulse Level: 10 kV.

F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

G. Isolate core and coil from enclosure using vibration-absorbing mounts.

H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.02 GENERAL PURPOSE TRANSFORMERS

A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.

B. Insulation System and Allowable Average Winding Temperature Rise:
   1. Less than 15 kVA: Class 180 degrees C insulation system with 115 degrees C average winding temperature rise.
   2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.

C. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.

D. Winding Taps:
   1. Less than 3 kVA: None.
   2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
   3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
   4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.

E. Energy Efficiency: Comply with 10 CFR 431, Subpart K.

1. Test efficiency according to NEMA TP 2.
2. Label transformer according to NEMA TP 3.

F. Sound Levels: Standard sound levels complying with NEMA ST 20.

G. Mounting Provisions:
1. Less than 15 kVA: Suitable for wall mounting.
2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
3. Larger than 75 kVA: Suitable for floor mounting.

H. Transformer Enclosure: Comply with NEMA ST 20.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
2. Construction: Steel.
   a. Less than 15 kVA: Totally enclosed, non-ventilated.
   b. 15 kVA and Larger: Ventilated.
3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
4. Provide lifting eyes or brackets.

2.03 K-FACTOR TRANSFORMERS RATED FOR NONLINEAR LOADS

A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 1561, and designed to supply nonlinear loads to the degree designated by the UL defined K-factor; ratings as indicated on the drawings.

B. K-factor Rating: K-4, or higher.

C. Insulation System and Allowable Average Winding Temperature Rise: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.

D. Coil Conductors: Continuous aluminum windings with terminations brazed or welded. Individually insulate secondary conductors and arrange to minimize hysteresis and eddy current losses at harmonic frequencies. Size secondary neutral conductor at twice the secondary phase conductor ampacity.

E. Winding Taps: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.

F. Neutral Bus: Sized to accommodate twice the rated secondary current.

G. Energy Efficiency: Comply with 10 CFR 431, Subpart K.
1. Test efficiency according to NEMA TP 2.
2. Label transformer according to NEMA TP 3.

H. Sound Levels: Standard sound levels complying with NEMA ST 20.

I. Mounting Provisions:
1. Up to 75 kVA: Suitable for wall, floor, or trapeze mounting.
2. Larger than 75 kVA: Suitable for floor mounting.

J. Transformer Enclosure: Comply with NEMA ST 20.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
2. Construction: Steel, ventilated.
3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
4. Provide lifting eyes or brackets.

END OF SECTION

SECTION 26 2726

WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Wall plates.

1.02 RELATED REQUIREMENTS

A. Section 26 0537 - Boxes.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Federal Specification; Revision G, 2001.

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification; Revision F, 1999.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.

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

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

1.04 SUBMITTALS

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hubbell Incorporated: www.hubbell-wiring.com.

B. Leviton Manufacturing Company, Inc: www.leviton.com.

C. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

2.02 ALL WIRING DEVICES

A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.03 WALL SWITCHES

A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

B. Wall Switches: Heavy Duty, AC only general-use snap switch, complying with NEMA WD 6 and WD 1.
   1. Body and Handle: Ivory plastic with toggle handle.
   2. Ratings:
      a. Voltage: 120 - 277 volts, AC.

b. Current: 20 amperes.

2.04 RECEPTACLES

A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

2.05 WALL PLATES

A. Wall Plates: Comply with UL 514D.
   1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
   2. Screws: Metal with slotted heads finished to match wall plate finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switches: 48 inches above finished floor.
      b. Wall Dimmers: 48 inches above finished floor.
      c. Fan Speed Controllers: 48 inches above finished floor.
      d. Receptacles: 18 inches above finished floor or 6 inches above counter.
   2. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Install wiring devices plumb and level with mounting yoke held rigidly in place.

I. Install wall switches with OFF position down.

J. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

K. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

L. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

3.04 FIELD QUALITY CONTROL

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

B. Perform field inspection, testing, and adjusting in accordance with Section 01 4000.

C. Inspect each wiring device for damage and defects.

D. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

E. Test each receptacle to verify operation and proper polarity.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 5100
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts and drivers.

E. Fluorescent emergency power supply units.

F. Lamps.

G. Luminaire accessories.

1.02 REFERENCE STANDARDS

A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; 2006.

B. ANSI C82.1 - American National Standard for Lamp Ballast - Line Frequency Fluorescent Lamp Ballast; 2004.

C. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type); 2002.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

E. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.

F. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

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

H. NFPA 101 - Life Safety Code; 2015.

I. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

J. UL 1598 - Luminaires; Current Edition, Including All Revisions.

1.03 SUBMITTALS

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

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Ballast product specification sheet from manufacturer.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70 and NFPA 101.

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

1.05 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.06 WARRANTY

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

B. Provide two year manufacturer warranty for all linear fluorescent ballasts.

C. Provide five year pro-rata warranty for batteries for emergency lighting units.

D. Provide ten year pro-rata warranty for batteries for self-powered exit signs.

E. Provide three year full warranty for fluorescent emergency power supply units.

1.07 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Furnish two of each plastic lens type.

C. Furnish two of each emergency battery type.

PART 2 PRODUCTS

3.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

3.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70 and NFPA 101.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

3.03 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:
   1. Sealed maintenance-free nickel cadmium unless otherwise indicated.
   2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

3.04 EXIT SIGNS

A. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single or double as indicated or as required for the installed location.
   2. Directional Arrows: As indicated or as required for the installed location.

3.05 LAMPS

A. Manufacturers:
   1. General Electric Company/GE Lighting: www.gelighting.com.
   2. Osram Sylvania: www.sylvania.com.
   3. Philips Lighting Company: www.lighting.philips.com.

B. Lamps - General Requirements:
   1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
   2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
   3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
   4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Strategic Energy Solutions, Inc. to be inconsistent in perceived color temperature.

3.06 ACCESSORIES

PART 3 EXECUTION

4.01 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0537 as required for installation of luminaires provided under this section.

B. Install products according to manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship), NECA 500 (commercial lighting), and NECA 502 (industrial lighting).

D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

E. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   4. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

F. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.

G. Suspended Luminaires:
   1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   2. Unless otherwise indicated, support pendants from swivel hangers.

H. Install accessories furnished with each luminaire.

I. Bond products and metal accessories to branch circuit equipment grounding conductor.

J. Emergency Lighting Units:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

K. Exit Signs:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

L. Install lamps in each luminaire.

4.02 FIELD QUALITY CONTROL

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

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Strategic Energy Solutions, Inc..

4.03 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Strategic Energy Solutions, Inc.. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Strategic Energy Solutions, Inc. or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Strategic Energy Solutions, Inc. or authority having jurisdiction.

4.04 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

4.05 CLOSEOUT ACTIVITIES

A. Just prior to Substantial Completion, replace all lamps that have failed.

4.06 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

4.07 ATTACHMENTS

A. Luminaire schedule.

END OF SECTION

SECTION 26 5561
THEATRICAL LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stage lighting units and lamps.

B. Dimmers and control units.

1.02 REFERENCE STANDARDS

A. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

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

1.03 SUBMITTALS

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

B. Operation Data:
   1. Instructions for operating lighting control system.
   2. Instructions for operating system under unusual conditions when emergency life safety conditions exist.
   3. Identify limits beyond which operation would result in hazardous or unsafe conditions or in equipment damage.
   4. Document ratings of system and of each major component.

C. Maintenance Data:
   1. Routine preventive maintenance schedule.
   2. Lists of special tools, maintenance materials, and replacement parts.
   3. Repair instructions for procedures to check, repair, and test equipment during typical malfunctions.
   4. Recommended cleaning methods, frequency, and materials.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL COMPONENTS

A. Lighting Dimming and Control System: For stage area and house lighting.

B. Dimmers: Portable dimming unit suitable for mounting at lighting unit.

PART 3 EXECUTION

3.01 INSTALLATION

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

B. Aim and adjust luminaires as indicated on Drawings.

C. Clean electrical parts to remove conductive and harmful materials.

D. Remove dirt and debris from enclosure.

E. Clean photometric control surfaces as recommended by manufacturer.

F. Clean finishes and touch up damage.

END OF SECTION

SECTION 26 5600

EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0537 - Boxes.

D. Section 26 0923 - Lighting Control Devices: Automatic controls for lighting including outdoor motion sensors, time switches, and outdoor photo controls.

E. Section 26 5100 - Interior Lighting.

1.03 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code; 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2006.

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

E. UL 1598 - Luminaires; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acuity Brands, Inc: www.acuitybrands.com.

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

2.02 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.03 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

END OF SECTION

SECTION 311000 – SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Related Documents:
   1. Drawings and general provisions of the Subcontract apply to this Section.
   2. Review these documents for coordination with additional requirements and information that apply to work under this Section.

B. Section Includes:
   1. Removal and disposal of surface debris.
   2. Removal and disposal of paving, curbs, gutters, fences, posts, or other structures indicated on the drawings.
   3. Site clearing and disposal of plant life and grass.
   4. Removal and disposal of trees and shrubs.
   5. Removal and disposal of root system of trees and shrubs.
   6. Topsoil excavation and stockpiling.

C. Related Sections:
   1. Division 01 Section "General Requirements."

1.2 SUBMITTALS

A. Comply with the provisions of Division 01 Section "General Requirements".

1.3 QUALITY ASSURANCE

A. Conform to applicable codes and local, state and federal regulations for disposal of debris and use of herbicides. Burning of debris, lumber or scrap will not be permitted.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, as shown and detailed on the Civil Engineering plans and details.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 PREPARATION

A. Verify that existing plant life in areas of construction is designated to remain, is tagged or identified.

B. Sawcut paving, curbs gutters and other structures between portion to remain and portion to be removed.

3.3 PROTECTION

A. Locate, identify, and protect from damage, utilities indicated to remain.

B. Protect trees, plant growth, and features indicated to remain against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated material within drip line, excess foot or vehicular traffic or parking of vehicles within drip line.

C. Protect from damage or displacement, bench marks and existing structures indicated to remain.

D. Protect existing utilities to remain from damage.

E. Do not disrupt public utilities without permit from authority having jurisdiction.

F. Protect existing structures and other elements that are not being removed.

3.4 CLEARING

A. Clear areas required for access to site and execution of the Work.

B. Remove paving, curbs, and gutters, fences, posts, or structures indicated on the Drawings.

C. Remove trees and shrubs indicated on drawings.
   1. In areas to be filled and under structures, walkways and roads, remove stumps, and main root system to a depth of not less than 2 feet (0.6 m) below the original ground surface.
   2. Do not burn, bury, landfill or leave on site, except as indicated.
      a. Chip, grind crush or shred vegetation for mulching, composting or other purposes; preference should be given to on-site uses.
      b. Trees: Replant on site if possible. Location to be determined by Landscape Architect.
   3. All trees less than six inches in diameter to be removed shall be incidental to construction.
   4. Removal of trees shall include removing such trees, grinding of the stump, backfilling of all holes after removal of tree, and disposing of materials.

5. Trees having major limbs lower than four feet from the ground shall be measured at the smallest diameter below such limbs. Where more than one tree grows from a common source below ground, each tree or stump from there will be measured as a separate tree or stump.

D. Clear undergrowth and dead wood without disturbing subsoil.

E. Apply herbicide approved by the City of Sterling Heights to remaining stumps to inhibit growth.

F. Cut tree branches in conflict with the construction close to the bole in a workmanlike manner. Remove other tree branches in such a manner that the tree will present a balanced appearance.
1. Coat cut faces with emulsified asphalt or other acceptable coating, formulated for use on damaged plant tissue.

G. Remove debris, rock, and extracted plant life from site.

H. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace of no cost to the City of Sterling Heights.

3.5 TOP SOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, re-landscaped, or re-graded.

B. Stockpile in area designated on site to depth not exceeding 8 feet (2.5 m) and protect from erosion. Remove excess topsoil not being reused from site. Coordinate removal with City for possible reuse at other sites in this project or within the City.

END OF SECTION 311000

SECTION 311413 – TOPSOIL STRIPPING AND STOCKPILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Topsoil removal and stockpiling as indicated or required per the Construction Documents.

B. Related sections:

1. Section 31 10 00 - Site Clearing
2. Section 31 20 00 - Earthmoving

PART 2 – PRODUCTS

2.1 MATERIALS

A. Topsoil: Topsoil shall be relatively free from roots, sticks, weeds, brush or stones large than 1-inch in diameter or other litter or waste products. It shall be a loamy mixture having at least 90 percent passing a No. 10 sieve. A sample, free from extraneous materials, shall comply to the following requirements.

1. Organic Matter: Topsoil shall contain not less than 10 percent organic matter as determined by the test for organic matter, AASHTO T 194.

2. Clay: The topsoil shall contain not less than 12 percent clay or more than 50 percent as determined in accordance with AASHTO T 88.

3. Sand: The sand content shall not exceed 55 percent as determined in accordance with AASHTO T 88.

4. pH: The pH of the sample shall not be less than 5.0 nor higher than 8.0. The pH shall be determined with an acceptable pH meter, on that portion of the sample passing a No. 10 sieve, in accordance with ASTM D-4972, pH of soils.

B. If sufficient topsoil is not available at the Site or the Contractor elects the option to secure topsoil elsewhere, the Contractor must receive the Owner's approval of material in writing prior to securing topsoil. All topsoil secured off Site must meet other requirements of this Section.

PART 3 – EXECUTION

3.1 TOPSOIL REMOVAL

A. Excavate or strip topsoil in all cut-and-fill areas and stockpile for later use in connection with finish grading. Excavate topsoil to the depths required to remove all organic material from subgrade, but not less than 2-in.

B. Transport and deposit topsoil in stockpiles to a depth not exceeding 8 feet and protect from erosion at designated locations in a manner convenient for spreading and finish grading.

C. Removal of topsoil includes removal all roots, debris, vegetation and stones 3-in. or larger and other undesirable material prior to stockpiling. (This removal does not include grass or grass roots in the topsoil.)

D. Remove excess topsoil not being reused from site. Coordinate removal with City for possible reuse at other sites in this project or within the City.

3.2 STOCKPILING

A. Stockpile excavated topsoil to a depth not exceeding 8 feet, separate from other excavated materials for later use. Stockpile area shall be cleared and grubbed prior to placing any topsoil. Keep stockpile free of all undesirable materials. Make stockpiles neatly shaped, and free to drain. Place stockpiles at locations shown on Drawings or as directed by Owner. Cover storage piles, as required, to prevent wind blown dust.

END OF SECTION 311413

SECTION 312000 – EARTHMOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Excavation, filling, and backfilling for structures, pavement, and out parcels.
2. Trenching and backfilling for utilities.
3. Dewatering.
4. Boring under crossings.

B. Related Sections
1. Section 31 10 00 - Site Clearing
2. Section 01 56 39 - Tree and Plant Protection
3. Section 31 25 00 - Erosion and Sedimentation Controls
4. Section 33 40 00 - Storm Drainage Utilities
5. Section 32 12 16 - Asphalt Paving
6. Section 32 13 13 - Concrete Paving
7. Section 32 16 13.13 - Concrete Curbs and Gutters

1.2 REFERENCED STANDARDS

A. All work under this section shall be completed in general conformance with construction plan details, Municipality standards, and/or the Michigan Department of Transportation's (MDOT) standard specifications for construction (current edition), MDOT's standard plans (current edition), MDOT's construction manual (current edition), MDOT's quality assurance procedures manual (current edition), and as specified herein.

B. ASTM International (ASTM)
1. ASTM D 422 - Standard Test Method For Particle Size Analysis of Soil
2. ASTM D 698 - Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN.m/m^3))
3. ASTM D 1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 Kn.m/m^3))
4. ASTM D 2922 - Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
5. ASTM D 4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils

C. American Association of State Highway and Transportation Officials (AASHTO)
1. AASHTO T 88 - Particle Size Analysis of Soils

D. National Fire Protection Association (NFPA)
1. NFPA 70 - National Electrical Code

E. American Water Works Association (AWWA)
1. AWWA C200 - Standard For Steel Water Pipe - 6 In. (150 Mm) And Larger
2. AWWA C206 - Field Welding Of Steel Water Pipe

1.3 DEFINITIONS

A. Satisfactory Materials: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, SM, ML, CL or a combination of these group symbols.
   1. Fill material shall further conform to the plasticity index and liquid limits (PI and LL) specified in Paragraph FILLING hereinafter.
   2. Satisfactory materials shall be free of rock or gravel larger than allowed for fill or backfill material as specified hereinafter or as shown on the drawings.
   3. Satisfactory materials shall contain no debris, waste, frozen materials, vegetation, and other deleterious matter.
   4. Unless specifically stated otherwise in "Foundation Subsurface Preparation" on the Drawings, the following table stipulates maximum allowable values for plasticity index (PI) and liquid limit (LL) of satisfactory materials to be used as fill in specified areas:

Location	PI	LL
Building area (below upper four feet)	20	50
Building area (upper four feet)	12	40
All other areas outside the building pad		
(below upper two feet)	20	50
(upper two feet, except for depth to receive topsoil)	15	40

(References to depth are to proposed sub-grade elevations)

B. Unsatisfactory Materials: Materials which do not comply with the requirements for satisfactory materials are unsatisfactory.
   1. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory materials which contains root and other organic matter or frozen material. The TL shall be notified of any contaminated materials.
   2. Unsatisfactory materials also include satisfactory materials not maintained within 2 percent of optimum moisture content at time of compaction.

1.4 SUBMITTALS

A. Test Reports: The Soil Engineer or Testing Laboratory shall submit the following reports directly to the Contractor for testing services, with copy to the Engineer.
   1. Test reports on borrow material.
   2. Field reports for in-place soil density tests.
   3. One optimum moisture-maximum density curve for each type soil encountered.
   4. Report of actual unconfined compressive strength and/or results of bearing tests for each stratum tested.
   5. Field Reports: Observation of proof rolling, noting areas exhibiting excessive pumping or yielding.

B. If geo-textile fabrics or geo-grids are to be used, design shall be submitted for approval by Contractor / Soil Engineer.

C. Shop drawings or details pertaining to excavating and filling are not required unless otherwise shown on the Drawings or if contrary procedures to Construction Documents are proposed.

D. Shop drawings or details pertaining to site utilities are not required unless required by regulatory authorities or unless uses of materials, methods, equipment, or procedures that are contrary to The Drawings or Specifications are proposed. Do not perform work until required shop drawings are approved.

1.5 PROJECT CONDITIONS

A. Site Information: The contractor shall make his own determination as to soil conditions and shall assume all risk and responsibility and shall complete the work in whatever material and under whatever condition he may encounter or create, without extra cost to the Owner. This shall apply whether or not borings are shown on the drawings.

B. A small number of borings have been made. These borings have been made by a disinterested soils engineer and the reports are available in the project manual. The information is provided as evidence of ground conditions at only certain locations and the Contractor himself shall assume the entire responsibility for any conclusions which he may draw from it. The Owner does not guarantee, however, that the ground encountered during construction will conform with these borings and the Contractor should secure such other information as they consider necessary to check and supplement the data. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner will not be responsible for interpretations or conclusions drawn from this data by the Contractor.
   1. The Contractor may perform additional test borings and other exploratory operations, at the Contractor's option; however, no change in the contract Sum will be authorized for such additional exploration.
   2. Refer to "Geo-technical Inspection Report" included in this project manual.

C. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.
   1. Should uncharted, or incorrectly charted piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility Owner.
   2. DO NOT interrupt existing utilities serving facilities occupied by the Owner, except when permitted in writing by the Owner. Include acceptable temporary utility services if required.
      a. Provide minimum 72 hour notice.

D. Protection of Persons and Property:
   1. Barricade open excavation occurring as part of this work and post with warning lights.
   2. Operate warning lights as recommended if required by authorities having jurisdiction.
   3. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout, erosion and other hazards created by earthwork operations.
   4. Perform excavation by hand within drip line of large trees to remain. Protect root systems from damage or dry out to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

PART 2 - PRODUCTS

2.1 SOIL AND ROCK MATERIALS

A. Fill and Backfill. Satisfactory materials excavated from the site as approved by Soil Engineer.

B. Imported Fill Material: Satisfactory material(s) provided from offsite borrow areas when sufficient satisfactory materials are not available from required excavations.

C. Trench Backfill: ASTM D 2321 unless otherwise specified or shown on the drawings.

D. Building Subbase Material: Subbase for building and appurtenances slabs on ground is specified in Section 03 30 00 as applicable.

E. Bedding: Aggregate Type as indicated on the plans or naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No.200 sieve.

F. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

G. Backfill and Fill Materials: "Satisfactory" soil materials free of clay, rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.
   1. Granular Backfill: Clean, natural, coarse bank run sand, conforming to requirements for MDOT Class II or ASTM C 33, materials.
   2. Aggregate Backfill: Crushed limestone conforming to MDOT aggregate 21AA or 22AA.

H. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

I. Impervious Fill: Clayey mixture without granular materials capable of compacting to a dense composite as acceptable to Testing and Inspecting Agency.

J. Coarse Aggregate: As indicated on drawings.

K. Aggregate Surfaces and Shoulders: Surfaces on which no bituminous or concrete pavement is to be placed; crushed stone or gravel conforming to MDOT aggregate 21AA, 22AA, 22A or 23A.

L. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2- inch sieve and 0 to 5 percent passing a No.8 sieve.

M. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No.4 sieve.

N. Topsoil: Topsoil shall consist of stripping material excavated from the site. Topsoil shall consist of organic surficial soil found in depth of not more than 6-inches. Topsoil shall be as further defined in Section 02919 – "Topsoil".

2.2 EQUIPMENT

A. Transport off-site materials to project using well-maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements by rutting, overloading, or pumping.

2.3 SOURCE QUALITY CONTROL

A. In areas to receive pavement, California Bearing Ratio (CBR) or Limerock Bearing Ratio (LBR) tests shall be performed for each type of material that is imported from off-site. CBR or LBR value shall be equal to or above pavement design subgrade CBR or LBR value indicated on Construction Drawings, or within the geotechnical report.

B. Following tests shall be performed on each type of on-site or imported soil material used as compacted fill:
1. Moisture and Density Relationship: ASTM D 698 or ASTM D 1557.
2. Mechanical Analysis: AASHTO T 88 or ASTM D422.
3. Plasticity Index: ASTM D 4318

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify required lines, levels, contours, datum, elevations, and grades necessary for construction as shown on the drawings.

B. Notify utility companies to remove or relocate public utilities that are in conflict with proposed improvements.

C. Protect plant life, lawns, fences, existing structures, sidewalks, paving, and curbs, unless otherwise noted on the drawings from excavating equipment and vehicular traffic.

D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

E. Remove from site, material encountered in grading operations that, in opinion of the Soil Engineer or Testing Laboratory (TL) is unsatisfactory material or undesirable for backfilling, sub-

grade, or foundation purposes. Dispose of in manner satisfactory to local governing agencies. Backfill areas with layers of satisfactory material and compact as specified herein.

F. Prior to placing fill in low areas, such as previously existing creeks, ponds, or lakes, perform following procedures:

1. Drain water out by gravity with ditch having flow line lower than lowest elevation in low area. If drainage cannot be performed by gravity ditch, use adequate pump to obtain the same results.

2. After drainage of low area is complete, remove muck, mud, debris, and other unsatisfactory material by using acceptable equipment and methods that will keep natural soils underlying low area dry and undisturbed.

3. All muck, mud, and other materials removed from low areas shall be dried on-site by spreading in thin layers for observation by the Soil Engineer or TL. Material shall be inspected and, if found to be satisfactory for use as fill material, shall be incorporated into lowest elevation of site filling operation, but not under building sub-grade or within 10'-0" of perimeter of building sub-grade or paving sub-grade. If, after observation by the TL, material is found to be unsatisfactory, it shall be removed from site.

G. Locate and identify utilities that have previously been installed and protect from damage.

H. Locate and identify existing utilities that are to remain and protect from damage.

I. Maintain in operating condition existing utilities, previously installed utilities, and drainage systems encountered in utility installation. Repair surface or subsurface improvements shown on The Drawings.

J. Verify location, size, elevation, and other pertinent data required for making connections to existing utilities and drainage systems as indicated on The Drawings.

K. Over excavate and properly prepare areas of subgrade that are not capable of supporting proposed systems.

3.2 DEWATERING

A. General:
1. Provide dewatering systems as required for excavations.

2. Design and provide dewatering system using accepted and professional methods consistent with current industry practice to eliminate water entering the excavation under hydrostatic head from the bottom or sides. Design system to prevent differential hydrostatic head, which would result in floating out soil particles in a manner, termed as a “quick” or “boiling” condition. System shall not be dependent solely upon sumps or pumping water from within the excavation where differential head would result in a quick condition, which would continue to worsen the integrity of the excavation’s stability.

3. Provide dewatering system of sufficient size and capacity to prevent ground and surface water flow into the excavation and to allow Work to be installed in a dry condition.

4. Control, by acceptable means, all water regardless of source. Contractor shall be responsible for disposal of the water.

5. Confine discharge piping or ditches to available easement or to additional easement obtained by Contractor. Provide necessary permits or easement.

6. Control groundwater in a manner that preserves strength of foundation soils, does not cause instability or raveling of excavation slopes, and does not result in damage to existing structures. Where necessary, lower water level in advance of excavation utilizing wells, well points, jet educators, or similar positive methods. The water level as measured by piezometers shall be maintained a minimum of 3 feet below prevailing excavation level.

7. Commence dewatering prior to any appearance of water in excavation and continue until Work is complete to the extent that no damage results from hydrostatic pressure, flotation, or other causes.

8. Open pumping with sumps and ditches will be allowed provided it does not result in boils, loss of fines, softening of the ground, or instability of slopes.

9. Install wells or well points, if required, with suitable screens and filters so that continuous pumping of fines does not occur. Arrange discharge to facilitate collection of samples. During normal pumping and upon development of wells, levels of fine sand or silt in the discharge water shall not exceed 5 ppm. Install sand tester on discharge of each pump during testing to verify that levels are not exceeded.

10. Control grading around excavations to prevent surface water from flowing into excavation areas.

B. Design:

1. Designate and obtain the services of a qualified dewatering specialist to provide dewatering plan as may be necessary to complete the Work.

2. Contractor shall be responsible for the accuracy of the drawings, design data, and operational records required.

3. Contractor shall be responsible for the design, installation, operation, maintenance, and any failure of any component of the system.

C. Damages:

1. Contractor shall be responsible for and shall repair any damage to work in place, other contractor’s equipment, utilities, residences, highways, roads, railroads, private and municipal well systems, adjacent structures, natural resources, habitat, existing wells, and the excavation. Contractor responsibility shall also include, damage to the bottom due to heave and including but not limited to, removal and pumping out of the excavated area

that may result from Contractor's negligence, inadequate or improper design and operation of the dewatering system, and any mechanical or electrical failure of the dewatering system.

2. Remove sub-grade materials rendered unsatisfactory by excessive wetting and replace with approved backfill material at no additional cost to the Owner.

D. Maintaining Excavation in Dewatering Condition:

1. Dewatering shall be a continuous operation. Interruptions due to power outages or any other reason will not be permitted.

2. Continuously maintain excavation in a dry condition with positive dewatering methods during preparation of sub-grade, installation of pipe, and construction of structures until the critical period of construction or backfill is completed to prevent damage of sub-grade support, piping, structure, side slopes, or adjacent facilities from flotation or other hydrostatic pressure imbalance.

3. Provide standby equipment on site, installed, wired, and available for immediate operation if required to maintain dewatering on a continuous basis in the event any part of the system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, perform such work as may be required to restore damaged structures and foundation soils at no additional cost.

4. System maintenance shall include but not be limited to 24-hour supervision by personnel skilled in the operation, maintenance, and replacement of system components, and any other work required to maintain excavation in dewatered condition based on site conditions or as directed by the Contractor.

E. System Removal: Upon completion of the work, remove dewatering equipment from the site, including related temporary electrical service.

F. Wells shall be removed or cut off a minimum of 3 feet below final ground surface, capped, and abandoned in accordance with regulations by agencies having jurisdiction.

3.3 TOPSOIL EXCAVATION

A. Cut heavy growths of grass from areas before stripping and remove cuttings with remainder of cleared vegetative material.

B. Strip topsoil to a depth of not less than 6 inches from areas that are to be filled, excavated, landscaped, or re-graded to such depth that it prevents intermingling with underlying subsoil or questionable material.

C. Stockpile topsoil in storage piles in areas shown on The Drawings or where directed. Construct storage piles to freely drain surface water. Cover storage piles as required to prevent windblown dust. Dispose of unsuitable topsoil as specified for waste material, unless otherwise specified. Remove excess topsoil from site and coordinate for possible use at other parks in project or within City.

3.4 GENERAL EXCAVATION

A. Classification of Excavation: The Contractor shall assure himself by site investigation or other necessary means that he is familiar with the type, quantity, quality, and character of excavation work to be performed. Excavation shall be considered unclassified excavation, except as indicated in the Contract Documents.

B. When performing grading operations during periods of wet weather, provide adequate dewatering, drainage and ground water management to control moisture of soils.

C. Shore, brace, and drain excavations as necessary to maintain excavation as safe, secure, and free of water at all times.

D. Excavate building areas to line and grade as shown on the Drawings being careful not to over excavate beyond elevations needed for building sub-grade.

E. Place satisfactory excavated material into project fill areas.

F. Unsatisfactory excavated material shall be disposed of in manner and location that is acceptable to Owner and local governing agencies.

G. Perform excavation using capable, well-maintained equipment and methods acceptable to Contractor and local governing agencies.

3.5 SUBGRADE PREPARATION

A. Scarification and Compaction: Areas exposed by excavation or stripping and on which sub-grade preparations are to be performed shall be scarified to minimum depth of 8 inches and compacted as specified hereinafter.

B. Proof-rolling: Sub-grades shall be proof-rolled to detect areas of insufficient compaction. Proof-rolling shall be accomplished by making minimum of 2 complete passes with fully-loaded tandem-axle dump truck with a maximum weight of 20 tons, or approved equal, in each of 2 perpendicular directions while under the supervision and direction of the testing laboratory. Document and explain proof-rolling inspection procedures and results in the laboratory inspection report. Areas of failure shall be excavated and re-compacted as specified herein. Continual failure areas shall be stabilized. Sub-grade exposed longer than 48 hours or on which precipitation has occurred shall be re-proof rolled.

3.6 FILLING

A. Fill areas to contours and elevations shown on the Drawings with materials deemed satisfactory.

B. Place fills in continuous lifts specified herein.

C. Fill within proposed building sub-grade and paving sub-grade shall not contain rock or stone greater than 6 inches in any dimension.

D. Unless otherwise specified for rock fill, rock or stone less than 6-inches in largest dimension may be used in fill below structures, paving, and graded areas, up to 24 inches below surface of proposed sub-grade or finish grade of graded areas when mixed with satisfactory material. Rock or stone less than 2 inches in largest dimension may be used in fill within the upper 24 inches of proposed sub-grade or finish grade of graded areas when mixed with satisfactory material.

E. Fill materials used in preparation of sub-grade shall be placed in lifts or layers not to exceed 8 inches loose measure and compacted as specified hereinafter.

F. Material imported from off-site shall have CBR or LBR value equal to or above pavement design sub-grade CBR or LBR value indicated on the construction drawings, or as identified in the geotechnical report.

G. Building area sub-grade pad shall be that portion of site directly beneath and up to 10 feet beyond building

H. Prepare building area sub-grade pad in strict accordance with "Foundation Subsurface Preparation" as shown on the Drawings. The Foundation Subsurface Preparation provisions shall take precedence over the provisions of this section whenever duplication or conflict occurs.

3.7 ROCK FILL

A. Rock fill shall include on-site excavated material classified as rock excavation. Rock fill may be utilized in fill up to 48 inches below top of subgrade or finish grade of graded areas unless otherwise permitted in higher elevations by the TL. Rock fill shall consist of rock having a maximum dimension not greater than 12 inches in any dimension. Rock fill shall be placed in successive horizontal layers of loose material having a thickness of approximately the maximum size of the larger rock in the lift, but not greater than 12 inches. Each layer of material shall be spread uniformly, completely saturated, and compacted. Shot rock shall not be dumped into place, but shall be distributed in horizontal lifts by blading and dozing in such a manner as to ensure proper placement into final position in the embankment. Voids shall be filled with finer material including shot rock fines and limited soil fines during the spreading operation. Successive layers shall not be placed until all voids of the current lift are filled and the lift is compacted. Each successive layer of material shall adequately bond to the material on which it is placed. Compaction shall be accomplished with vibratory compactors, heavy rubber-tired rollers, or steel-wheeled rollers. Compaction shall be by uniform passes of compaction equipment in sufficient number of passes, but not less than two passes, such that no further consolidation is evident as determined by the TL.

3.8 COMPACTION

A. Compact as follows:

Location	Percent of Maximum Laboratory Density ASTM D698	ASTM D1557
Subgrade & Fill Below Structures and Pavement	98	95
Subgrade & Fill in All other Areas	95	92

B. Maintain moisture content of not less than 1 percent below and not more than 3 percent above optimum moisture content of fill materials to attain required compaction density.

C. Exercise proper caution when compacting immediately over top of pipes or conduits. Water jetting or flooding is not permitted as method of compaction.

D. Corrective Measures for Non-Complying Compaction: Remove and re-compact deficient areas until proper compaction is obtained. Continual failure areas shall be stabilized at no additional cost to Owner.

3.9 MAINTENANCE OF SUBGRADE

A. Verify finished subgrades to ensure proper elevation and conditions for construction above subgrade.

B. Protect subgrade from excessive wheel loading during construction, including concrete trucks, dump trucks, and other construction equipment.

C. Remove areas of finished subgrade found to have insufficient compaction density to depth necessary and replace in manner that will comply with compaction requirements by use of material with CBR or LBR equal to or better than that specified in the construction drawings, or within the geotechnical report. Surface of subgrade after compaction shall be firm, uniform, smooth, stable, and true to grade and cross-section.

D. Construct temporary ditches and perform such grading as necessary to maintain positive drainage away from subgrade at all times.

3.10 BORROW AND SPOIL SITES

A. Comply with NPDES and local erosion control permitting requirements for any and all on-site and off-site, disturbed spoil and borrow areas. Upon completion of spoil or borrow operations, clean up spoil or borrow areas in a neat and reasonable manner to the satisfaction of Owner or off-site property owner, if applicable.

3.11 FINISH GRADING

A. Check grading of building subgrades by string line from grade stakes. Allowable tolerance shall be plus or minus 0.10 feet from plan grade. Provide engineering and field staking as necessary for verification of lines, grades, and elevations.

B. Grade areas where finish grade elevations or contours are indicated on the Drawings, other than paved areas and buildings, including excavated areas, filled and transition areas, and landscaped areas. Graded areas shall be uniform and smooth, free from rock, debris, or irregular surface changes. Ground surfaces shall vary uniformly between indicated elevations. Grade finished ditches to allow for proper drainage without ponding and in manner that will minimize erosion potential. For topsoil, sod, and seeding requirements refer to Section 32 92 00 for additional information and direction.

C. Correct settled and eroded areas. Bring grades to proper elevation.

D. Eliminate any steep drop-offs at new or existing paved areas, areas with potential for erosion failure, or ponding water. A gentle slope shall exist on either side of pathways and areas adjacent to new or existing paving when complete.

E. Owner or the Owner's representative to approve all finish grade areas prior to seeding.

3.12 QUALITY ASSURANCE TESTING AND INSPECTION

A. Responsibilities: Unless otherwise specified, quality control tests and inspection specified below will be conducted by the Contractors' Soil Engineer or Testing Laboratory (TL).

B. Field testing, frequency, and methods may vary as determined by and between the Contractor and Soil Engineer or TL.

C. Work shall be preformed by a "Qualified Material Testing Technician" unless specified otherwise. Report of testing and inspection results shall be made upon the completion of testing.

D. Classification of Materials: Perform test for classification of materials used and encountered during construction in accordance with ASTM D2488 and ASTM D2487.

E. Laboratory Testing Of Materials: Perform laboratory testing of materials (Proctor, Sieve Analysis, Atterberg Limits, Consolidation Test, etc.) as specified.

F. Field Density Tests.
   1. Provide one optimum moisture-maximum density curve for each type of soil encountered in sub-grade and fills. Determine maximum densities in accordance with ASTM D 1557 and ASTM D 2049, as applicable.
      a. Analyze materials within 3 feet of finished grades of paved areas to determine frost susceptibility.
      b. Determine suitability of materials to be used as fill.
   2. For borrow materials, perform a mechanical analysis (AASHTO T 88), plasticity index (AASHTO T 90), moisture-density curve (AASHTO T 180 or ASTM D 1557), and frost susceptibility analysis.
   3. Building Sub-grade Areas, Including 10'-0" Outside of Exterior Building Lines: In cut areas, not less than 1 compaction test for every 2,500 sq. ft. In fill areas, same rate of testing for each 8-inch lift, measured loose.
   4. Areas of Construction Exclusive of Building Sub-grade Areas: In cut areas, not less than 1 compaction test for every 10,000 sq. ft. In fill areas, same rate of testing for each 8-inch lift, measured loose.
   5. Utility Trench Backfill: Intervals not exceeding 200-feet of trench for first and every other 8-inch lift of compacted trench backfill.
   6. Test Method: In-place nuclear density, ASTM D 2922 (Method B-Direct Transmission).

G. Corrective Measures For Non-Complying Compaction: Remove and re-compact deficient areas until proper compaction is obtained at no additional expense. Adjust moisture content as necessary to conform to the requirements of this section.

H. Observation and Inspection:
   1. Observe all sub-grades/excavation bases below footings and slabs and verify design bearing capacity is achieved as required. Work shall be preformed by a “Qualified Material Testing Technician”.
   2. Observe and document presence of groundwater within excavations.
   3. Verify cut and fill slopes as specified in the contract documents. Work shall be preformed by a “Qualified Material Testing Technician”.

END OF SECTION 312000

SECTION 312500 – EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Installation of temporary and permanent erosion and sedimentation control systems
   2. Installation of temporary and permanent slope protection systems

B. Related Sections:
   1. Section 02 00 00 - Existing Conditions - General Information/Site Construction
   2. Section 31 10 00 - Site Clearing
   3. Section 31 20 00 - Earthmoving

1.2 ENVIRONMENTAL REQUIREMENTS

A. Protect adjacent property and any identified endangered or threatened species or critical habitat, any identified cultural or historic resources, and receiving water resources from erosion and sediment damage until final stabilization.

PART 2 – PRODUCTS

3.1 MATERIALS

A. Seed, sod, and ground covers for the establishment of vegetation in accordance with Section 32 92 00.

B. Sediment control devices as specified on the Construction Drawings or plan details.

C. Rolled erosion control products according to Erosion Control Technology Council (ECTC) standard specifications.

D. Temporary mulches such as loose straw, wood cellulose, or agricultural silage.

E. Rip-Rap protection as specified in Section 31 37 00.

F. Temporary and permanent outfall structures as specified on the drawings.

PART 3 – EXECUTION

3.1 SOIL EROSION AND SEDIMENTATION CONTROL AND SLOPE PROTECTION IMPLEMENTATION

A. Place erosion and sediment control systems in accordance with the drawings or as may be dictated by site conditions in order to maintain the intent of the specifications and permits.

B. Deficiencies or changes on the drawings shall be corrected or implemented as site conditions change. Changes during construction shall be posted on the drawings (Site Maps).

C. Contractor has authority to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations and to direct or provide immediate permanent or temporary pollution control measures.

D. Maintain temporary erosion and sedimentation control systems as dictated by site conditions, indicated in the construction documents, or as directed by governing authorities or Owner to control sediment until final stabilization. Contractor shall respond to maintenance or additional work ordered by Contractor governing authorities immediately, but in no case, within not more than 48 hours if required at no additional cost.

E. Contractor shall incorporate permanent erosion control features, paving, permanent slope stabilization, and vegetation into project at earliest practical time to minimize need for temporary controls.

F. Permanently seed and mulch cut slopes as excavation proceeds to extent considered desirable and practical.

G. Unless required within a shorter timeframe by the applicable General Permit for Storm Water Discharges Associated with Construction Activity, disturbed areas that will not be graded or actively worked for a period of 30-45 days or more, shall be temporarily stabilized as work progresses with vegetation or other acceptable means in accordance with Section 32 92 00 unless otherwise specified in the Contract Documents. In the event it is not practical to seed areas, slopes must be stabilized with mulch and tackifier, bonded fiber matrix, netting, blankets or other means to reduce the erosive potential of the area.

END OF SECTION 312500

SECTION 321000 – CONCRETE SIDEWALKS

PART 1 - GENERAL

1.1 SUMMARY

These Specifications shall govern the construction of all sidewalks and service walks as indicated on the Drawings.

A. Section includes:
   1. Installation and placement of concrete walks as indicated in the construction documents.
   2. Production of on-site concrete mixtures.
   3. Production of transit / ready-mixed / batch plant concrete mixtures.
   4. Installation and placement of construction joints

B. Related Sections:
   1. Section 31 20 00 – Earthmoving
   2. Section 31 13 13 – Concrete Paving

1.2 REFERENCED STANDARDS

A. All work under this section shall be completed in general conformance with construction plan details. Municipality standards, and/or the Michigan Department of Transportation's (MDOT's) standard specifications for construction (current edition), MDOT's standard plans (current edition), MDOT's construction manual (current edition), MDOT's quality assurance procedures manual (current edition), and as specified herein.

   1. American Association of State Highways and Transportation Officials (AASHTO)
   2. American Concrete Institute (ACI)
   3. American Society for Testing and Materials (ASTM)

1.3 QUALITY ASSURANCE

a) Testing and Inspection Service: The Contractor or Owner shall retain a testing agency to sample and test concrete materials proposed for use in the Work, perform tests and calculations for concrete mixtures, and perform testing during concrete placement / paving operations.

b) Submit, to the Contractor, two copies of materials certificates signed by Material Producer and Contractor. Certificates shall state that each material item meets specified requirements.

c) Submit, to the Contractor, job mix formulas for each required cement-aggregate mixture. Mix designs shall be within allowable tolerances as specified for the particular application.

1.4 TRAFFIC CONTROL

A. Maintain vehicle and pedestrian traffic during paving and repair operations in such a manner as to not disrupt normal business activities of adjacent enterprises.

1.5 WEATHER LIMITATIONS

A. Construct concrete surface course only when ground temperature is above 35 degrees F. and base is dry. Base course may be laid when temperature is above 35 degrees F. and rising.

PART 2 – PRODUCTS

2.1 MATERIALS

A. All cement used in sidewalk construction shall be Portland Cement, Type I or II ASTM C-150.

B. The fine aggregate shall meet all requirements of Section 902 of Michigan Department of Transportation Specifications for No. 2NS Natural Sand

C. The coarse aggregate shall meet all requirements of Section 902 of Michigan Department of Transportation Standard Specification for No. 6AA Coarse Aggregate.

D. Optimized aggregate per Section 4.13 of the MDOT Quality Assurance Procedures Manual and per Section 902.03 C of the MDOT Standard Specifications for Construction.

E. Water used in concrete shall be clean, free from oil, acids, strong alkalis or vegetable matter and potable. If City water is used in the concrete, all necessary permits shall be obtained from the City Water Department.

F. Admixtures must be listed in the Qualified Products List (QPL) from the MDOT Materials Source Guide.

G. Air-Entraining Admixture shall be in accordance with ASTM C-260.

H. The use of fly ash is not permitted.

I. Expansion papers shall be of the pre-molded non-extruding, asphalt impregnated type, not less than 1/2-inch thick. The length shall be equal to the width of the slab, and the depth equal to the thickness of the slab plus 1-inch.

J. The curing compound shall be white membrane type and comply with ASTM C-309. It shall not allow a moisture loss of more than 0.055 gr./sq/ cm. when applied at 200 sq. ft./ gal.

K. Concrete shall be ready-mixed concrete meeting MDOT P1.

L. Prefabricated composite tile for detectable warning surface to be set in wet concrete. The tile color shall be brick red color or as approved by Architect.

2.2 MINIMUM QUALITY REQUIREMENTS

A. Concrete mix shall be proportioned to provide the following:

a) Compressive Strength at 28 days: 3,500 psi minimum - unless otherwise specified on plans.

b) Total air content by volume: 6.5%

c) Slump 3-inch maximum.

d) Water to Cement ration: 0.43

e) Total cementitious content: 526 lbs/cy cd (6.0 sack)

B. Summer mixes shall meet the following additional requirements:
   a) Low Alkali Cement: 15% maximum GGBFS replacement
   b) High Alkali Cement: 25% maximum GGBFS replacement

C. Winter mixes shall meet the following additional requirements:
   a) Use Low Alkali cement with a maximum GGFBS replacement of 15%

D. The Contractor shall provide Portland cement concrete mixtures for the project that are resistant to excessive expansion caused by Alkali Silica Reactivity (ASR). All mixes must be shown to be resistant to deleterious ASR by one of the following:
   a) Aggregates are shown to be non-reactive per ASTM C1260 (expansion less than 0.10%)
   b) Alkalis as Na_20 in cement are shown to be less than 0.60 % by a recent mill test report (Low Alkali)
   c) An ASTM C1260 Test is provided that shows an expansion of less than 0.10% for a potentially expansive aggregate at the proposed replacement of cement with GGFBS
   d) An ASTM C 1567 test is provided that shows an expansion of less than 0.10% for the specific combination of materials and proportions used for a particular mixture

2.3 PRODUCTION OF ON-SITE CONCRETE MIXTURES

A. All concrete shall be mixed in mechanical mixers except when permitted by the Engineer. Mixers shall have a legible, permanently attached plate showing manufacturer's rated capacity, mixing speed and serial number.

B. The Contractor shall at his expense furnish samples of the fresh concrete and provide safe and satisfactory facilities for obtaining the samples.

C. The temperature of materials as placed into the mixer shall be such that the temperature of the mixed concrete at the time it is placed in final position is not less than 40 degrees F. nor more than 90 degrees F. Aggregates and water used for mixing shall not exceed 150 degrees F.

D. Mixing time, measured from the time the ingredients, including water, are in the drum shall be a minimum of 1.5 minutes for the first cubic yard, plus 0.5 minutes for each additional cubic yard of capacity. The maximum amount of time mixing will be allowed to continue is three times the minimum mixing time. Mixing of the batch any longer than the maximum amount of time allowed will constitute immediate rejection of that batch. The total elapsed time between the intermingling of damp aggregates and cement and the start of mixing shall not exceed 30 minutes.

E. Cement and other materials used in the batch shall be placed in the mixer in such a manner as to prevent any loss due to the effects of wind or an accumulation of cement on surfaces of conveyors or hoppers, or in other conditions which may vary the required quantity of cement in the concrete mixture.

F. Water shall be measured to the correct amount for the required water/cement ratio prior to placement into the mixer. A single addition of water is permitted, provided the slump after the addition is not outside the range stated on the Approved Concrete Mix Design. No water will be placed in the mixer by used of pressurized hoses. The water must be charged into the mixer. Water other than that charged into the mixer is not permitted.

G. Mixers and agitators shall be clean and free of any accumulated hard concrete or mortar. Mixed blades shall be in good working order. If a mixer does not meet these requirements, it must be cleaned and repaired prior to use or a new mixer used.

2.4 SUBMITTALS OF ON-SITE MIXED CONCRETE

A. The Contractor will keep a record of each batch mixed, which will include:

1. Type and brand of cement used
2. Amount of cement in sacks per cu. yd.
3. Maximum sizes of aggregate
4. Total water contact in W/C ratio (lbs./lbs.)
5. Total amount of mixing time, starting at placement of water in the mixer
6. Location of placement of each batch

B. Copies of these records shall be furnished to the Contactor, and the Testing Laboratory and the Engineer at the completion of each day's work or on demand.

C. One copy of each delivery ticket for the Aggregate used shall be submitted to the Contactor.

2.5 READY-MIXED CONCRETE MANUFACTURER'S QUALIFICATIONS

All ready-mixed concrete suppliers must be approved by the Contractor. Concrete shall be manufactured and delivered to the job site by a ready-mixed concrete manufacturer thoroughly experienced in ready-mixed concrete. If requested by the Contractor, submit a written description of proposed ready-mixed concrete Manufacturer, giving qualifications of Personnel, location of batching plant, list of Projects similar in scope to specified Work, and other information as may be requested by the Contractor.

2.6 SUBMITTAL OF TRANSIT / READY-MIXED / BATCH PLANT CONCRETE INFORMATION

A. Statement of Purchase for Ready-Mixed Concrete: Prior to actual delivery of concrete, submit to the Contractor four copies of Statement of Purchase, giving the dry weights of cement and saturated surface dry weights of fine and coarse aggregates and quantities, type and name of admixtures (if any) and of water per cu. yd., that will be used in the manufacture of the concrete. The Contractor shall also furnish evidence that the materials to be used and proportions selected will

produce concrete of the quality specified. Whatever strengths are obtained, the quantity of cement used shall no be less than the minimum specified.

B. Reports: Submit four copies of reports to the Contractor for ready-mix concrete slump, air content unit weight, yield and strength tests as specified in Section 15 and 17 of ASTM C94.

C. Ready-Mixed Concrete Delivery Tickets: Submit one copy of each delivery ticket to the Contractor in accordance with Section 16 of ASTM C94.

2.7 PRODUCTION OF TRANSIT / READY-MIXED / BATCH PLANT CONCRETE

A. Ready-mixed concrete shall be batched, mixed and transported in accordance with ASTM C94, and comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete", except as otherwise specified herein.

B. Ready-mixed concrete shall be mixed and delivered to the point of discharge at the job by means of a ready-mix concrete truck.

C. No water from the truck water system or elsewhere shall be added after the initial introduction of the mixing water for the batch. Under no circumstances shall the approved maximum water content be exceeded nor shall the slump exceed the maximum specified.

D. Discharge of the concrete shall be completed within 1-1/2 hours or before the drum has revolved 300 revolutions, whichever comes first, after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregate.

E. Air content at the point of placement shall be 5.0% to 8.0%. For pavements made by slip form paver, the air loss through the paver shall be established daily. Air tests from samples taken at the truck discharge shall be adjusted for this loss to determine compliance.

F. Do not place if the evaporation rate exceeds 0.20 psf/hr, calculated from the following NRMCA Formula:

Evaporation Rate = (Tc2.5 – r Ta2.5) *(1+0.4V) *(1 x 10-6)

Tc = Temperature of Concrete, degrees Fahrenheit
r = Relative Humidity, percent
Ta = Ambient Air Temperature, degrees Fahrenheit
V = Wind Speed, mph

G. In hot weather (air temperature 80-degrees F. and above) or under conditions contributing to quick stiffening of the concrete, the time shall be reduced to one hour.

H. Concrete delivered in cold weather (air temperature 45-degrees F. and lower) shall have a temperature not less than 60-degrees F. at the point of discharge at job, and in compliance with ACI 306 R "Cold Weather Concreting". Concrete placing will not be permitted when the air temperature is 35-degrees or lower

I. Concrete delivered under hot weather conditions contributing to quick stiffening of concrete, or in air temperature of 80-degrees F. and over, shall have a temperature between 60- and 80- degrees F. at the point of discharge at job, and in accordance with ACI 305 R "Hot Weather Concreting."

2.8 CLEANING THE MIXER OR TRUCK

A. In no case shall the mixer or truck be flushed out onto the street pavement, in a catch basin or sewer manhole, or in any public right-of-way.

B. Implement Concrete Washout procedures meeting the requirements of EPA Stormwater Best Management Practice for Concrete Washout.

2.9 FORMS

A. Forms shall be metal or wood and of an approved section. They shall be straight, free from distortion and shall show no vertical variation greater than 1/8-inch (1/8") in 10-foot lengths from the true plane surface on the top of the forms when tested with a 10-foot straight edge, and shall show no lateral variation greater than 1/4-inch (1/4") in 10-feet from the true plan surface on the lateral face of the form when tested with a 10-foot straight edge. They shall be of the depth specified for the walk, securely held in place and true to line and grade.

PART 3 – EXECUTION

3.1 GRADING

A. All new walks shall be placed only on a prepared sub-grade, smoothed and leveled to the grades established by the Engineer. In clay soils the sub-grade shall be excavated six inches below the curb base and filled with approved sand meeting Michigan Department of Transportation (MDOT) Class II Sand Designation. The sub-grade shall be thoroughly compacted and leveled to grade. Any existing sidewalk shall be removed except where grade will allow at least 4-inches (4") of sand fill to be placed over it.

3.2 SLOPE

A. Sidewalks shall pitch toward the street with a required cross slope of 1/4-inch per foot of width. In some extreme cases, as determined by the Engineer, the cross-slope may be increased but in no case shall it be less that 3/16-inch per foot of width.

3.4 FINISHING

A. The concrete surface shall be "broom finished" and/or finished to match existing sidewalk texture.

3.5 PROPERTY MARKERS

A. All property stakes, irons, monuments, etc. shall be protected and shall not be moved without the written permission of the Property Owner.

3.6 CONCRETE PLACING

A. Prior to placing the concrete, all debris, stones, dirt, etc., shall be removed from the subgrade. The sub-grade shall be moistened with water in such a manner as to thoroughly wet the material without forming puddles or pockets of water. No concrete shall be placed on frozen subgrade.

B. The concrete shall be deposited continuously in the forms in such a manner as to avoid segregation and it shall be thoroughly tamped or vibrated so that the forms are entirely filled and the concrete thoroughly consolidated. The slabs shall be placed in sections or blocks in one operation as monolith.

3.7 CONTRACTION JOINTS – Plane of Weakness Joints / Control Joints

A. Contraction joints shall be placed at right angles to the edge of the sidewalk and perpendicular to the surface and at a depth of at least 1/4 the slab thickness with a minimum depth of 1-1/4 inches. These joints shall be created via hand tooling only. No saw cutting of joints will be permitted.

B. Contraction joints shall be spaced at a minimum of every 5 feet, or as shown on the Plans.

C. The concrete surface shall be struck off to a plane surface with a straightedge. After the surface has been floated to an even surface, the contraction joint shall be cut and all slab edges rounded with a 1/2-inch radius edging tool that will finish to a width of 2-inches.

D. After the concrete has slightly set, a broom shall be brushed lightly across the surface at right angles to forms so as to impart a rough finish.

E. After concrete has set up, a flexible joint sealant (Grey Color) shall be applied to all plane of weakness / control joints within sidewalk, sidewalk ramp, and non-traffic pavement areas only.

3.8 EXPANSION (OR ISOLATION) JOINTS

A. Expansion Joints shall be placed at the following locations:

1. At the back of the curb and front edge of the sidewalks adjacent to each driveway approach and service walk.
2. At intervals not to exceed 30-feet in all public sidewalks.
3. At the back of the curb where the ramps extend from the key flag to the street.
4. Between the key flag and the ramp in all cases except where there are existing expansion joints at the intersections of the sidewalks and the key flag.
5. At any place where a sidewalk abuts a building or fixed structure.
6. At any other locations indicated on the plans.

3.9 ADA SIDEWALK RAMP DETECTABLE WARNING SURFACE

A. Prefabricated composite tiles for detectable warning surface shall be placed at locations noted on the plans in accordance with MDOT Standard Plan Detail No. R-28-G or latest plan revision.

B. Construction shall be performed in accordance with Subsection 803.03.B through Subsection 803.03E and 803.03G of the 2003 MDOT Standard Specifications for Construction and shall

meet and comply with all applicable regulations and requirements of the American with Disabilities Act Accessibility Guidelines.

C. All sidewalk slopes and grades shall meet all current requirements of the Americans with Disabilities Act Accessibility Guidelines and with MDOT Standard Plan Detail No. R-28-G or latest plan revision.

D. The prefabricated, cast-in-place composite tile detectable warning surface shall be installed at all sidewalk ramp curb openings (curb drops) installed for pedestrian crossings as shown on MDOT Standard Plan No. R-28-G or latest plan. The tile shall be set into wet concrete. The detectable warning surface shall extend the full width of the curb drop or crosswalk. The detectable warning surface shall consist of small domes conforming to the MDOT standard plan.

E. The prefabricated, cast-in-place composite tiles for the detectable warning surface shall be Step-Safe® manufactured by Transpo Industries, Inc.; Armor-Tile™ manufactured by Engineered Plastics, Inc. or approved equal and shall be installed according to the manufacture's instruction and as specified on MDOT Standard Plan Detail No. R-28-G or latest plan revision. Color to be Colonial Red.

3.10 CURING CONCRETE

A. Freshly placed concrete shall be protected as required to maintain the temperature of the concrete at not less that 50 degrees F. nor more than 80 degrees F. and in a moist condition continuously for the period of time necessary for the concrete to cure. Changes in temperature of the concrete during curing shall be as uniform as possible and shall not exceed 5 degrees F. in any one hour, nor 50 degrees F. in any 24-hour period.

3.11 REMOVAL OF FORMS

A. All forms, rails and stakes shall be removed with 24-hours after placing the curb.

3.12 WEATHER PROTECTION OF CONCRETE DURING CURING

A. Cold Weather Protection: When the temperature of the atmosphere is 40-degrees F. and below, the concrete shall be protected by heating, insulation covering, housing or combination thereof as required to maintain the temperature of the concrete curing period. Cold 50-degrees F. and in a moist condition continuously for the concrete curing period. Cold weather protection shall meet the requirements of ACI 306R "Cold Weather Concreting."

B. Hot Weather Protection: When the temperature of the atmosphere is 90-degree F. and above, or during other climatic conditions which will cause too rapid drying of the concrete, the concrete shall be protected by windbreaks, shading, fog spraying light-colored moisture-retaining covering, or a combination thereof as required to maintain the temperature of the concrete below 80-degrees F. and in a moist condition continuously for the concrete curing period. Hot weather protection shall meet the requirements of ACI 305R "Hot Weather Concreting."

3.13 CLEANUP

A. After completion of concrete curing in an area, remove all weather protection materials and rubbish and debris resulting from specified work, sweep concrete curbs clean, and seal joints

3.14 FIELD QUALITY CONTROL

A. Quality Control during Paving Operations: Perform the following sampling and testing of concrete mixtures for quality control during paving operations. Record the locations where samples are taken, to correlate with subsequent testing.

B. Perform one test per 50 cubic yards or less to a maximum of four tests for each day's paving, unless otherwise specified or directed by the Owner.

C. Test fresh concrete mix, and report the following:
   1. Slump per ASTM C-143
   2. Air-entrainment per ASTM C-231
   3. Collect 3 cylinders for compression test per ASTM C-31

D. Test one cured concrete cylinder from each sample location per ASTM C-39 at 7-day and 28-day periods and report the following:
   1. Type of failure
   2. Compressive strength at failure.
   3. Note: The third cylinder is to be stored for future use.

E. Additional testing may be required if any of the previous tests indicate insufficient values. If two successive test indicate insufficient values, contact the Engineer for a course of action.

F. Concrete materials not complying with specified requirements shall be repaired or removed and replaced with new paving.

END OF SECTION 321000

SECTION 321123 – AGGREGATE BASE COURSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Aggregate base for HMA and/or Portland cement concrete paving.

B. Related Sections

1. Section 02 00 00 - Existing Conditions - General Information/Site Construction

2. Section 31 20 00 - Earthmoving

1.2 REFERENCED STANDARDS

A. Asphalt Institute

B. All work under this section shall be completed in general conformance with the construction plan details, Municipality standards and/or the Michigan Department of Transportation's (MDOT) standard specifications for construction (current edition), MDOT's standard plans (current edition), MDOT's construction manual (current edition), MDOT's quality assurance procedures manual (current edition), and as specified herein.

1.3 QUALITY ASSURANCE

A. A Testing Laboratory (TL) shall be retained by the Contractor to perform construction testing of in place base course for compliance with requirements for thickness, compaction, and density. Paving base course tolerances shall be verified by the Contractor by rod and level readings on not more than 50 foot centers to be not more than 0.05-feet above design elevation which will allow for paving thickness as shown on Construction Drawings.

1.4 SUBMITTALS

A. Submit materials certificate to the testing laboratory that is signed by materials producer and Contractor, certifying that materials comply with, or exceed, requirements specified herein or on the Construction Drawings.

B. Submit certification of base course materials and placement as specified in Parts 2 and 3 hereinafter.

1.5 WEATHER LIMITATIONS

A. Do not place aggregate when base surface temperature is less than 40 degrees F, nor when air temperature is below 45 degrees F. Do not place aggregate when surface is wet or frozen. Do not place aggregate when weather conditions are unfavorable.

PART 2: PRODUCTS

2.1 BASE COURSE MATERIAL

A. Aggregate Base Course: Aggregate base course shall consist of a well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction. Base course may consist of a granular base (crushed concrete, crushed stone, or gravel, etc), natural sand / aggregate base material, or a hot-mix sand asphalt base.

B. Base course shall be as shown on the drawings, or when not shown, shall be as specified herein.

C. Aggregate base material shall meet MDOT specifications for the material specified.

D. Aggregate shall consist of clean, sound, durable particles of crushed stone, crushed concrete, crushed gravel, or other approved material as specified in the plans. Aggregate shall be free of lumps of clay, organic matter, and other objectionable materials or coatings. The portion retained on the No. 4 sieve shall be known as coarse aggregate; that portion passing the No. 4 sieve shall be known as fine aggregate.

1. Coarse aggregates shall be angular particles of uniform density.

2. Fine aggregates shall be angular particles of uniform density. Fine aggregate shall consist of processed or naturally combined with the coarse aggregate.

E. Gradation: The specified MDOT gradation requirements shall apply to the completed base course. The aggregates shall have a maximum size of 2 inches and shall be continuously well graded.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Contractor shall verify to the Engineer in writing that the sub-grade has been inspected, tested, and gradients and elevations are correct, dry, and properly prepared in accordance with Section 31 20 00.

3.2 CONSTRUCTION

A. Perform base course construction in accordance with the applicable State standard specifications or as shown or specified.

B. Perform base course construction in a manner that will drain the surface properly and pre-vent runoff from adjacent areas from draining onto base course construction.

C. Compact base material to not less than 98 percent of optimum density as determined by ASTM D 698 or 95 percent of optimum density, as determined by ASTM D 1557 unless otherwise indicated on the construction plans, specifications or as directed by Soil Engineer or TL.

D. Construct to thickness indicated on Construction Drawings.

1. Granular Base: Apply in lifts or layers not exceeding 8-inches, measured loose.

2. Sand/Aggregate Base: Apply in lifts or layers not exceeding 4-inches, measured loose.

3.3 FIELD QUALITY CONTROL

A. Field testing specified below will be performed by the Testing Laboratory.

B. Field testing, frequency, and methods may vary as determined by the Engineer and the Testing Laboratory.

C. Field density tests for in place materials will be performed in accordance with the following:

1. Nuclear Method: ASTM D 2922 (Method B-Direct Transmission)

2. Base material thickness: One test for each 20,000 sq. ft. of in-place base material area.

3. Base material compaction: One test in each lift for each 20,000 sq. ft. of in-place base material area.

D. The testing laboratory will prepare reports that indicate test location, elevation data, and test results. Contractor shall be provided with copies of the reports within 96 hours of the time the test was performed. In the event that the test results show failure to meet any of the Specifications. The Contractor and Engineer will be notified immediately by the testing laboratory.

E. The Contractor shall certify in writing to the Engineer that base course placement is in accordance with specification requirements prior to subsequent work thereon.

F. The Contractor shall pay for retesting due to failures at no additional expense. Contractor shall provide free access to the site for testing activities.

END OF SECTION 321123

SECTION 321213.13 – TACK COAT

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes:

1. Application of bituminous material or HMA on prepared surface.

2. Weather limitations.

B. Related Sections:

1. Section 02 00 00 - Existing Conditions - General Information/Site Construction

2. Section 32 12 16 - Asphalt Paving

1.2 REFERENCED STANDARDS

A. All work under this section shall be completed in general conformance with construction plan details, Municipality Standards, and/or the Michigan Department of Transportation's (MDOT) standard specifications for construction (current edition), MDOT's standard plans (current edition), MDOT's construction manual (current edition), MDOT's quality assurance procedures manual (current edition), Central Michigan University standards, and as specified herein.

B. AASHTO – American Association of State Highway and Transportation Officials

C. ASTM – American Society of Testing and Materials.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Tack Coat: The material used for the tack coat shall be emulsified asphalt, Grade RS-2 and shall conform with the requirements specified in Michigan Department of Transportation (MDOT) Type SS-1h Asphalt Emulsion material) and/or AASHTO Designation M 140-82 per local requirement.

2.2 EQUIPMENT

A. The pressure distributor used for placing the tack coat shall be equipped with pneumatic tires having sufficient width of rubber in contact with the road surface to avoid breaking the bond of or forming a rut in the surface. The distance between the centers of openings of the outside nozzles of the spray bar shall be equal to the width of the application required, within an allowable variation of 2 inches. The outside nozzle at teach end of the spray bar shall have an area of opening of not less than 25 percent, nor more than 75 percent in excess of the other nozzles which

shall have uniform openings. When the application covers less than the full width, the normal opening of the end nozzle at the junction line may remain the same as those of the interior nozzle.

PART 3 – EXECUTION

3.1 PREPARATION

A. Before applying any bituminous material, all loose material, dust, dirt and foreign material which might prevent proper bond with the existing surface, shall be removed. Particular care shall be taken to clean the outer edges of the strip to be treated in order to insure that the prime or tack coat will adhere.

B. When the tack coat is applied adjacent to the curb, or any other concrete surface (except where they are to be covered with a bituminous wearing course), such concrete surfaces shall be protected by heavy paper or other protective material while the prime or tack coat is being applied. Any bituminous material deposited on such concrete surfaces shall be removed immediately.

3.2 WEATHER LIMITATIONS

A. No bituminous material shall be applied when the air temperature is less than 50 degrees F. in the shade, or when the weather conditions or the condition of the existing surface is unsuitable. In no case shall bituminous material be applied while rain is falling or when there is water on the surface to be covered.

3.3 APPLICATION

A. No tack coat shall be applied until the primed base or leveling course has been cleaned and is free from sand, dust or other objectionable material.

B. The tack coat shall be applied with a pressure distributor as specified above. It shall be heated to a suitable consistency and applied in a thin uniform layer at the rate of between 0.05-gallons and 0.10-gallons per square yard over all areas to be paved including hidden edge of curb sections.

C. The tack coat shall be applied sufficiently in advance of the laying of the wearing surface to permit drying, but shall no be applied so far in advance or over such an area as to lose its adhesiveness as a result of being covered with dust or other foreign material. Suitable precautions shall be taken by the Contractor to protect the surface while the tack coat is drying and until the wearing surface is applied.

END OF SECTION 311213.13

SECTION 321216 – ASPHALT PAVING & PULVERIZATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Asphaltic concrete binder, bituminous material / HMA and surface course.
2. Milling of existing pavement.
3. Pulverizing of existing pavement.

B. Related Sections
1. Section 31 20 00 - Earthmoving
2. Section 32 11 23 - Aggregate Base Course
3. Section 32 17 23 - Pavement Markings
4. Section 32 16 13.13 - Concrete Curbs and Gutters
5. Section 32 10 00 - Concrete Sidewalks

1.2 REFERENCED STANDARDS

A. All work under this section shall be completed in general conformance with construction plan details, Municipality standards, and/or the Michigan Department of Transportation's (MDOT) standard specifications for construction (current edition), MDOT's standard plans (current edition), MDOT's construction manual (current edition), MDOT's quality assurance procedures manual (current edition), and as specified herein.

B. The Asphalt Institute (AI)
1. MS 2 - Mix Design Methods/ Asphalt Concrete/ Hot Mix Types

C. ASTM International (ASTM)
1. ASTM D1556 - Density and Unit Weight of Soil in Place by the Sand-Cone Method.
2. ASTM D2950 - Density of Bituminous Concrete In Place by the Nuclear Methods
3. ASTM D1188 - Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples.
4. ASTM D2726 - Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixture.
5. ASTM D5444 - Mechanical Size Analysis of Extracted Aggregate.

D. American Association of State Highway and Transportation Officials (AASHTO)
1. AASHTO M 17 - Mineral Filler for Bituminous Paving Mixtures.
2. AASHTO M 140 - Emulsified Asphalt
3. AASHTO M 208 - Cationic Emulsified Asphalt
4. AASHTO M 226 - Viscosity Graded Asphalt Cement
5. AASHTO T 245 - Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
6. AASHTO TP 53 - Asphalt Content of Hot Mix Asphalt by the Ignition Method

1.3 QUALITY ASSURANCE

A. A testing laboratory (TL) retained by the Contractor shall perform construction testing of in-place asphaltic concrete, bituminous material / HMA surface and wearing courses for compliance with requirements for thickness and compaction per contract documents.

B. Comply with standards and specifications where applicable of Michigan Department of Transportation (MDOT), "Standard Specifications for Highway Construction" current edition.

1.4 SUBMITTALS

A. Within 10 days prior to asphalt construction, submit actual design mix to Civil Engineering Consultant of Record and testing laboratory for review and approval. Design mix submittal shall follow a format as indicated in Asphalt Institute Manual MS-2, Marshall Stability Method; and shall include type/name of mix, gradation analysis, grade of asphalt cement used, Marshall Stability in pounds flow, effective asphalt content in percent, and direct references to state highway department specifications sections for each material. Design shall be for mixture listed in current edition of MDOT standard specifications for construction. Mix designs over 1 year old will not be accepted. Paving contractor to submit certification that mix design conforms to specification requirements. Paving shall not begin until all mix designs have been reviewed and approved by the Engineer.

1.5 PROJECT CONDITIONS

A. Weather Limitations:
   1. Apply tack coats when ambient or base surface temperature is above 40 F, and when temperature has been above 35 F for 12 hours immediately prior to application. Do not apply when base is wet, contains excess moisture, during rain, or when frozen.
   2. Construct asphaltic concrete, bituminous material / HMA paving when ambient temperature is above 40 F and rising or 50 F in the shade.

B. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

C. Grade Control: Establish and maintain required lines and grades, including crown and cross-slope, for each course during construction operations.

PART 2 - PRODUCTS

2.1 SUMMARY

A. Aggregate Base: Uniformly graded mixture of crushed concrete, stone or crushed gravel acceptable to Engineer complying with MDOT 21AA requirements or Soil Engineer's report for recommended pavement section and/or as indicated on construction plan details.

B. Coarse Aggregate (for Bituminous Mixture): Crushed stone or gravel conforming to the following MDOT Specifications and/or as indicated on construction plan detail or Soil Engineer Report: 21AA.

C. Fine Aggregate: Natural or manufactured sand conforming to MDOT Specifications 3FS or 3CS. Sand manufactured from limestone will not be permitted.

D. Mineral Filler: Limestone or dolomite dust, conforming to MDOT Specification 3MF.

E. Asphalt Cement: Conform to MDOT Designation (Penetration Grade) PG 85-100

F. Tack (Bond Coat): Asphalt emulsion conforming to Michigan Department of Transportation (MDOT) Designation SS-1H at .10 Gallon per square yard

2.2 BITUMINOUS MIXTURES

A. Provide asphalt-aggregate mixtures complying with the following MDOT Designations:
1. HMA Base Course: MDOT No. 1100L, 20 AA / PG58-22.
2. HMA Leveling Course: MDOT No. 1100L, 20 AA / PG64-22.
3. HMA Wearing Course: MDOT No.1300T, 20 AA/ PG 64-22.

B. Provide course thickness as indicated on construction plans (Maximum of 15% RAP / 3% Air Void Allowed per Soil Engineer Recommended Pavement Cross-section).

2.3 EQUIPMENT

A. Equipment necessary for the paving of HMA / asphaltic concrete shall be on the project prior to beginning paving operations.

B. Maintain equipment in satisfactory operating condition and correct breakdowns in manner that will not delay or be detrimental to the schedule of paving operations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which hot mixed bituminous paving is to be installed. Notify Contractor and Engineer in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Soil Engineer / Engineer / Contractor.

3.2 MILLING EXISTING PAVEMENT

A. Clean existing pavement of loose and deleterious materials immediately prior to cold milling. Remove exiting bituminous pavement by cold milling to grades and cross sections indicated in the plans.

B. Repair or replace curbs, manholes, catch basins, and other construction damaged during pavement milling operations.

C. Prepared milled pavement as required to receive new bituminous pavement.

3.3 PULVERIZING EXISTING PAVEMENT

A. Pulverization of pavement shall be in accordance with MDOT Standard Specifications for Construction, 2012, Section 305.

B. Pulverization and base preparation shall include: pulverizing existing asphalt pavement in place (full depth), re-shaping to coordinate with the proposed paving section and plan details, compaction, proof-rolling, performing undercutting as necessary, and performing final compaction prior to new asphalt placement.

C. Minimum pulverizing depth shall be 3”, or the full thickness of the existing asphalt pavement, whichever is greater.

D. Contractor is responsible for calculating the amount of pulverized material that will be required

E. The thickness of the asphalt may increase by 25% or more upon pulverization and re-compaction.

F. Any excess material will need to be stockpiled on-site, or trucked off-site and disposed of in a legal manner, as determined by the owner.

G. Pulverized material compacted in place is permitted as backfill material for undercuts.

H. The contractor shall take due care to make sure that pulverized areas are not left open for more than 72 hours before they are to be paves. Weather may adversely affect the pulverized base conditions and the pulverization work should be performed only when the weather forecast calls for dry conditions until the paving work will be completed.

I. Construction traffic is not allowed on pulverized pavement.

3.4 PREPARATION

A. Existing Pavement: Where new hot mixed bituminous paving abuts existing bituminous pavement including repair work, provide straight line, sawing through existing bituminous pavement construction.
   1. Perform sawing prior to removing bituminous pavement to be replaced.
   2. Refer to joint spacing provisions under Placing the Mix and to patching provisions under Compacting the Mix for coordination purposes and/or per construction plan details.
   3. In areas where sawed lines have become damaged or worn by construction activities, the contractor shall re-saw straight, clear lines immediately prior to paving.

B. Proof roll prepared base material surface to check for unstable areas in accordance with MDOT Specification for Construction, current edition and/or Section 31 20 00 whichever is more strin-

gent including documentation and re-proof rolling as required. Paving work shall begin only after unsuitable areas have been corrected and are ready to receive paving.

C. Remove loose material from compacted base material surface immediately before applying prime coat.

D. Establish and maintain required lines and elevations.

E. Cover the surfaces of curbs, gutters, manholes and other structures on which the asphaltic concrete mixture will be placed, with a thin, uniform coat of liquid asphalt. Where the asphaltic concrete mixture will be placed against the vertical face of an existing pavement, clean the vertical face to remove foreign substances and apply a coating of liquid asphalt at a rate of approximately 0.25 gallons per square yard.

3.5 FRAME ADJUSTMENTS

A. Set frames for manholes and other such units, within areas to be paved, to final grade as part of this work. Include existing frames or new frames furnished in other sections of these Specifications.

B. Surround frames set to grade with a ring of compacted hot mixed bituminous base prior to paving. Place bituminous pavement mixture up to 1 inch below top of frame, slope to grade, and compact with hand tamp.

C. Adjust frames as required for paving. Provide temporary closures over openings until completion of rolling operations. Remove closures at completion of work. Set cover frames to grade, flush with surface of adjacent pavement.

3.6 PREPARING THE MIX

A. Plant Equipment and Procedures: Comply with all MDOT specifications and requirements.

B. Aggregate Storage: Keep each component of various-sized combined aggregates in separate stockpiles. Maintain stockpiles so that aggregate sizes will not be intermixed and to prevent aggregation.

C. Asphalt Cement Preparation: Heat asphalt cement at mixing plant to a viscosity that can readily be pumped and distributed throughout the hot mixed asphalt mixture. Add asphalt cement binder to aggregate at a temperature between 235 degrees F and 350 degrees F.

D. Aggregate Preparation: Dry aggregate and deliver to mixer at a temperature between 235 degrees F and 350 degrees F. Maintain the temperature between these limits according to the penetration grade and viscosity characteristics of the hot mixed asphalt cement, ambient temperature, and workability of the mixture, while the hot mixed asphalt cement is being added.
   1. Dry aggregate to reduce moisture-content and to prevent hot mixed asphalt mixture from foaming, slumping or segregating during hauling and placing operations.

E. Mixing: Accurately weigh or measure dried aggregates and weigh or meter asphalt cement to comply with job-mix formula requirements. Do not heat asphalt cement above 350 degrees F, at time of introduction into mixer.

1. Mix aggregate and asphalt cement to achieve 90-95 percent of coated particles for base mixture and 85-90 percent of coated particles for surface mixture.

F. Delivery: Transport hot mixed bituminous paving mixtures from mixing plant to project site in trucks having tight, clean compartments. If required, coat hauling compartment surfaces with a lime-water mixture or a soap or detergent solution to prevent bituminous pavement mixture from sticking. Elevate and drain compartment of excess solution before loading mix.
1. Provide covers over hot mixed bituminous paving mixture when delivering to protect mixture from weather and to prevent loss of heat.
2. During periods of cool weather or for long-distance deliveries, provide insulation around entire truck bed surfaces.

3.7 APPLICATION

A. Tack Coat:
1. Apply to contact surfaces of previously constructed asphaltic concrete base courses or Portland cement concrete and surfaces abutting or projecting into asphaltic concrete or into asphaltic concrete pavement.
2. Apply tack coat to asphaltic concrete base course or sand asphalt base course. Apply emulsified asphalt tack coat between each lift or layer of full depth asphaltic concrete and sand asphalt bases and on surface of bases where asphaltic concrete paving will be constructed.
3. Apply at minimum rate of 0.10 gal per sq. yd of surface.
4. Allow drying until at proper condition to receive paving.

3.8 ASPHALTIC CONCRETE PLACEMENT

A. Place asphaltic concrete mixture on completed compacted subgrade surface, spread, and strike off. Spread mixture at following minimum ambient temperatures:
1. Between 40 and 50 F: Mixture temperature: 285 F
2. Between 50 and 60 F: Mixture temperature: 280 F
3. Higher than 60 F: Mixture temperature: 275 F

B. Whenever possible, spread pavement by finishing machine; however, inaccessible or irregular areas may be placed by hand methods. Spread hot mixture uniformly to required depth with hot shovels and rakes. After spreading, carefully smooth hot mixture to remove segregated course aggregate and rake marks. Rakes and lutes used for hand spreading shall be type designed for use on asphalt mixtures. Do not dump loads faster that they can be properly spread. Workers shall not stand on loose mixture while spreading.

C. Paving Machine Placement: Apply successive lifts of asphaltic concrete in transverse directions with surface course placed parallel to flow of traffic. Place asphaltic paving in typical strips not less than 10'-0" wide. Asphaltic concrete pavement, including base and surface course, shall be placed in two or more equal lifts. Each lift shall be from 1 to 3 inches thick or per MDOT Specification for Construction, current edition.

D. Joints: Make joints between old and new pavements, or between successive days and work in manner that will provide continuous bond between adjoining work. Construction joints shall have same texture, density, and smoothness as other sections of asphaltic concrete course. Clean contact surfaces of joints and apply tack coat.

3.9 ROLLING AND COMPACTION

A. After being spread, mixture shall be compacted by rolling as soon as it will bear the weight of rollers without undue displacement. Number, weight, types of rollers, and sequences of rolling operations shall be such that the required density and surface are consistently attained while the mixture is in workable condition.

B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

C. Breakdown Rolling: Perform breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling and repair displaced areas by loosening and filling with hot material.

D. Second Rolling: Follow breakdown rolling as soon as possible while mixture is hot. Continue second rolling until mixture has been thoroughly compacted as follows:
   1. Average Density: 96 percent of reference laboratory density according ASTM D1556, but not less than 94 percent nor greater than 100 percent.

E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

F. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot asphaltic concrete. Compact by rolling to maximum surface density and smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked. Any masked or marred finish surfaces shall be repaired or smoothed.

3.10 JOINTS

A. General
   1. Place each asphaltic paving layer as continuous as possible to keep the number of joints to a minimum. Create joints between old and new pavement, between successive days work, and where the mixture has become cold (less than 140 degrees F). Make these joints in such a manner as to create a continuous bond between the old and new pavement construction courses.
   2. Offset joint of successive courses by at least 6 inches.

B. Transverse Joints: If placing of material is discontinued or if material in place becomes cold, make a joint running perpendicular to the direction traveled by the paver. Before placement continues, trim the edge of the previously placed pavement to a straight line perpendicular to the paver and cut back to expose an even vertical surface for the full thickness of the course. When placement continues, position the paver on the transverse joint so that sufficient hot mixture will be spread in order to create a joint after rolling that conforms to the required smoothness. If the temperature of the previously placed pavement material drops below 140 degrees F before pav-

ing is resumed, give the exposed vertical face a thin coat of liquid asphalt just before paving is continued.

C. Longitudinal Joints: Coat longitudinal joints that are not completed before the previously laid mixture has cooled to a temperature below 140 degrees F, with liquid asphalt just before paving is continued.

3.11 SEAL COAT

A. Apply seal coat over new wearing course if requested by owner and/or if indicated on plans.

B. Allow pavement to cure three weeks minimum. Remove dust and oil to ensure proper adhesion of seal coat to pavement. Persistent or oil films that are not removed by mechanical brushing or scrubbing with detergent and water can be sprayed with primer at not more than 0.01 gallons per sq. yd. Detergent must be thoroughly rinsed off before pavement is sealed.

C. Mix a sand slurry using sealer, sand, and makeup water as recommended by manufacturer.

D. Apply sand slurry evenly and uniformly at a rate of 0.10 to 0.15 gallons per sq. yd.

E. When sand slurry treatment is dry, apply one coat of sealer (without sand) uniformly over entire area at a rate of 0.10 to 0.15 gallons per sq. yd.

3.12 FIELD QUALITY CONTROL

A. Field quality control tests specified herein will be conducted by the Testing Laboratory (TL). The Contractor shall perform additional testing as considered necessary by the Contractor for assurance of quality control. Retesting required as a result of failed initial tests shall be at the Contractor’s expense.

B. Field testing, frequency, and methods may vary as determined by and between the Contractor and the Testing Laboratory.

C. Testing shall be performed on finished surface of each asphalt concrete course for smoothness, using 10'-0" straightedge applied parallel with, and at right angles to centerline of paved area. The following tolerances in 10 ft shall not be exceeded:

Base / Leveling Course Surface:	1/4-inch
Wearing Course Surface:	1/8-inch

D. Field density test for in-place materials:
1. Density tests shall be conducted on each core sample taken in accordance with ASTM D1188 or D2726 as applicable.
2. In-place density tests by nuclear method in accordance with ASTM D2950 shall also be taken as necessary to assure the specified density is obtained. Nuclear density shall be correlated with ASTM D1188 or D2726.

E. Pavement density will be measured by the Engineer at the time of placement using a nuclear density gauge with the maximum theoretical specific gravity (Gmm) from the job mix formula

(JMF) being used as the field control. 92% maximum of the theoretical maximum density (TMD) is required for acceptance.

F. Laboratory Air Void, Marshall Stability, and Flow: Mixture samples shall be taken at least four times for every 2000 tons or 8 hour day and compacted into specimens, using compactive blows (35, 50, or 75) equal to mix design per side with the Marshall hammer as described in AASHTO T 245. Temperature shall be equal to temperature at paving machine with reheating. After compaction, the laboratory air voids of each specimen shall be determined, as well as the Marshall stability and flow.

G. Check surface areas as necessary to identify any area that pond water. Remove and replace all unacceptable paving as directed by Engineer.

H. Asphalt Extraction and Aggregate Gradation: Asphalt extraction and gradation of extracted aggregate testing shall be performed in accordance with AASHTO TP 53 and ASTM D5444 respectively. At least two extraction and two gradation tests shall be taken for each 2000 tons or each day pavement is placed.

I. Areas of deficient paving, including compaction, smoothness, thickness, and asphalt mixture, shall be delineated, removed, and replaced in compliance with Specifications requirements unless corrected otherwise as directed and approved by the Engineer.

J. The Contractor shall certify in writing that asphalt placement is in accordance with specification requirements.

END OF SECTION 321216

SECTION 321313 – CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Preparation and placement of Portland cement concrete parking areas.
2. Preparation and placement of Portland cement concrete roads and entrances.

B. Related Sections
1. Section 31 20 00 - Earthmoving.
2. Section 32 11 23 - Aggregate Base Course.

1.2 REFERENCD STANDARDS

A. All work under this section shall be completed in general conformance with construction plan details, Municipality standards, and/or the Michigan Department of Transportation's (MDOT's) standard specifications for construction (current edition), MDOT's standard plans (current edition), MDOT's construction manual (current edition), MDOT's quality assurance procedures manual (current edition), and as specified herein.

B. American Concrete Institute (ACI)
1. ACI 301 - Structural Concrete for Buildings
2. ACI 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete
3. ACI 305R - Hot Weather Concreting
4. ACI 306R - Standard Specification for Cold Weather Concreting
5. ACI 308 - Standard Practice for Curing Concrete
6. ACI 318 - Building Code Requirements for Reinforced Concrete

C. American Society for Testing and Materials (ASTM)
1. ASTM A185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
2. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement
3. ASTM C 31 - Test Methods of Making and Curing Concrete Test Specimens in the Field.
4. ASTM C33 - Concrete Aggregates
5. ASTM C 39 - Test Method for Comprehensive Strength of Cylindrical Concrete Specimens.
6. ASTM C42 - Obtaining And Testing Drilled Cores And Sawed Beams Of Concrete
7. ASTM C94 - Ready-Mixed Concrete
8. ASTM C 138 - Test Method for Unit Weight, Yield, and Air Content (Gravemetric) of Concrete.
9. ASTM C143 - Method for Slump of Hydraulic Cement Concrete
10. ASTM C150 - Portland Cement
11. ASTM C 172 - Method of Sampling Freshly Mixed Concrete.
12. ASTM C231 - Air-Content of Freshly Mixed Concrete by the Pressure Method
13. ASTM C260 - Air-Entraining Admixtures for Concrete
14. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete
15. ASTM C920 - Standard Specification for Elastomeric Joint Sealants
16. ASTM C1064 - Temperature Of Freshly Mixed Portland Concrete Cement

17. ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous)
18. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-Extruding and Resilient Bituminous Types)
19. ASTM D2628 - Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

D. Federal Specifications (FS)
1. FS HH-F-341 - Fillers, Expansion Joint: Bituminous (Asphalt & Tar)

1.3 QUALITY ASSURANCE

A. Establish and maintain required lines and elevations in accordance with construction plans via construction staking / construction layout by a professional surveying company.

B. Check surface areas at intervals necessary to eliminate areas which pond water. Remove and replace unacceptable paving as directed by Engineer.

C. Concrete Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

D. Concrete Testing Service: The Contractor shall engage a qualified testing agency to perform materials evaluation tests and to design concrete mixes.

1.4 SUBMITTALS

A. Submit certified laboratory test data or manufacturer's certificates and data for the items listed below certifying that materials are in conformance requirements specified herein. Submit the following documentation to the Engineering Consultant of Record and the Testing Laboratory for review and approval within 7 calendar days after receipt of Notice-to-Proceed, submit for approval; certified laboratory test data or manufacturers certificates and data for the following items:
1. Portland cement concrete mix
2. Aggregate gradations
3. Preformed expansion joint filler
4. Field molded/poured sealant
5. Dowel bars
6. Expansion sleeves
7. Tie bars
8. Reinforcing steel bars
9. Welded wire fabric
10. Air entraining admixtures
11. Water-reducing and set-retarding admixtures (if used)
12. Sources for all fine and coarse aggregates proposed to be used identified by their MDOT A.S.I # as listed in the Qualified Products List from the current MDOT Materials Source Guide if applicable or by an identifiable name if not applicable.
13. Sources and recent mill test reports for all cementitious materials and supplementary cementitious materials proposed to be used.

1.5 PROJECT CONDITIONS

A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. Coat forms with non-staining type of coating that will not discolor or deface surface of concrete.

B. Form Release Agent: Provide commercial formulation form-release agent with a maximum of 350g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

C. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A185. Furnish in flat sheets.

D. Reinforcing Bars: Deformed steel bars, ASTM A615, Grade 60.

E. Portland Cement: ASTM C150, Type II

F. Slag: ASTM C989, Grade 100 or 200.

G. Exterior Pavement Joint Materials
   1. Joint Back-up Material: Polyethylene foam, 60% closed cell
   2. Sealant:
      a. Dow 888, by Dow Corning.
      b. 301 NS by Pecora.
      c. Spectrum 800 or 900 by Tremco.

H. Course Aggregate: MDOT 6AA

I. Fine Aggregate: MDOT 2NS

J. Optimized Aggregate: Per Section 4.13 of the MDOT Quality Assurance Procedures Manual and per section 902.03 C. of the MDOT Standard Specifications for Construction.

K. Water: Clean and potable

L. Dowel Bars: ASTM A615, grade 60, and plain steel bars.

M. Supports for Reinforcement: Chairs, spacers, dowel bar supports and other devices for spacing, supporting and fastening bars, welded wire fabric and dowels in place. Use wire bar-type supports complying with CRSI Specifications.

N. Use supports with sand plates or horizontal runners where base materials will not support chair legs.

2.2 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, Type II
1. Use one brand of cement throughout Project unless otherwise acceptable to Engineer.

B. Normal Weight Aggregates: ASTM C 33, Class 4, (MDOT 6AA and 2NS), and as follows. Provide aggregates from a single source.
1. Maximum Aggregate Size: 1-1/2 inches.
2. Do not use fine or coarse aggregates that contain substances, which could cause spalling.

C. Water: Potable

2.3 ADMIXTURES

A. Admixtures must be listed on the Qualified Products List (QPL) from the MDOT Materials Source Guide.

B. Provide concrete admixtures that contain not more than 0.1 percent chloride ions.

C. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures:
1. Products: Subject to compliance with requirements, provide one of the following:
a. Darex AEA or Daravair; W.R. Grace & Co.
b. MB-VR or Micro-Air; Master Builders, Inc.
c. Sealtight AEA; W.R. Meadows, Inc.
d. Sika AER; Sika Corp.

D. Water-Reducing Admixture: ASTM C 494, Type A.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Chemtard; ChemMasters Corp.
b. WRDA 19 or Daracem; W. R. Grace & Co.
c. Pozzolith Normal; Master Builders, Inc.
d. Plastocrete 161; Sika Corp.

E. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G.
1. Products: Subject to compliance with requirements, provide one of the following:
a. WRDA 19 or Daracem; W.R. Grace & Co.
b. Rheobuild or Polyheed; Master Builders, Inc.
c. Sikament 300; Sika Corp.

F. Water-Reducing and Accelerating Admixture: ASTM C494, Type E.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Daraset; W.R. Grace & Co.
b. Pozzutec 20; Master Builder, Inc.

G. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Daratard-17; W.R. Grace & Co.
b. Pozzolith R; Master Builders, Inc.
c. Plastiment; Sika Corp.

H. Fly Ash is not permitted.

2.4 CURING MATERIALS

A. Water-Based Acrylic Curing Compound: Clear liquid type membrane curing compound complying with ASTM C 309, Type I, Class B.
1. Products: Subject to compliance with requirements, provide one of the following:
a. "Safe Cure and Seal (J-18)": Dayton Superior Corp.
b. "Dress & Seal WB": L & M Construction Chemicals, Inc.
c. "VOCOMP-20": W.R Meadows.
d. "Kure-N-Seal": Sonneborne Building Products.

B. Water-Based Acrylic Curing Compound: White pigmented liquid type membrane curing compound complying with ASTM C 309, Type II, Class B.
1. Products: Subject to compliance with requirements, provide one of the following:
a. "Day-Chem White Pigmented Cure (J-10-W)": Dayton Superior Corp.
b. "1200-White": W.R Meadows.

C. Evaporation Control: Monomolecular Film-forming compound applied to exposed concrete slab surfaces for temporary protection from moisture loss.
1. Products: Subject to compliance with requirements, provide one of the following:
a. "E-Con": L & M Construction Chemicals, Inc.
b. "Confilm": Master Builders, Inc.

2.5 JOINT MATERIALS

A. Fiber Joint Filler: Rectangular shaped with holes for load transfer devices, conforming to ASTM D 1751 (MDOT 8.16.04).

B. Hot Poured Joint Sealant: Mixture of natural rubber or uncured synthetic rubber, or reclaimed rubber, or a combination of, with asphalt plasticizer and tackifiers conforming to ASTM D 1190 (MDOT 8.16.04).

C. Flexible Joint Sealant: Flexible joint sealant (Grey Color) to be placed in all non-traffic pavement areas. (Refer to Specification 32 10 00 for additional information).

2.6 RELATED MATERIALS

A. Bonding Agent: Styrene butadiene or acrylic base, rewettable type.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Day-Chem Ad Bond (J-40); Dayton Superior Corp.
b. Daraweld C; W.R. Grace & Co.
c. Everbond; L&M Construction Chemicals, Inc.
d. Acryl-Set; Master Builders, Inc.

e. Intralok; W. R. Meadows, Inc.

B. Epoxy Adhesive: ASTM C 881, two component material suitable for use on dry or damp surfaces. Provide material "Type", "Grade", and "Class" to suit project requirements.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Resi-Bond (J-58); Dayton Superior.
b. Concresive Liquid; Master Builders, Inc.
c. Rezi-Weld 1000; W.R. Meadows, Inc.
d. Sikadur 32 Hi-Mod; Sika Corp.

2.7 CONCRETE MIX

A. Prepare design mixes for each type and strength of normal-weight concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use a qualified independent testing agency for preparing and reporting proposed mix designs.
1. The Contractor shall obtain the services of a testing agency for the preparation of required mix design services.
2. The Contractor shall provide Portland cement concrete mixtures for the project that are resistant to excessive expansion caused by Alkali Silica Reactivity (ASR). The evaluation as to the resistance of submitted concrete mixtures to excessive expansion caused by ASR shall be by the Owner as described herein.

B. Concrete mixes shall meet the requirements of MDOT P1 Mod with an Optimized Gradation as indicated herein.

C. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal weight concrete with the following properties:
1. Compressive Strength (28 day): 4000 psi.
2. Maximum Water-Cement Ratio at Point of Placement: 0.43.
3. Slump Limit at Point of Placement: 3 inches.
a. Slump limit for concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site - verified 2 to 3 inch slump concrete.

D. Add air-entraining admixture at manufacturer's prescribed rate of result in concrete at point of placement having an air content as follows with a tolerance of plus or minus 1-1/2 percent.
1. 5.5 percent for 1-1/2 inch maximum aggregate
2. 6.0 percent for 1 inch maximum aggregate
3. 6.0 percent for 3/4 inch maximum aggregate
4. 7.0 percent for 1/2 inch maximum aggregate

E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, project conditions, weather, test results, or other circumstances warrant.
1. Summer Mixes:
a. Low Alkali Cement: 15% Maximum GGBFS replacement
b. High Alkali Cement: 25% Maximum GGBFS replacement
2. Winter Mixes:
a. Use Low Alkali Cement with a maximum of GGFBS replacement of 15%

F. Supplementary Cementitious Materials (SCM):
1. Ground Granulated Blast Furnace Slag (GGBFS): If used, provide 20% minimum to 25% maximum of total cementitious content. If required to mitigate potential sulfate exposure or aggregate reactivity, up to 50% may be allowed.
2. Maintain air-entrainment at specified levels.
3. In cold weather, provide adequate concrete strength gain so concrete will not be damaged from traffic and loads of use.

G. Total Cementitious Content: 526 lbs/cu yd. (6.0 Sack) maximum

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94
1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which concrete curbs, walks and paving are to be installed. Notify Engineer / Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in an acceptable manner.

3.2 PREPARATION

A. Proof-roll prepared base material surface to check for unstable areas in accordance with Section 31 20 00 including documentation and re-proof rolling as required. Paving work shall begin only after unsuitable areas have been corrected and are ready to receive paving.

B. Remove loose material from compacted base material surface to produce firm, smooth surface immediately before placing concrete.

3.3 INSTALLATION

A. Form Construction
1. Set forms to plan grades and lines, rigidly braced and secured.
2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place minimum of 24 hours after concrete placement.
3. Check completed formwork for grade and alignment to following tolerances:
a. Top of forms not more than 1/8-inch in 10'-0".
b. Vertical face on longitudinal axis, not more than1/4-inch in 10'-0".
4. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.

B. Reinforcement: Fasten reinforcing bars or welded wire fabric (if required) accurately and securely in place with suitable supports and ties. Remove from reinforcement all dirt, oil, loose

mill scale, rust, and other substances that will prevent proper bonding of the concrete to the reinforcement.

C. Concrete Placement
1. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel and items to be embedded or cast in. Notify other trades to permit installation of their work.
2. Remove snow, ice or frost from subbase surface and reinforcing before placing concrete. DO NOT place concrete on surfaces that are frozen.
3. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.
4. Comply with requirements and with ACI 304R for measuring, mixing, transporting and placing concrete.
5. The maximum time from the time the concrete was batch until placement is 90 minutes.
6. The concrete temperature shall be 90 deg. F. maximum.
7. Site Water Addition: A single addition of water is permitted, provided the slump after the addition is not outside the range stated on the Approved Concrete Mix Design. The water addition must be charged into the mixer. Water other than that charged into the mixer is not permitted.
8. Air content at the point of placement: 5.0% to 8.0% at the point of placement. For pavements made by slip form paver, the air loss through the paver shall be established daily. Air tests from samples taken at the truck discharge shall be adjusted for this loss to determine compliance.
9. Do not place if ambient air temperature is over 90 degrees F.
10. Do not place if the evaporation rate exceeds 0.20 psf/hr, calculated from the following NRMCA Formula:

$$\text{Evaporation Rate} = (Tc^{2.5} - r\,Ta^{2.5}) * (1+0.4V) * (1 \times 10^{-6})$$

Tc = Temperature of Concrete, degrees Fahrenheit
r = Relative Humidity, percent
Ta = Ambient Air Temperature, degrees Fahrenheit
V = Wind Speed, mph

11. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
    a. When concrete placing is interrupted for more than 1/2 hour, place a construction joint.
12. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
13. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures to consolidate concrete complying with ACI 309R.
    a. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcing, dowels and joint devices.

14. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.
15. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off and screed.
    a. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to Architect.
16. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of it's 28 day compressive strength.
17. Cold-Weather Placement: Comply with provisions of ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing conditions or low temperatures.
    a. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 90 deg F (27 deg C) at point of placement.
    b. Do not use frozen materials or materials containing ice or snow.
    c. Do not use calcium chloride, salt or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
18. Hot-Weather Placement: Place concrete complying with ACI 305 R and as specified when hot weather conditions exist.
    a. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled, or chopped ice may be used, to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
    b. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
    c. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

D. Joint Construction: Construct expansion, weakened-plane control (contraction), and construction joints straight with face perpendicular to concrete surface. Construct transverse joints perpendicular to centerline, unless otherwise detailed.
    1. Weakened-Plane Control or Contraction Joints: Provide joints at spacing of 15'-0" on centers, maximum each way. Construct control joints for depth equal to at least 1/4 of the concrete thickness, as follows:
        a. Form tooled joints in fresh concrete by grooving top with recommended tool and finishing edge with jointer.
        b. Form sawed joints using powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.
    2. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for period of more than 1/2 hour, except where such placements terminate at expansion joints. Construct joints in accordance with standard details.

3. Transverse Expansion Joints: Locate expansion joints at maximum of 180'-0" on centers, maximum each way unless otherwise shown on the Construction Drawings. Provide pre-molded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, sidewalks, and other fixed objects.
4. Butt Joints: For joints against existing pavement, place 16” long dowels eight inches into holes drilled into center of existing slab. Epoxy dowels into holes with approved epoxy compound. Place dowels prior to concrete placement for new concrete. Dowel spacing to be 24” on center unless otherwise shown on Construction Drawings. Saw joint and fill with joint sealer.

E. Joint Sealants: Joints shall be sealed with approved exterior pavement joint sealants and shall be installed in accordance with manufacturer's recommendations.

3.4 CONCRETE FINISHING

A. After striking off and consolidating concrete, smooth surface by screeding and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10'-0" straightedge. Distribute concrete as required to remove surface irregularities and re-float repaired areas to provide continuous smooth finish.

B. Work edges of slabs and formed joints with edging tool, rounding edge to 1/2-inch radius. Eliminate tool marks on concrete surface. After completion of floating and troweling, when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:
1. Inclined Slab Surfaces: Provide coarse, non-slip finish by scoring surface with stiff-bristled broom perpendicular to flow of traffic so as to produce regular corrugations not over 1/16 of an inch deep.
2. Paving: Provide coarse, non-slip finish by scoring surface with stiff-bristled broom perpendicular to flow of traffic so as to produce regular corrugations not over 1/16 of an inch deep.

C. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Owner.

3.5 CURING AND PROTECTION

A. Protect and cure finished concrete paving using with curing compound or with acceptable moist-curing methods in accordance with "water-curing" section of ACI 308. Cure for a period not less than 7 days.

B. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of ACI 306 R for cold weather protection and ACI 305 R for hot weather protection during curing.

C. Evaporation Control: In hot, dry and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Apply curing compound uniformly in continuous operation by power sprayer or roller, at rate, in conformance with manufacturer's recommendations.

3.6 CLEANING AND ADJUSTING

A. The Contractor shall certify in writing that placement is in accordance with specification requirements.

B. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

C. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement or as otherwise approved by the Engineer or Testing Laboratory. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

3.7 FIELD QUALITY CONTROL

A. Field quality control tests specified herein will be conducted by the Contractors' Testing Laboratory. The Contractor shall perform additional testing as considered necessary by the Contractor for assurance of quality control. Retesting required as a result of failed initial tests shall be at the Contractor's expense.

B. Field testing, frequency, and methods may vary as determined by and between the Contractor and Testing Laboratory.

C. Review the Contractor's proposed materials and mix design for conformance with specifications.

D. Perform testing in accordance with ACI 301 and testing standards listed herein.

E. Strength Tests:
   1. Secure composite samples in accordance with ASTM C 172. Sample at regularly spaced intervals from middle portion of the batch. Sampling time shall not exceed 15 minutes.
   2. Mold and cure specimens in accordance with ASTM C 31.
      a. A minimum of four concrete test cylinders shall be taken for every 100 cubic yards or less of each class of concrete placed each day and not less than once for each 5000 square feet of paved area.
      b. During the initial 24 hours (plus or minus 8 hours) after molding, the temperature immediately adjacent to the specimens shall be maintained in the range of 60 to 80 degrees F. Control loss of moisture from the specimens by shielding from the direct rays of the sun and from radiant heating devices.
      c. Specimens transported prior to 48 hours after molding shall not be demolded, but shall continue initial curing at 60 to 80 degrees F until time for transporting.
      d. Specimens transported after 48 hours age shall be demolded in 24 hours (plus or minus 8 hours). Curing shall then be continued but in saturated limewater at 73.4 degrees (plus or minus 3 degrees F) until the time of transporting.
      e. Wet cure cylinders under controlled temperature until testing.
   3. Test cylinders in accordance with ASTM C 39.

a. Date test cylinders and number consecutively. Give each cylinder of each set an identifying letter (i.e. A, B, C, D). Prepare a sketch of the building plan for each test set identifying location of placed concrete.
b. Test one cylinder (A) at 7 days for information. If the compressive strength of the concrete sample is equal to or above the 28 day specified strength, test another cylinder (B) at 7 days. The average of the breaks shall constitute the compressive strength of the concrete sample.
c. Test two cylinders (B and C) at 28 days and the average of the breaks shall constitute the compressive strength of the concrete sample.
d. Retain fourth cylinder (D) for further testing if needed, but do not retain cylinder more than 60 days.

4. Evaluation and Acceptance:
a. Strength level of concrete will be considered satisfactory if the average of all sets of three consecutive strength tests equal or exceed specified strength and no individual strength test (average of two cylinders) results are below specified compressive strength by more than 500 psi.
b. Complete concrete work will not be accepted unless requirements of ACI 301, have been met, including dimensional tolerances, appearance, and strength of structure.
c. Where average strength of cylinders, as shown by tests is not satisfactory, Owner reserves the right to require Contractor to provide improved curing conditions of temperature and moisture to secure required strength. If average strength of laboratory control cylinders should fall so low as to cause portions of structure to be in question by Architect/Engineer, follow core procedure set forth in ASTM C42. If results of core test indicate, in opinion of Architect/Engineer, that strength of structure is inadequate, provide without additional cost to owner, replacement, load testing, or strengthening as may be ordered by Architect/Engineer. If core tests are so ordered and results of such tests disclose that strength of structure is as required, cost of test will be paid by Owner.

F. Slump Test: Conduct slump test for each cylinder set taken in accordance with ASTM C 143. Make additional slump tests for every other load from a stationary mixer or truck to test consistency. Sampling shall be in accordance with ASTM C 172.

G. Air Content: Conduct air content test for each cylinder set for concrete exposed to freeze-thaw in accordance with ASTM C 231, ASTM C 173, or ASTM C 138. Indicate test method on report. Make test at same time as slump test.

H. Unit Weight: ASTM C 138.

I. Temperature Test: Conduct temperature test for each cylinder set taken in accordance with ASTM C 1064. Test hourly when air temperature is 40 F and below or 80 F and above. Determine temperature of concrete sample and ambient air for each strength test.

J. In addition to required information noted previously in this Section, record the following information on concrete compression reports:
1. Test cylinder number and letter.
2. Specific foundations or structures covered by this test.
3. Proportions of concrete mix or mix identification.
4. Maximum size coarse aggregate.

5. Specified compressive strength.
6. Tested compressive strength.
7. Slump, air-content (when applicable) and concrete temperature.
8. Concrete plastic unit weight.
9. Concrete Temperature.
10. Elapsed time from batching at plant to discharge from delivery truck at project.
11. Date and time concrete was placed.
12. Ambient temperature, wind speed, and relative humidity during concrete placement.
13. Name of technician securing samples.
14. Curing conditions for concrete strength test specimens (field and laboratory).
15. Date strength specimens transported to laboratory.
16. Age of strength specimens when tested.
17. Type of fracture during test.

K. At the start of each day's mixing, report any significant deviations from approved mix design including temperature, moisture and condition of aggregate.

L. Certify each delivery ticket of concrete. Report type of concrete delivered, amount of water added and time at which cement and aggregate were loaded into truck, and time at which concrete was discharged from truck

M. In Place Pavement Testing: The Owner or Contactors' Testing Laboratory (TL) will randomly core pavement at minimum rate of 1 core per 20,000 sq. ft of pavement, with minimum of 3 cores from heavy-duty areas and 3 cores from light duty areas. Cores will be sampled and tested in accordance with ASTM C 42. Core will be tested for thickness and quality of aggregate distribution. Core holes shall be patched by the Contractor immediately with Portland cement concrete and shall be finished to provide level surface as specified herein.

N. Additional Tests: Additional in-place tests shall be conducted as directed by the Engineer or Testing Laboratory when specified concrete strengths and other characteristics have not been attained in the structures.

O. The criteria for approval of a proposed concrete mixture for resistance to excessive expansion caused by ASR shall be as follows:
1. If a proposed concrete mixture contains cement with an alkali level of less than 0.60% expressed as equivalent sodium oxide (percent Na2O + 0.658 x percent K2O) the mixture shall be considered to be resistant to the potential for excessive expansion caused by ASR.
    a. The determination of the alkali level of the proposed cement shall be made from the mill test reports submitted.
2. If a proposed concrete mixture contains both fine and coarse aggregates for which there is testing per ASTM C 1260 that shows that both the fine and course aggregates produce expansions of less than 0.10%, the fine or coarse aggregate used to construct the mortar bar shall be considered to be "innocuous" (per Appendix X1 of ASTM C-33). Concrete mixtures that include both fine and coarse aggregates considered to be innocuous shall be considered to be resistant to excessive expansion caused by ASR.
3. If a proposed concrete mixture for which there is previous testing per ASTM C 1567, shows the proposed combination of cementitious materials and aggregates produce expansions of less than 0.10% the mixture shall be considered to be resistant to excessive expansion caused by ASR.

4. If a proposed concrete mixture for which there is previous testing per ASTM C 1293 shows that both the fine and course aggregates meets the criteria of Appendix XI of ASTM C 1293 with respect to the non-reactivity of the aggregate, the mixtures shall be considered to be resistant to excessive expansion caused by ASR.
5. If, based on the Engineer's evaluation, additional testing of the fine and / or coarse aggregates is needed to make the evaluations as discussed herein; the Owner shall perform such testing.
    a. The Owner shall have access to all materials, including aggregate pits, in order to obtain samples for such additional testing.
    b. The Owner shall perform the following test using the fine and/or coarse aggregates proposed for each concrete mixture: ASTM C 1260 – Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar – Bar Method).
    c. All samples submitted for testing per ASTM C 1260 shall first be tested to establish conformance to the required material specification for gradation.
    d. All samples submitted shall meet the required material specification for gradation prior to being submitted for testing per ASTM C1260.

P. If, based on the Engineer's evaluation, the submitted concrete mixture does not meet any one of the criteria of 1.05A.1. the mixture shall be rejected or be mitigated by Methods 1. or 2. as follows:
1. Method 1. Use of a cement with an alkali level of less than 0.60% expressed as equivalent sodium oxide (percent Na_2O + 0.658 x percent K_2O).
    a. The determination of the alkali level of the proposed cement shall be made from the mill test reports submitted.
2. Method 2. Substitution of a portion of the cement with Ground Granulated Blast Furnace Slag (GGBFS) Grade 100 or 120 (ASTM C 689).
    a. For Method 2, the maximum substitution of cement with the GGBFS permitted shall be 25% by weight of total cementitious material (cement plus GGBFS).
    b. For Method 2, the effectiveness of the proposed cement–GGBFS combination to resist the potential for excessive expansion caused by ASR for each aggregate that is considered to be potentially reactive shall be demonstrated.
    c. The effectiveness of the proposed cement–GGBFS combination shall be based on test mortar bars per ASTM C 1260 using each fine or coarse aggregate that has been considered to be potentially reactive and the proposed cement-GGBFS combination for the concrete mixture
    d. The criteria for evaluating the mitigation of a proposed concrete mixture with respect to ASR by Method 2. shall be as follows:
        1) If a mortar bar constructed of an aggregate that is considered to be potentially reactive and the proposed cement-GGBFS combination produces an expansion of less than 0.10%, the aggregate and proposed cement-GGBFS combination shall be considered to be resistant to excessive expansion caused by ASR.
        2) Concrete mixtures that include both fine and coarse aggregates considered to be resistant to excessive expansion caused by ASR by mitigation Method 2. as described herein shall be considered to have been adequately mitigated with respect to and resistant to excessive expansion caused by ASR.
        3) If a mortar bar constructed of an aggregate that is considered to be potentially reactive and the proposed cement-GGBFS combination produces an expansion of 0.10% or greater, concrete mixtures containing these

materials shall not be considered resistant to the potential for excessive expansion caused by ASR and the concrete mixture shall be rejected.

e. The contractor shall be responsible for all costs associated with the mitigation of a concrete mixture for ASR and any delay costs incurred from the Owner if, due to the mitigation method selected by the Contractor, it takes the Contractor beyond their completion dates.

Q. If the Contractor intends to change suppliers or if the supplier intends to change concrete mixtures after the evaluation and/or Mortar-Bar tests are performed, the Contractor shall inform the Owner immediately, but not less than forty-five (45) days prior to concrete batching.

1. Upon notification, all concrete work will be postponed, without any additional costs or extension of time allowed by the Owner, until evaluation of the new mixtures and testing of the new materials, if needed, have been completed.

3.8 CONCRETE WASHOUT

A. Definition

1. A designated and protected area used to rinse out concrete mixers and pumps after delivery onsite.

B. Concrete washouts shall be designated for all sites where concrete equipment to be cleaned onsite to collect and retain all concrete washout water and solids in a leak proof container so as to prevent the caustic material from reaching the soil surface, surface waters or migrating into the ground water. Follow EPA Stormwater Best Management Practice for Concrete Washout.

C. Concrete washout facilities shall not be located within 50 feet of storm drain inlets, swales, wetlands or waterbodies. They should be placed so that it is convenient for the concrete trucks to access and utilize the station, yet not within highly active construction areas that the washout could be accidentally damaged; causing a leak or spill. They shall also not be located in an area that receives a significant amount of runoff, i.e., in a sump or bottom of hill, which could cause capacity or leaching issues. The washout facility must have a paved or gravel access drive leading to it with a minimum width of 10 feet and sloped downwards towards the washout at 2% slope. The access drive shall connect to a paved or gravel surface. Signs should be placed designating the facility and throughout the construction site to direct traffic to its location.

D. Container Types Permitted:

1. Excavated washout pit: The facility shall be minimum 6’x6’ at the bottom and 3’ deep. The facility may be larger and should be sized per the expected loadings. The area shall be excavated to the required depth with 2:1 side slopes. The excavated area is to be lined with minimum 10mil of polyethylene fabric. The liner shall be anchored in place by backfilling underneath a 1 foot high x 1 foot wide berm, located around the perimeter except for the access road. If it is anticipated to empty out and reuse the washout, the liner may be draped over the berm and anchored on the downslope side with sandbags. The liner shall be free of holes, tears or other defects that would compromise the impermeability of the material.
2. Prefabricated concrete washout: A manufactured unit with minimum 4’x4’ area and 12" depth. The unit shall be lined with a minimum 4mil polyethylene liner (meeting manufacturer’s recommendations) that can be tied off during rain events. After the washout unit is utilized it shall remain exposed (except during rain events) so that the

wastewater can evaporate, leaving only solid concrete residue. Properly dispose of solid residue.

3. A ready mix truck mounted chute washout box.
4. A chute washout bucket and pump.
5. A metal washout container designed to securely contain concrete washwater and solids. Provide a cover to protect from rainwater. The container shall be removed from the site once washwater has evaporated and solids have hardened.

E. Concrete washout facilities should be inspected daily and after heavy rains to check for leaks, identify any plastic linings and sidewalls have been damaged by construction activities, and determine whether they have been filled to over 75 percent capacity. When the washout container is filled to over 75 percent of its capacity, the washwater should be vacuumed off or allowed to evaporate to avoid overflows. Then when the remaining cementitious solids have hardened, they should be removed and recycled. Damages to the container should be repaired promptly. Before heavy rains, the washout container's liquid level should be lowered or the container should be covered to avoid an overflow during the rain storm.

F. The construction site superintendent should make ready mixed truck drivers aware of washout facility locations and be watchful for improper dumping of cementitious material. In addition, concrete washout requirements should be included in contracts with concrete delivery companies.

3.9 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged or defective, or does not comply with requirements of this Section.

B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from paving for at least 14 days after placement. Where construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discolorations, dirt and other foreign materials. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321613.13 – CONCRETE CURBS & GUTTERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Portland cement concrete curbs, concrete gutter, and/or concrete curb and gutters.

B. Related Sections
   1. Section 02 00 00 - Existing Conditions - General Information/Site Construction
   2. Section 31 20 00 - Earthmoving
   3. Section 32 12 16 - Asphalt Paving
   4. Section 32 13 13 - Concrete Paving

1.2 REFERENCED STANDARDS

A. All work under this section shall be completed in general conformance with construction plan details, Municipality standards, and/or the Michigan Department of Transportation's (MDOT) standard specifications for construction (current edition), MDOT's standard plans (current edition), MDOT's construction manual (current edition), MDOT's quality assurance procedures manual (current edition), and as specified herein.

B. American Concrete Institute (ACI)
   1. ACI 305R - Hot Weather Concreting
   2. ACI 306R - Standard Specification for Cold Weather Concreting
   3. ACI 308 - Standard Practice for Curing Concrete

C. ASTM International (ASTM)
   1. ASTM A185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
   2. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement
   3. ASTM C31 - Test Methods of Making and Curing Concrete Test Specimens in the Field
   4. ASTM C39 - Method for Comprehensive Strength of Cylindrical Concrete Specimens
   5. ASTM C42 - Obtaining and Testing Drilled Cores and Sawed Beams Of Concrete
   6. ASTM C94 - Ready-Mixed Concrete
   7. ASTM C138 - Test Method for Unit Weight, Yield, and Air Content (Gravemetric) of Concrete
   8. ASTM C143 - Method for Slump of Hydraulic Cement Concrete
   9. ASTM C231 - Air-Content of Freshly Mixed Concrete by the Pressure Method
   10. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete
   11. ASTM C173 – Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
   12. ASTM C260 - Air-Entraining Admixtures for Concrete
   13. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete
   14. ASTM C 1064 - Temperature Of Freshly Mixed Portland Concrete Cement
   15. ASTM D994 - Preformed Expansion Joint Filler for Concrete (Bituminous)
   16. ASTM C989 - Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars

17. ASTM D1190 - Concrete Joint Sealer, Hot Poured, Elastic Type
18. ASTM D1751 - Performed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
19. ASTM D2628 - Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

D. Federal Specifications (FS)
1. FS HH-F-341 - Fillers, Expansion Joint: Bituminous (Asphalt & Tar)

E. State Highway Department Standard Specifications

1.3 QUALITY ASSURANCE

A. Establish and maintain required lines and elevations.

B. Check surface areas at intervals necessary to eliminate ponding or pooling areas. Remove and replace unacceptable work as directed by Engineer.

1.4 SUBMITTALS

A. Certificates: Submit materials certificate from materials producer and Contractor, certifying that materials comply with, or exceed requirements specified herein to the Engineering Consultant of Record and the Testing Laboratory for review and approval and within 7 calendar days after receipt of Notice-to-Proceed, submit for approval, certified laboratory test data or manufacturers certificates and data for the following items:
1. Portland cement concrete mix
2. Aggregate gradations
3. Preformed expansion joint filler
4. Field molded/poured sealant
5. Dowel bars
6. Expansion sleeves
7. Tie bars
8. Reinforcing steel bars
9. Welded wire fabric
10. Air entraining admixtures
11. Water-reducing and set-retarding admixtures (if used)

1.5 PROJECT CONDITIONS

A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize temporary striping, flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. Forms shall be of depth equal to depth of curbing or sidewalk, and so designed as to permit secure fastening together at tops. Coat forms with non-staining type of coating that will not discolor or deface surface of concrete.

B. Reinforcing Steel: Deformed steel bars, ASTM A 615, Grade 60.

C. Portland Cement: Shall conform to ASTM C150, Type I

D. Slag: ASTM C989, Grade 100 or 120.

E. Exterior Pavement Joint Materials
1. Joint Back-up Material: Polyethylene foam, 60% closed cell
2. Sealant:
   a. Dow 888, by Dow Corning.
   b. 301 NS by Pecora.
   c. Spectrum 800 or 900 by Tremco.

F. Aggregate: ASTM C33.

G. Water: Clean and potable

H. Dowel Bars: ASTM A615, grade 60, and plain steel bars.

I. Air Entrainment: ASTM C260. .
1. Air-Mix or AEA-92, by Euclid.
2. MB-VR MB-AE 90, or Micro-Air, by Master Builders.
3. Daravair or Darex Series, by W.R. Grace.
4. Equivalent approved products.

J. Liquid Membrane Curing and Sealing Compound: ASTM C 1315, Type I, Class A or B, 25% minimum solids content, clear non-yellowing with no styrene-butadiene.
1. Water Based, VOC less than 350 g/l:
   a. Super Aqua Cure, by Euclid Chemical Corp.
   b. Kure 1315 by Degussa.

2.2 CONCRETE MIXING

A. Mix concrete and deliver in accordance with ASTM C94. Design mix shall produce normal weight concrete consisting of Portland cement, aggregate, water-reducing admixture, air-entraining admixture, and water to produce following:
1. Compressive Strength: 3,500 psi minimum at 28 days unless otherwise indicated on the Drawings.
2. Slump Range: 2”-4” for hand placed concrete, 1-1/4” to 3” for machine placed (slip-form) concrete.
3. Air Entrainment: 5 to 8 percent.

B. Supplementary Cementitous Materials (SCM):
   1. Ground Granulated Blast Furnace Slag (GGBF): If used, provide 20% minimum to 25% maximum of total cementitious content. If required to mitigate potential sulfate exposure or aggregate reactivity, up to 50% may be allowed.
   2. Maintain air-entrainment at specified levels.
   3. In cold weather, provide adequate concrete strength gain so concrete will not be damaged from traffic and loads of use.

C. The Contractor shall provide portland cement concrete mixtures for the project that are resistant to excessive expansion caused by Alkali Silica Reactivity (ASR). The evaluation as to the resistance of submitted concrete mixtures to excessive expansion caused by ASR shall be by the Owner as described herein.

PART 3 - EXECUTION

3.1 PREPARATION

A. Begin paving work only after unsuitable areas have been corrected and are ready to receive paving.

B. Remove loose material from compacted base material surface to produce firm, smooth surface immediately before placing concrete.

3.2 INSTALLATION

A. Form Construction
   1. Set forms to required grades and lines, rigidly braced and secured.
   2. Install sufficient quantity of forms to allow continuance of work and so that forms remain in place minimum of 24 hours after concrete placement.
   3. Check completed formwork for grade and alignment to following tolerances:
      a. Top of forms not more than 1/8-inch in 10'-0".
      b. Vertical face on longitudinal axis, not more than 1/4-inch in 10'-0".
   4. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.

B. Reinforcement: Fasten reinforcing bars or welded wire fabric (if required) accurately and securely in place with suitable supports and ties. Remove from reinforcement all dirt, oil, loose mill scale, rust, and other substances that will prevent proper bonding of the concrete to the reinforcement.

C. Concrete Placement
   1. Concrete shall be mixed and placed when the air temperature in the shade and away from artificial heat is a minimum of 35 degrees F and rising. Hot and cold weather concreting shall be in accordance with ACI 305R and 306R, respectively.
   2. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time

concrete is placed. Do not place concrete around manholes or other structures until set at required finish elevation and alignment.

3. Place concrete using methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
4. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place construction joint. Automatic machine may be used for curb and gutter placement. Machine placement shall be at required cross section, line, grade, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified herein.

D. Joint Construction
1. Contraction Joints: Construct concrete curb or combination concrete curb and gutter, where specified on Construction Drawings, in uniform sections of length specified on Construction Drawings. Form joints between sections either by steel templates, 1/4-inch in thickness, of length equal to width of curb and gutter, and with depth which will penetrate at least 2-inches below surface of curb and gutter; or with 3/4-inch thick performed expansion joint filler cut to exact cross section of curb and gutter; or by sawing to depth of at least 2-inches while concrete is between 4 and 24 hours old. If steel templates are used, they shall be left in place until concrete has set enough to hold it's shape, but shall be removed while forms are still in place.
2. Longitudinal Construction Joints: Tie concrete curb or combination concrete curb and gutter, where specified on Construction Drawings, to concrete pavement with 1/2-inch round deformed reinforcement bars of length and spacing shown on Construction Drawings.
3. Transverse Expansion Joints: Concrete curb, combination concrete curb and gutter, or concrete sidewalk shall have filler cut to exact cross section of curb, gutter, or sidewalk. Joints shall be similar to type of expansion joint used in adjacent pavement.

E. Joint Fillers: Extend joint fillers full-width and depth of joint, and not less than 1/2-inch or more than 1-inch below finished surface where joint sealer is indicated. Furnish joint fillers in 1-piece lengths for full width being placed, wherever possible. Where more than 1 length is required, lace or clip joint filler sections together.

F. Joint Sealants: Install in accordance with manufacturer's recommendations.

3.3 CONCRETE FINISHING

A. After striking off and consolidating concrete, smooth surface by screeding and floating. Adjust floating to compact surface and produce uniform texture. After floating, test surface for trueness with 10'-0" straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide continuous smooth finish.

B. Work edges of gutters, back top edge of curb, and formed joints with edging tool, rounding edge to 1/2-inch radius. Eliminate tool marks on concrete surface. After completion of floating and trowelling, when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

1. Curbs and gutters: Broom finish by drawing fine-hair broom across surface perpendicular to flow of traffic. Repeat operation as necessary to produce fine line texture.

C. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up minor honeycombed areas. Remove and replace areas or sections with major defects as directed Owner.

3.4 CURING AND PROTECTION

A. Protect and cure finished concrete paving using with curing compound or with acceptable moist-curing methods in accordance with "water-curing" section of ACI 308. Cure for a period not less than 7 days.

B. Use solvent based curing compound when compound is applied below 40 F.

3.5 BACKFILL

A. After concrete has set sufficiently, spaces on either side of concrete curb, combination concrete curb and gutter, or concrete sidewalk shall be refilled to required elevation with suitable material compacted in accordance with Section 31 20 00.

3.6 CLEANING AND PROTECTION

A. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

3.7 FIELD QUALITY CONTROL

A. Field quality control tests specified herein will be conducted by the Owner’s Independent Testing Laboratory at no cost to the Contractor. The Contractor shall perform additional testing as considered necessary by the Contractor for assurance of quality control. Retesting required as a result of failed initial tests shall be at the Contractor’s expense.

B. Field testing, frequency, and methods may vary as determined by and between the Owner and the Owner’s Testing Laboratory.

C. Review the Contractor's proposed materials and mix design for conformance with specifications.

D. Perform sampling testing and evaluation in accordance with ASTM C94 and as follows.

E. Strength Tests:

1. Secure composite samples in accordance with ASTM C 172. Sample at regularly spaced intervals from middle portion of the batch. Sampling time shall not exceed 15 minutes.
2. Mold and cure specimens in accordance with ASTM C 31.
   a. A minimum of four concrete test cylinders shall be taken for every 50 cubic yards or less of concrete placed each day.
   b. Construction Manager may choose to waive testing requirements on concrete placements less than 9 cubic yards.
3. Test cylinders in accordance with ASTM C 39.

F. Slump Test: Conduct slump test for each cylinder set taken in accordance with ASTM C 143.

G. Air Content: Conduct air content test for each cylinder set for concrete exposed to freeze-thaw in accordance with ASTM C 231, ASTM C 173, or ASTM C 138.

END OF SECTION 321613.13

SECTION 321723 – PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Painting and marking of pavements, curbs, guard posts, and light pole bases.
2. Complete all paving as indicated in the construction documents.
3. Preparation of existing surface.
4. Layout for pavement markings.
5. Painting of letters, markings, stripes and islands on the pavement surface.

B. Related Sections
1. Section 02 00 00 - Existing Conditions - General Information/Site Construction
2. Section 32 12 16 - Asphalt Paving

1.2 REFERENCED STANDARDS

A. All work under this section shall be completed in general conformance with construction plan details, Municipality standards, and/or the Michigan Department of Transportation's (MDOT) standard specifications for construction (current edition), MDOT's standard plans (current edition), MDOT's construction manual (current edition), MDOT's quality assurance procedures manual (current edition), and as specified herein.

B. ASTM International (ASTM)
1. ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness by Notched Gauges.

1.3 QUALITY ASSURANCE

A. Use trained and experienced personnel in applying the products and operating the equipment required for properly performed work.

1.4 SUBMITTALS

A. Material Certificates: Provide copies of material certificates signed by material producer and Contractor, certifying that materials comply with, or exceed, specified requirements.

B. Pavement marking plan indicating lane separations and defined parking spaces. Note dedicated handicapped spaces with international graphic symbol.

1.5 PROJECT CONDITIONS

A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs, and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Paint shall be waterborne or solvent borne, colors as shown or specified herein. Pavement marking paints shall comply with all applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.

B. Waterborne Paint: Paints shall conform to FS TT-P-1952.

C. Solvent Borne Paint: Paint shall conform to FS A-A-2886 or AASHTO M248. Paint shall be non-bleeding, quick-drying, and alkyd petroleum base paint suitable for traffic-bearing surface and be mixed in accordance with manufacture's instructions before application for colors White, Yellow, Blue, and Red.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the work area and correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Immediately before application of the paint, the existing surface shall be dry and entirely free from dirt, grease, oil, acids, laitance, or other foreign matter which would reduce the bond between the coat of paint and the pavement. The surface shall be thoroughly cleaned by sweeping and blowing as required to remove all dirt, laitance and loose materials. Areas which cannot be satisfactorily cleaned by power brooming and/or blowing shall be scrubbed as directed with a water solution of tri-sodium phosphate (10%Na3P or by weight) or an approved equal solution. After scrubbing, the solution shall be rinsed off and the surface dried prior to painting.

B. Where existing pavement markings are indicated on Construction Drawings to be removed or would interfere with adhesion of new paint, a motorized abrasive device shall be used to remove the markings. Equipment employed shall not damage existing paving or create surfaces hazardous to vehicle or pedestrian traffic. Within public rights-of-way, appropriate governing authority shall approve method of marking removal.

C. New pavement surfaces shall be allowed to cure for not less than 30 days before application of marking materials.

3.3 CLEANING EXISTING PAVEMENT MARKINGS

A. In general, markings shall not be placed over existing pavement marking patterns. Existing pavement markings, which are in good condition but interfere or conflict with the newly applied marking patterns, shall be removed. Deteriorated or obscured markings that are not misleading or confusing or do not interfere with the adhesion of the new marking material do not require removal. Whenever grinding, scraping, sandblasting or other operations are performed, the work shall be conducted in such a manner that the finished pavement surface is not damaged or left in a pattern that is misleading or confusing. When these operations are completed the pavement surface shall be blown off with compressed air to remove residue and debris resulting from the cleaning work.

3.4 LAYOUTS AND ALIGNMENT

A. The contractor is responsible for laying out a sample section of striping for approval by the Engineer before the contractor may proceed with the striping program. The contractor is to insure that all subsequent striping meets the quality of the approved sample application.

B. On those sections of pavements where no previously applied figures, markings, or stripes are available to serve as a guide, suitable layouts and lines of proposed stripes shall be spotted in advance of the point application. Control points shall be spaced as such intervals as will ensure accurate location of all markings.

C. The contractor shall provide and experienced technician to supervise the location, alignment, layout, dimensions and application of the paint.

3.5 EQUIPMENT

A. All equipment for the work shall be approved by the contractor and shall include the apparatus necessary to properly clean the existing surface, a mechanical marking machine, and such auxiliary hand painting equipment as may be necessary to satisfactorily complete the job.

B. The mechanical marker shall be an approved atomizing spray-type marking machine suitable for application of traffic paint. It shall produce an even and uniform film thickness at the required coverage and shall be designed so as to apply markings of uniform cross-sections and clear-cut edges without running or spattering and within the limits for straightness set forth herein. When needed, a dispenser shall be furnished which is properly designed for attachment to the mechanical marker and suitable for dispensing the required quantity of reflective material.

C. Suitable adjustments shall be provided on the sprayer/sprayers of a single machine or by furnishing additional equipment for painting the width required.

3.6 APPLICATION

A. Apply two coats of paint at manufacturer's recommended rate, without addition of thinner, with maximum of 100 square feet per gallon or as required to provide a minimum wet film thickness of 15 mils and dry film thickness of 7 ½ mils per coat. Paint shall be applied for a total dry film

thickness of 15 mils. Apply with mechanical equipment to produce a 4" wide stripe with uniform straight edges. At sidewalk curbs and crosswalks, use straightedge to ensure uniform, clean, and straight stripe.

B. Markings shall be applied at the locations and to the dimensions and spacing indicated on the plans or as specified. Paint shall not be applied until the indicated alignments are laid out and the conditions of the existing surface have been approved by the Owner.

C. The paint shall be mixed in accordance with the manufacturer's instructions before application. The paint shall be thoroughly mixed and applied to the surface of the pavement with the marking machine at its original consistency without the addition of thinner. If the paint is applied by brush, the surface shall receive two (2) coats; the first coat shall be thoroughly dry before the second coat is applied.

D. Install markings according to manufacturer's recommended procedures for specified material.

E. A period of one (1) week shall elapse between application of the bituminous seal coat, slurry seal or the placement of the bituminous surface course and the marking of the pavement. The paint shall not bleed excessively, curl, or discolor when applied to bituminous surfaces.

F. In the application of straight stripes, any deviation in the edges exceeding ½ inch in 50 feet shall be obliterated and the marking corrected. The width of the marking shall be as designated within a tolerance of 5 percent (5%).

G. The following items shall be painted with colors noted below except where modified by owner. Coordinate all specified painted areas with owner prior to application:
   1. ADA Symbols: Blue
   2. ADA Parking Space: Blue.
   3. Parking Stall Striping: White

3.7 FIELD QUALITY CONTROL

A. Inspection: After the paint has thoroughly dried, visually inspect the entire application and touch up as required to provide clean, straight lines and surfaces throughout.

3.8 CLEANING

A. Waste materials shall be removed at the end of each workday. Upon completion of the work, all containers and debris shall be removed from the site. Paint spots upon adjacent surfaces shall be carefully removed by approved procedures that will not damage the surfaces and the entire job left clean and acceptable.

END OF SECTION 321723

SECTION 323119-DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Welded ornamental steel fence
   2. Welded ornamental steel gates

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product literature, including color charts and installation details.

1.3 QUALITY ASSURANCE

A. The contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques specified.

1.4 REFERENED STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.

C. ASTM D523 - Test Method for Specular Gloss

D. ASTM D714 - Test Method for Evaluating Degree of Blistering in Paint.

E. ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.

F. ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.

G. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

H. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

I. ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.

J. ASTM F2408 – Ornamental Fences Employing Galvanized Steel Tubular Pickets.

1.1 DELIVERY, STORAGE AND HANDLING

A. Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

1.2 WARRANTY

A. All structural fence components (i.e. rails, pickets, and posts) shall be warranted within specified limitations, by the manufacturer for a period of 20 years from date of original purchase. Warranty shall cover any defects in material finish, including cracking, peeling, chipping, blistering or corroding.

B. Reimbursement for labor necessary to restore or replace components that have been found to be defective under the terms of manufactures warranty shall be guaranteed for five (5) years from date of original purchase.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis for Design: Ameristar Fence Products, Inc. Tulsa, OK (800) 333-3422

B. Acceptable alternates: As approved by Architect.

2.2 MATERIAL

A. The fence system shall conform to Montage Plus standard picket space, welded and rackable (ATF – All Terrain Flexibility) Ornamental Steel, Majestic design, flush bottom rail treatment, 3-Rail style manufactured by Ameristar Fence Products, Inc.

B. Steel material for fence panels and posts shall conform to the requirements of ASTM A653/A653M, with a minimum yield strength of 45,000 psi (310 MPa) and a minimum zinc (hot-dip galvanized) coating weight of 0.60 oz/ft2 (184 g/m2), Coating Designation G-60.

C. Material for pickets shall be 3/4” square x 18 Ga. tubing. The rails shall be steel channel, 1.5” x 1.4375” x 14 Ga. Picket holes in the rail shall be spaced 4.675 inches o.c. Fence posts and gate posts shall meet the minimum size requirements of manufacturer.

2.3 FABRICATION

A. Pickets, rails and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept pickets.

B. Pickets shall be inserted into the pre-punched holes in the rails and shall be aligned to standard spacing using a specially calibrated alignment fixture. The aligned pickets and rails shall be joined at each picket-to-rail intersection by Ameristar's proprietary fusion welding process, thus completing the rigid panel assembly

C. The manufactured panels and posts shall be subjected to an inline electrode position coating (E-Coat) process consisting of a multi-stage pretreatment/wash (with zinc phosphate), followed by a duplex application of an epoxy primer and an acrylic topcoat. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils (0.058 mm). The color shall be Black. The coated panels and posts shall be capable of meeting the performance requirements for each quality characteristic as required by manufacturer.

D. The manufactured fence system shall be capable of meeting the vertical load, horizontal load, and infill performance requirements for Commercial weight fences under ASTM F2408.

E. Gates with an out to out leaf dimension less than and including 72 inches shall be fabricated using Montage Plus ornamental panel material and 1-3/4" sq. x 14ga. gate ends. Gate leafs greater than 72 inches shall be fabricated using ForeRunner rails, 17 gauge pickets, intermediate uprights, gussets and 1-3/4" sq. x 14ga. gate ends. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding.

PART 3 - EXECUTION

3.1 PREPARATION

A. All new installation shall be laid out by the contractor in accordance with the construction plans.

3.2 INSTALLATION

A. Fence post shall be spaced according to manufacturers requirements. For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the manufacturer. Posts shall be set in concrete footers having a minimum depth of 42 inches. Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by engineering analysis to be sufficient in strength for the intended application.

B. When cutting/drilling rails or posts adhere to the following steps to seal the exposed steel surfaces; 1) Remove all metal shavings from cut area. 2) Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole; let dry. 3) Apply 2 coats of custom finish paint matching fence color. Failure to seal exposed surfaces per steps 1-3 above will negate warranty. Ameristar spray cans or paint pens shall be used to prime and finish exposed surfaces; it is recommended that paint pens be used to prevent overspray. Use of non-Ameristar parts or components will negate the manufactures' warranty.

C. Gate posts shall be spaced according to the manufacturers' gate drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. The

manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacture of the gate and shall be installed per manufacturer's recommendations.

3.3 CLEANING

A. The contractor shall clean the jobsite of excess materials; post-hole excavations shall be scattered uniformly away from posts.

END OF SECTION 323119

SECTION 325200-SYNTHETIC TURF

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. A complete synthetic athletic turf system including under field drainage, field turf, field markings and resilient infill material.
   2. A complete synthetic turf system for landscape application including turf and infill material.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.

C. Samples: For each product indicated

D. Product Literature: Submit two (2) copies of manufacturer's recommended installation and maintenance information, including any technical criteria for evaluation of the installed product. Descriptions of all equipment recommended for the maintenance and repair of turf product, as well as a list of any activities not recommended relative to the warranty.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of providing aluminum framed storefront system that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.

C. Certified copies of independent (third-party) laboratory reports on ASTM tests as follows:
   1. Pile Height, Face Width & Total Fabric Weight, ASTM D418 or D5848
   2. Primary & Secondary Backing Weights, ASTM D418 or D5848
   3. Tuft Bind, ASTM D1335

D. The Synthetic Turf Installer and the Turf Manufacturer shall provide complete information on its warranty/insurance policy and coverage. Provide a complete sample copy of all warranty documentation.

PART 2 - PRODUCTS

2.1 SYNTHETIC ATHLETIC TURF SYSTEM

A. Manufacturers:
1. Basis for Design: SporTurf, 200 Howell Dr., Dalton, GA 30721 (800) 798-1056 www.sporturf.com
2. Accepted manufacturers:
   a. Shaw Sports Turf
   b. Field Turf
   c. As approved by Architect

B. Material:
1. Basis for Design:
   a. SporTurf, Game Changer 40Z, Dual Fiber
2. Turf Fiber:
   a. The turf fiber must be tufted to the backing with a minimum tuft bind of 10 pounds.
   b. The tufted fiber weight shall be a minimum of 40 ounces per square yard.
   c. The turf fiber shall be 100% polyethylene.
   d. The turf fiber shall be non-abrasive and a minimum of 100 microns thick.
   e. The turf fiber must contain less than 100 ppm of lead in all colors.
   f. The turf fibers must be from the same dye lots.
   g. The turf fibers must be from a single source.
   h. The turf fibers must be guaranteed for a period of Eight Years not to fade or fail (as distinguished from a change in texture) or have a pile height decrease to 50% of pile height as result of UV degradation.
   i. The infill must be within ¼" of the tips of the fibers upon completion of the install.
   j. The turf fiber must retain a minimum of 75% of its original fibril width after 10,000 cycles on the Lisport Studded Roll Test Machine.
   k. The pile fiber shall possess the following characteristics:
      1) Liner Density (Denier) – 14,000 combined, ASTM D 1577
      2) Yarn Thickness – 100 Microns (Slit Film); 235 Microns (Monofilament), ASTM D 3218
      3) Tensile Strength – 37 N (Slit Film); 71 N (Monofilament), ASTM D 2256
      4) Pile Weight – 40 oz./sq.yd., ASTM D 5848
   l. The pile fabric shall possess the following physical characteristics:
      1) Finished Pile Height – 2 – 2 ¼ inches, ASTM D 5823
      2) Product Weight – 69 oz., ASTM D 3218
      3) Primary Backing Weight – 7.4 oz. / sq. yd., ASTM D 2256
      4) Secondary Backing Weight – 22 oz. / sq. yd., ASTM 5848
      5) Fabric Width – 15 feet, ASTM D 5793
      6) Tuft Gage – ½ inch, ASTM 5793
      7) Grab Tear Strength – 200 lb-F, ASTM D 5034
      8) Tuft Bind – less than 10 lb-F, ASTM D 1335
      9) Sand Infill – 1 lb Silica Sand
      10) Rubber Infill – 3 lbs. SBR Rubber
3. Backing Material:
   a. Primary Backing:
      1) Primary backing must be a dual layered woven polypropylene material.
      2) Primary backing system weight must be a minimum of 7.0 ounces/square yard.

b. Secondary Backing:
   1) Secondary backing system weight must be a minimum of 22 ounces/ square yard.
   2) Secondary backing shall saturate the primary backing and effectively lock the fiber tufts in place to the primary backing.
   3) Secondary backing must be a heat activated polyurethane coating with no vegetable based polyols.
   4) Secondary backing system shall have minimum tuft bind strength of 10 pounds.
   5) Secondary backing must have Drainage Perforations: 3/16" to ¼" diameter at 4 inches or less on center each way. Non-perforated backing is not acceptable.

4. Turf roll seams: to be sewn or glued on site so that no openings larger than the porous backing mat openings are created. Roll width to coincide with tufted-in sports line markings where possible. All turf fabric edges to be securely bound as per the perimeter detail design. Adhesives for joining seams of turf together shall be Nordot 34G, Mapei 2K, Turf Claw, hot melt technology or equivalent. No substitutions.
5. Fabric surface: shall be constructed and installed in minimum widths of 15 feet with no longitudinal or transverse seams, except for inlaid lines with a finish roll assembly. Seams shall be 15'-0" apart. Rolls that do not comply with the proper length or conform to the seaming diagram, as approved prior to installation, shall be rejected from the site. No fitted pieces shall be allowed to true alignment. Parallel seams only are acceptable in the main playing areas. No head seams are acceptable on the sports fields.
6. The entire system shall be resistant to weather, including ultra-violet light and heat degradation; insects, rot, mildew and fungus growth and be non-allergenic and non-toxic.
7. Fiber Color**s:** Submit samples of the full available color palette for owner approval prior to placing order for turf including at a minimum the below listed colors:
   a. Grass – green in standard color
   b. Lines and Markings - white
8. The turf material shall be non-combustible and pass the DIN standard Pill Burn test or ASTM D 2859.

C. Lines and Markings
1. All line material is to be identical dimensionally and of the same material to that used for the main playing field fiber system.
2. All lines and markings shall be accurately set and surveyed to within ½" tolerance of the location shown on the drawings and in conformance with specified field marking standards.
3. All lines and markings shall be installed prior to any installation of in-fill material.

D. Synthetic Glue Material
1. Adhesive products shall be Nordot 34G, Mapei 2K, Turf Claw, hot melt technology or equivalent as approved by the Architect.
2. Any adhesive products required for the installation of a proposed turf system shall be purpose-suited to the system. The material and application methods shall be as recommended by the adhesive manufacturer.
3. Disposal of adhesive containers and unused adhesives as well as any fees resulting from such disposal shall be the responsibility of the Contractor.

E. In-fill Material

1. The synthetic infill material shall consist of a blend of graded, silica sand and treated and mixed ground rubber.
   a. Sand: specially-graded, dust-free silica sand shall be placed on the turf in a minimum quantity of 1 pound/ square foot and shall include test results that demonstrate the following minimum properties:
      1) Color – tan
      2) Sand shall be round non-angular in shape
      3) Roundness – 0.6+
      4) Hardness - 0.6-0.8 on the Mohs Scale
      5) Size – 1.00 mm ± 0.15 mm
      6) Density – 90 – 95 lbs/ cu ft.
      7) Dust - < 0.001 %
      8) Angle of Repose - < 30°
      9) Sand shall be heavy metal safe
   b. Rubber: Rubber is SBR ambient (styrene butadiene rubber) rubber, color black, 10-18 mesh, that is 99% fiber free and is heavy metal safe. Rubber shall be placed on the turf in a minimum quantity as referenced the table in Section 2.02 in this document and shall be of the following Mesh Size Distribution:

	Mesh Size	% Retained
1)	10	0-15%
2)	12	5-30%
3)	16	40-70%
4)	20	15-35%
5)	30	0-10%
6)	40	0-1%
7)	Pan	0-1%

   c. The infill materials shall be installed to allow an exposed fiber of not less than ¼ inch after finish brushing and ½ inch after 180 days.
   d. Sufficient quantities of the top dressing infill material must be stored on site at the time of installation to be used 180 days after the completion of the installation to mitigate the differential settling of high traffic zones on the field. This fill addition must be carried out by the Contractor within the time specified above.
   e. 100% NEW INFILL ONLY. No replacement rubber from other turf permitted.
   f. New infill must have point of origin with sieve analysis.

2.2 SYNTHETIC TURF FOR LANSCAPING

A. Manufacturers:
   1. Basis for Design: XGrass, 210 Howell Drive, Dalton, GA 30721 (800) 881-8477 www.xgrass.com
   2. Accepted manufacturers:
      a. Grass Tex
      b. Synthetic Turf International
      c. AGL Grass
      d. As approved by Architect

B. Material:
   1. Basis for Design: XGrass Synthetic Turf for Landscapes
   2. Aggregate Base – Crushed angular hard stone, ¾”minus compactible stone (not clean).

3. Synthetic grass: 1.75” XGrass® Synthetic Turf for Landscapes from XGrass, or approved equal.
    a. Face Weight Minimum 50 oz/sy
    b. Face Yarn Type: Polyethylene
    c. Yarn Size 10800/7300
    d. Pile Height: 1.75 inches
    e. Color: Blend
    f. Construction: Broadloom tufted
    g. Tufting Gauge: 1/4”
    h. Primary Backing: Stabilized dual layered woven polypropylene
    i. Secondary Backing 10.0 oz. DuraFlo (non-urethane, 100% recyclable)
    j. Total Product Weight 69.7 oz/sy
    k. Finished Roll Width 180” untrimmed
    l. Warranty: 9 year fade
4. Synthetic Grass Infill : SofFill™ from XGrass, or approved equal. Coating: Priority acrylic, iron oxide and chromium oxide
    a. Grain shape: Hardness: 7.0 Mohs
    b. Curvature: .65
    c. Specific Gravity: 2.65 g/cm3
    d. Bulk Density: 100 lb/cu ft
    e. Uniform coefficient 1.10 to 1.40
    f. Effective Size .85 – 1.1 mm
    g. Blend rate of 3 to 4 lb per square foot.
5. Splicing Material: 1000 denier coated nylon (Cordura®) 12” wide minimum.
6. Adhesive: Synthetic Turf Adhesive (from XGrass)

PART 3 - EXECUTION

3.1 GENERAL

A. Installation of the synthetic turf system is to comply with the manufacturer’s recommendations, requirements and the reviewed and approved shop drawings.

B. Perform all work in strict accordance with the Contract Documents and the manufacturer’s specifications and instructions. Only those skilled technicians proposed in the bid phase are to be assigned to this project by the Contractor.

C. The designated Supervisor for the Synthetic Turf Installer must be present during any and all construction activity associated with the field installation, including testing, cleanup and training.

D. All products and equipment are to be from sources approved by the authorized turf manufacturer and conform to the specifications.

3.2 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in original containers and wrappers as agreed between the Engineer and Contractor. Inspect products upon delivery for damage.

B. Store products in a location and in a position that protects them from crush damage or any other defects.

C. Handle and store (on and off site) all materials safely to ensure their physical properties are not adversely affected and that they are not subject to vandalism or damage.

D. Rubber and sand infill shall arrive dry and loose. No rubber shall be accepted that is bulked or solid.

E. Adhesives shall arrive in dry, sealed containers.

F. Rubber infill shall arrive in large sacks or bags without tears or loose material about.

3.3 ATHLETIC TURF INSTALLATION

A. Install synthetic turf system in accordance with the manufacturer's written installation instructions.

B. All inlaid areas shall have full fastenings and no loose areas. At no time can pulling on the section separate the material.

C. Turf shall be attached to the perimeter edge as shown in the construction plans and as per the manufacturer.

D. All seams and inlaid areas shall be brushed thoroughly before infill materials are installed.

E. All terminations shall be as detailed and approved in the shop drawings.

3.4 ATHLETIC TURF INFILL INSTALLATION

A. The synthetic turf shall be thoroughly brushed prior to installation of infill materials to remove wrinkles.

B. The infill materials shall be installed in layers, in accordance with the turf manufacturer's installation instructions. Any mix of materials shall be uniform and even in thickness.

C. Turf shall remain free draining at all times before, during and after the infill materials are installed.

3.5 ATHLETIC FIELD MARKINGS

A. Sports field lines and event markings as per the Contract Documents shall be accurately positioned and marked in accordance with the current rules of the governing body. All lines shall be straight and true along the length of the marked boundary to within ½" along the length of any such boundary.

B. All markings shall be accurately measured and applied in widths and colors as required by the governing body and selected from the manufacturer's range of standard colors, or not more than one custom color if the manufacturer's standard colors do not meet the Owner's requirements.

3.6 TESTING FOR ATHLETIC FIELD TURF

A. At the time of substantial completion and bi-annually during the life of the warranty, the Contractor shall perform a series of tests by use of an independent testing agency to evaluate the shock absorption characteristics of the field. The tests shall be performed on a 50 foot grid in both directions using an accelerometer in accordance with ASTM F1936 and ASTM F355. Test the field at a minimum of 12 points and submit the results to the Owner within 30 days of testing. At no point shall any reading exceed 175 Gmax during the life of the warranty. If any point exceeds the maximum deceleration, the Contractor shall make corrections to provide the allowable Gmax deceleration at the Contractor's expense.

3.7 LANDSCAPE TURF INSTALLATION

A. General: The area to be smooth and graded to allow proper drainage. Refer to grading plan.

B. Compacted Aggregate Base: Place 4 inches of aggregate base as leveling layer compacted to 90% of max density per AASHTO T99. Compaction shall be done with mechanical compactors, including vibratory compactors, and/or powered tampers, and rollers. Aggregate size should be ¾" minus (compactible).

C. Sub-surface Drainage: Install composite drain and perforated perimeter collector drain to site drainage as indicated on drawings.

D. Synthetic Grass: Place turf and cut to fit configuration as shown on Drawings. Splice seams. All seams must be attached with splicing film/fabric and adhesive as approved by the manufacturer for this type of installation of their product.

E. Infill: Apply layers of synthetic grass infill evenly with a spreader and broom the turf fibers with stiff bristle broom to stand fibers up and allow infill to settle into the bottom. Broom in infill round quartz silica sand approximately 3 pounds per square foot.

F. Anchoring/Edging: Edges of turf will be secured to ground with mechanical fasteners, stakes or edging.

3.8 CLEANING AND PROTECTION

A. Protect all installed work from other construction activities as installation progresses.

B. The Contractor shall keep the area clean throughout the construction period and free from the installation process, including track surfaces.

C. Upon completion of the installation, thoroughly clean surfaces and site of all refuse resulting from the installation process, including track surfaces.

D. Any damage to existing fixtures or facilities resulting from the installation of the synthetic turf system shall be repaired to original condition at the Contractor's expense prior to Substantial Completion and commencement of the Warranty Period.

E. A deficiency list will be produced by the Engineer at the conclusion of the project. All installation project deficiencies not in dispute must be remedied by the Contractor prior to the issuance of a certificate of Substantial Completion.

F. Contractor to provide a written acceptance by the Turf Manufacturer that the turf and base system is installed in accordance with their recommendations prior to final completion.

END OF SECTION 325200

SECTION 329200 – TURFS AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY OF WORK

A. Extent of seeded and sodded lawns as shown on the drawings and by provisions of this section.

B. Type of work required include the following:
1. Soil preparation
2. Top Soil
3. Hydroseeding
4. Sodding
5. Erosion-Control material

1.2 QUALITY ASSURANCE

A. Seeding Contractor shall have a minimum of five years experience with hydroseeding, erosion control blanket installation and related work.

1.3 SUBMITTALS

A. Qualification Data for landscape installer.

B. Product Data.

C. Certification of grass seed from seed vendor for each grass seed mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

D. Manufacturer’s certification of fertilizer.

E. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.

F. Pesticides and Herbicides: Product label and manufacturer’s application instructions specific to Project.

1.4 DELIVERY, STORAGE AND HANDLING

A. Seed: Deliver seed in original sealed, labeled and undamaged containers.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in specifications. Deliver sod within 24 hours of harvesting and in time for planting properly. Protect sod from breakage and drying.

1.5 PROJECT CONDITIONS

A. Work notifications: Notify owner at least seven working days prior to start of work.

B. Protect existing utilities, paving and other facilities from damage caused by seeding operations.

C. Perform seeding work only after planting and other work affecting ground surface has been completed.

D. Restrict traffic from lawn areas until grass is established. Erect signs and barriers as required.

E. Provide hose and lawn watering equipment as required.

Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required maintenance period.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment in projects of comparable size.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Grass seed:
   1. Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.
   2. Use seed materials, of the preferred species for local environmental and projected traffic conditions from certified sources.
   3. Provide seed in containers clearly labeled to show seed name, lot number, net weight, percentage weed seed content, and guaranteed percentage of purity and germination.

B. Seed species:
   1. Seed of grass species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than .5 percent weed seed..
      1. Full Sun: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.
      2. Sun and Partial Shade: Proportioned by weight as follows:
         1) 50 percent Kentucky bluegrass (Poa pratensis)
         2) 30 percent chewings red fescue (Festuca rubra variety)

3) 10 percent perennial ryegrass (Lolium perenne).
4) 10 percent redtop (Agrostis alba).

C. Turfgrass Sod: Turfgrass Sod: Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.
1. Use a 1/4 inch (6 mm) shallow cut rolled sod from a reputable local grower.
2. Species should be wear-resistant, free from disease, and in excellent condition.
3. Sod shall be grown in sand or sandy loam soils only. Sod grown in soils of clay, silt, or high organic materials such as peat, will not be accepted.

D. Turfgrass Species: Sod of grass species as follows, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:
1. Full Sun: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.
2. Sun and Partial Shade: Proportioned by weight as follows:
1) 50 percent Kentucky bluegrass (Poa pratensis)
2) 30 percent chewings red fescue (Festuca rubra variety)
3) 10 percent perennial ryegrass (Lolium perenne).
4) 10 percent redtop (Agrostis alba).

E. Fertilizer:
1. Granular, non-burning product composed of not less than 50% organic slow acting, guaranteed analysis professional fertilizer.
Type A: Commercial Starter fertilizer containing 17% nitrogen, 23% phosphorous and 6% potassium, by weight or similar approved composition.

F. Ground limestone: Containing not less than 85% of total carbonates and ground to such fineness that 50% will pass through a 100 mesh sieve and 90% will pass through a 20 mesh sieve. Use if determined by soil tests to be necessary.

G. Water: Free of substances harmful to grass seed and grass growth. Hoses or other methods of transportation furnished by Contractor.

H. Topsoil:
1. Topsoil shall be fertile, friable and representative of productive soil, capable of sustaining vigorous plant grown and shall be free of clay clumps, sub-soil, weeds, seeds and other foreign debris.
2. Acidity range shall be between pH 5.0 and 7.5
3. Organic content shall be not less than 5% and not greater than 30%.
4. Clay content shall range between 5% and 25%.

I. Soil Erosion Control Blankets:
1. Erosion control blanket shall provide a temporary, biodegradable cover material to reduce slope and/or channel erosion and enhance revegetation. Erosion control blanket performance capabilities shall be determined by ASTM D 6459, “Determination of Erosion Control Blanket (ECB) Performance in Protecting Hillslopes from Rainfall-Induced Erosion”.
2. Performance Requirements:
1. Slopes: less than 2H:1V
2. C factor: .039
3. Shear Stress: 1.60 lb/ft2

4. Velocity: 5.0 ft/sec
5. Functional longevity: less than 3 months (netting)

3. Product: Curlex I CL Quick Mow as manufactured by American Excelsior Company, Arlington, TX (1-866-9FIBERS) or equal.
4. Staples: Minimum 4 inch biodegradable with U shaped top
5. Before placing blankets, the Contractor shall verify that the subgrade has been properly compacted, graded smooth, has no depressions, voids, soft or uncompacted areas, is free from obstructions such as tress roots, protruding stones or other foreign matter, and is seeded and fertilized according to the project specifications. The Contractor shall not proceed until all unsatisfactory conditions have been remedied. By beginning construction, the Contractor signifies that the preceding work is in conformance with this specification.
6. No vehicular traffic shall be permitted directly on the erosion control blanket.

2.2 PESTICIDES

A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine finish surfaces, grades, topsoil quality and depth. Do not start seeding work until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Limit preparation to areas which will be immediately seeded. Spread topsoil, fine grade.

B. Protect structures, site amenities, utilities, sidewalks, pavement, trees, shrubs and other plantings from damage caused by planting operations.

C. Scarify surface of lawn areas to minimum depth of 3 inches. Remove stones over one inch in any dimension and sticks, roots, rubbish and extraneous matter.

D. Apply 4 inches minimum topsoil to entire area to be seeded.

E. Grade lawn areas to smooth, free draining and even surface with a loose, uniformly fine texture. Roll and rake; remove ridges and till depressions as required to drain.

F. Apply limestone, if required by soil test results, at rate determined by the soil test, to adjust pH of topsoil to not less than 6.0 nor more than 6.8. Distribute evenly by machine and incorporate thoroughly into topsoil.

G. Apply Type A fertilizer at the rate equal to 1.0 lb. of actual nitrogen per 1,000 sq. ft. (43 lbs./acre). Apply fertilizer by mechanical rotary or drop type distributor, thoroughly and evenly incorporated with the soil to depth of one inch by discing or other approved methods. Fertilize area inaccessible to power equipment with hand tools and incorporated it into soil.

H. Dampen dry soil prior to seeding.

I. Restore prepared area to specified condition if eroded, settled or otherwise disturbed after fine grading and prior to seeding.

J. Restore areas 5 feet beyond edge(s) of all new paving. Provide smooth transition from all new paving areas.

K. Install soil erosion measures where required to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 HYDROSEEDING

A. Hyroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogenous slurry suitable for hydraulic application.

B. Mix slurry with non-asphaltic tackifier.

C. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply mulch at the minimum rate of 1,500 lbs/acre dry weight but not less than the rate required to obtain specified seed sowing rates.

3.4 PREPARATION FOR SOIL EROSION MATERIAL

A. Prepare area as specified in section 3.2.

B. Install erosion-control blanket from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

C. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 TURF AREA PREPARATION

A. General: Prepare planting area for soil placement.

B. Placing Planting Soil: Place and mix planting soil in place over exposed subgrade.
   1. Reduce elevation of planting soil to allow for soil thickness of sod.

C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

D. Before planting, obtain acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.6 SODDING

A. Lay sod within 24 hours of harvesting, unless a suitable preservation method is accepted by Landscape Architect prior to delivery time. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints, moistened and rolled to create good contact for growth. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
   1. Lay sod across slopes exceeding 1:3.
   2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage. All pegs or staples to be removed once sod is established.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below sod.

D. Sodded areas must be fertilized and kept moist during root establishment (minimum of 3 weeks).

3.7 TURF MAINENANCE

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
   1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
   2. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches (100 mm).

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch (25 mm) per week unless rainfall precipitation is adequate.

3.8 SATISFACTROY TURF

A. Turf installations shall meet the following criteria as determined by Landscape Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 5 by 5 inches (125 by 125 mm).
2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

3.9 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.10 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established. Any barricades constructed must still be accessible by emergency and fire equipment during and after construction.
1. Seeded areas must be protected from any traffic, other than for actual emergencies, for a period of 4 to 8 weeks, or until grass is mature enough to handle traffic.
2. Sodded areas must be protected from any traffic, other than emergency vehicles, for a period of 3 to 4 weeks, or until root system has established.

D. Remove nondegradable erosion-control measures after grass establishment period.

E. Repair any damage to adjacent materials and surfaces resulting from installation of this work.

END OF SECTION 329200

SECTION 330500 – MANHOLES AND STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Monolithic concrete, modular pre-cast concrete manhole assemblies.

B. Related Sections
   1. Section 02 00 00 - Existing Conditions - General Information/Site Construction
   2. Section 31 20 00 - Earthmoving
   3. Section 33 40 00 - Storm Drainage Utilities

1.2 REFERENCED STANDARDS

A. All work under this section shall be completed in general conformance with construction plan details, Municipal standards, and/or the Michigan Department of Transportation's (MDOT) standard specifications for construction (current edition), MDOT's standard plans (current edition), MDOT's construction manual (current edition), MDOT's quality assurance procedures manual (current edition), and as specified herein.

B. American Society for Testing and Materials (ASTM)
   1. ASTM A 48 - Gray Iron Castings
   2. ASTM C 55 - Concrete Building Brick
   3. ASTM C 478 - Pre-cast Reinforced Concrete Manhole Sections
   4. ASTM C 923 - Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes
   5. ASTM D 1248 - Polyethylene Plastics Molding and Extrusion Materials

C. International Masonry Industry All-Weather Council (IMIAC)
   1. Recommended Practices and Guide Specification for Cold Weather Masonry Construction

1.3 SUBMITTALS

A. Shop Drawings: Indicate reference to Construction Drawings for all manhole locations, elevations, piping with sizes, locations, and elevations of penetrations. Submit to Engineer for review and approval a minimum of three (3) weeks prior to installation date.

B. Product Data: Provide data for manhole covers, component construction, features, configuration, and dimensions.

PART 2 - PRODUCTS

2.1 MANHOLES

A. Pre-cast Concrete: Reinforced pre-cast concrete barrel of specified diameter.

1. Manhole sections conforming to ASTM C 478 with gaskets in accordance with ASTM C 923.
2. Construct manholes of pre-cast concrete sections as required by Construction Drawings to size, shape, and depth indicated.

B. Concrete Block/Brick: ASTM C 55, Grade N Type I-moisture controlled, normal weight, of same grade, type and weight as block units, nominal modular size of 3 5/8-inches x 7 5/8-inches x 2 1/4-inches

C. Mortar and Grout: Mortar for finishing and sealing shall be Class "C". Honeycombing less than 2-inches deep shall be repaired using Class "D" mortar.

D. Brick Transition Reinforcement: Formed steel 8-gauge wire with galvanized finish.

E. Configuration:
1. Barrel Construction: Concentric with eccentric cone top section.
2. Shape: Cylindrical
3. Clear Inside Dimensions: 48-inches diameter minimum or as indicated on Construction Drawings.
4. Design Depth: As indicated on Construction Drawings.
5. Clear Lid Opening: 22-inches minimum
6. Pipe Entry: Provide openings as indicated on Construction Drawings
7. Main and Lateral Pipes: Neatly cut off main and lateral pipes flush with inside of manhole or inlet where they enter structure walls. Point up irregularities and rough edges with non-shrink grout.

F. Inverts: Shape inverts for smooth flow across structure floor as indicated on Construction Drawings. Use concrete and mortar to obtain proper grade and contour. Finish surface with fine textured wood float.

2.2 COMPONENTS

A. Lid and Frame:
1. Manufacturer: Neenah Foundry Company, East Jordan Iron Works, and/or approved equal. All drainage structure covers shall be manufactured with municipality required frame and cover and/or machined with a generic “Storm Water Only – Dump No Waste / Drains to Water Way” logo if no municipality specific frame and cover are required.
2. ASTM A 48, Class 30B heavy duty cast iron construction, machined flat bearing surface.
3. Removable lid, closed or open as indicated on Construction Drawings, sealing gasket.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify items specified by other Sections are properly sized and located.

B. Verify that built-in items are in proper location and ready for roughing into work.

C. Verify that the excavation for manholes is correct.

3.2 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves as indicated on Construction Drawings.

3.3 PRECAST MANHOLE CONSTRUCTION

A. Place base pad to proper elevation and location and trowel top surface level for placement of manhole barrel.

B. Place manhole barrel plumb and level to correct elevations and anchor to base pad.
   1. After completion of slab foundation, lower first joint of manhole barrel into position, grooved end first; and set level and plumb on concrete base. Align and adjust to proper grade prior to placing and forming invert. Pour invert immediately after setting of first section of manhole barrel.

   2. Prior to setting subsequent manhole barrel sections, apply primer to tongue and groove ends and allow to set in accordance with manufacturer's recommendations. Place "Ram-neck", or equivalent, plastic rope on tongue end. Lower next section into position, and remove excess material from interior of structure. Add additional material on exterior of joint, if necessary, for completely watertight joint.

C. Set cover frames and lids level without tipping, to correct elevations. Utilize pre-cast rings or brick and mortar to achieve final rim elevation. Maximum limit, 4 courses.

END OF SECTION 330500

SECTION 334000 – STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Storm sewer drainage piping, fittings, and accessories.
   2. Storm drainage structures.

B. Related Requirements
   1. Section 02 00 00 - Existing Conditions - General Information/Site Construction
   2. Section 31 10 00 - Site Clearing
   3. Section 01 56 39 - Tree and Plant Protection
   4. Section 31 20 00 - Earthmoving
   5. Section 31 25 00 - Erosion and Sedimentation Controls
   6. Section 33 05 00 - Manholes and Structures

1.2 REFERENCED STANDARDS

A. All work under this section shall be completed in general conformance with construction plan details, Municipal standards, and/or the Michigan Department of Transportation's (MDOT's) standard specifications for construction (current edition), MDOT's standard plans (current edition), MDOT's construction manual (current edition), MDOT's quality assurance procedures manual (current edition), and as specified herein.

B. American Association of State Highway and Transportation Officials (AASHTO)
   1. AASHTO M190 - Bituminous Coated Corrugated Metal Culvert Pipe and Arches
   2. AASHTO M252 - Corrugated Polyethylene Drainage Tubing, 3 to 10 Inch Diameter
   3. AASHTO M294 - Corrugated Polyethylene Drainage Tubing, 12 to 60 Inch Diameter
   4. AASHTO M198 - Joints for Circular Sewer and Culvert Pipe Using Flexible Watertight Gaskets
   5. AASHTO H170 – Reinforced Concrete Culvert, Storm Drain and Sewer Pipe

C. ASTM International (ASTM)
   1. ASTM A74 - Cast Iron Soil Pipe and Fittings
   2. ASTM A185 - Steel welded Wire Fabric, Plain, for Concrete Reinforcement
   3. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
   4. ASTM A746 - Ductile Iron Gravity Sewer Pipe
   5. ASTM A760 - Corrugated Steel Pipe, Metallic-Coated For Sewers And Drains.
   6. ASTM A796 - Structural Design Of Corrugated Steel Pipe, Pipe-Arches, And Arches For Storm And Sanitary Sewers And Other Buried Applications.
   7. ASTM A798 - Factory-Made Corrugated Steel Pipe For Sewers And Other Applications.
   8. ASTM A929 - Steel Sheet, Metallic-Coated By The Hot-Dip Process For Corrugated Steel Pipe.
   9. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
   10. ASTM C150 - Portland Cement
   11. ASTM C206 - Finished Hydrated Lime

12. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
13. ASTM C564 - Rubber Gasket for Cast Iron Soil Pipe and Fittings
14. ASTM C969 - Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
15. ASTM D3034 - Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings
16. ASTM D3212 - Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
17. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe
18. ASTM F949 – Poly (Vinyl Chloride)(PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings

D. American Concrete Institute (ACI)
1. ACI 301 - Structural Concrete for Buildings

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Firm with at least three (3) years of successful installation experience on projects with storm sewer work similar to that required for project.

B. Codes and Standards:
1. Plumbing Code Compliance: Comply with all applicable portions of National Plumbing Standard Plumbing Code pertaining to selection and installation of storm sewer materials and products.
2. Comply with standards and requirements of Municipality and other agencies having jurisdiction. The current City of Detroit standard storm sewer details and specifications are referenced and included as part of the Contract Documents. If a discrepancy occurs between these details and specifications notify Architect / Engineer of all such conditions prior to commencing work or ordering materials.

C. Contractor to obtain and pay required fees, assessments, and other cost for permits, inspections, and testing required by authorities having jurisdiction.

1.4 SUBMITTALS

A. Shop Drawings: Indicate reference to Construction Drawings for all manholes, drainage structures, catch basin, inlet structure locations, elevations piping with sizes, locations and elevations of penetrations. Submit to Engineer for review and approval a minimum of three (3) weeks prior to installation date.

B. Product Data: Provide data on pipe materials, pipe fittings, and accessories. Manufacturer's Certificate: Certify that products meet or exceed specified local requirements.

C. Project Record Documents:
1. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.
2. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.5 PROJECT CONDITIONS

A. Coordinate work with termination of storm sewer connection outside building including connection to municipal storm sewer system.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. General: Provide pipe materials, weight/class and other characteristics as indicated on construction plans with compatible fittings and accessories of same material and weight/class as pipe, with joining method specified.

B. Reinforced Concrete Sewer Pipe and Fittings: ASTM C 76, Class IV, Wall B, for rubber gaskets.
1. Rubber Gaskets: ASTM C 443, rubber
2. Sizes: 12 inches and larger

C. PVC (Polyvinyl Chloride) Sewer Pipe and Fittings: ASTM D 3034, SDR 23.5, for solvent cement or elastomeric gasket joints.
1. Solvent Cement: ASTM D 2564
2. Gaskets: ASTM F 477, elastomeric seal
3. Sizes: 15 inches and smaller

D. PVC (Polyvinyl Chloride) Sewer Pipe and Fittings: ASTM F 679, T-1 wall thickness, bell and spigot, for elastomeric gasket joints.
1. Gaskets: ASTM F 477, elastomeric seal
2. Sizes: 18 to 36 inches

E. Composite (Truss) Sewer Pipe: Either PVC or ABS, ASTM D 2680 composite walls separated with spacers (truss) of same material as pipe. Voids between walls filled with insulating concrete. Joints solvent cement, Type SC, or mechanical seal, Type OR.
1. Sizes: 8 inches and larger

F. Bar Screens: Circular steel plate frame of outside diameter to suit inside diameter of pipe, with 1/2 inch diameter bars at 6 inches O.C. each way.

2.2 UNDERDRAINAGE PIPE AND FITTINGS

A. General: Furnish drainage pipe complete with bends, reducers, adapters, couplings, collars and joint materials.

B. Non-Perforated Polyvinyl Chloride (PVC) Pipe and Fittings: ASTM D 3034, SDR 35, bell-and-spigot ends, for gasketed joints.
1. Gaskets: ASTM F 477, elastomeric seal

C. Perforated Polyvinyl Chloride (PVC) Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

D. Perforated Polyethylene (PE) Pipe and Fittings: AASHTO M 252 or ASTM F 405, corrugated, for coupled joints, complete with geotextile filters.

1. Provide with non-woven geotextile screening sock over all tubing
2. Couplings: Manufacturer's standard, band type
3. Size: 4 inch diameter

2.3 DRAINAGE STRUCTURES

A. Manholes: Conform to Section 33 05 00.

B. Grates and Frame: Provide in accordance with details shown on Drawings.
1. Provide heavy duty grates, with maximum slot width of 1-1/8”
2. Acceptable Manufacturers:
a. Neenah Foundry
b. East Jordan Iron Works

C. Cast-In-Place concrete for drainage structures including manholes, inlets, catch basins, collars, support blocks, headwalls and paved ditches shall conform to ACI 301.
1. Compressive Strength: 3500 psi at 28 days
2. Reinforcement: ASTM A615, grade 40 or 60 deformed reinforcing bars, and ASTM A185 for wire fabric

D. Cement Mortar used for paving inverts, filling lift holes, joints, patching and anchoring castings shall consist of one part Portland cement, type I, ASTM C150, 1/4 part hydrated lime, ASTM C206 and 2-1/2 parts clean, well-graded sand and water free of suspended matter, alkali, and containing no industrial or domestic waste.

2.4 IDENTIFICATION

A. Plastic Underground Warning Tapes: Polyethylene plastic tape, 6 inches wide by 4 mils thick, solid green in color with continuously printed caption in black letter "CAUTION - SEWER LINE BURIED BELOW."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installer must examine areas and conditions under which storm sewers are to be installed. Notify Engineer / Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Verify that trench cut and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

A. Grade trench bottom to provide a smooth, firm, stable and rock-free foundation, throughout the length of the pipe.

B. Remove unstable, soft and unsuitable materials at the surface upon which pipes are to be laid, and backfill with bedding material shown to the indicated level.

C. Shape bottom of trench to fit bottom of pipe. Fill unevenness with compacted bedding material. Ensure continuous bearing of the pipe barrel on the foundation.

D. Remove large stones or other hard matter that could damage piping or impede consistent backfilling or compaction.

E. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

3.3 INSTALLATION - PIPE

A. Join concrete pipe and fittings with rubber gaskets in accordance with ASTM C 443, and install piping in accordance with applicable provisions of ACPA "Concrete Pipe Installation Manual".

B. Join and install PVC pipe as follows:
1. Elastomeric joints in accordance with ASTM D 3212
2. Solvent cement in accordance with ASTM D 2855 and ASTM F 402
3. Install in accordance with ASTM D 2321

C. Join and install Composite (Truss) pipe with elastomeric seals and install in accordance with ASTM D 2321 and manufacturer's recommendations.

D. Join different types of pipe with standard manufactured couplings and fittings.

E. The pipe shall be inspected for defects and cracks before being lowered into the trench, piece by piece. Any defective, damaged or unsound pipe or any pipe that has had its grade disturbed after laying shall be taken up and replaced. Open ends shall be protected with a stopper to prevent earth or other material from entering the pipe during construction. The interior of the pipe shall be free from dirt, excess water and other foreign materials as the pipe laying progresses and left clean at the completion of the installation.

F. Excavate pipe trench and place bedding material in accordance with Section 02300.

G. Install pipe in accordance with manufacturer’s written recommendations.

H. Installation shall commence at the lowest point for each segment of the route. RCP shall be laid with the groove or bell end upstream. Riveted CSP shall be placed with the inside circumferential laps pointing downstream. Repair damaged bituminous coating on CSP by applying bituminous material conforming to AASHTO M190.

I. Lay pipe to the required line and slope gradients with the necessary fittings, bends, manhole, risers and other appurtenances placed at the required location as noted on Drawings.

J. Do not displace or damage pipe when compacting.

K. No pipe shall be laid in water or when trench conditions are unsuitable for such work.

L. Joints:
1. Joints shall be constructed as described herein and in accordance with manufacturer's installation instructions for soil-tight joints.
2. For RCP, the joint surface shall be cleaned and washed with water, if necessary, before the joints are made. For tongue and groove joints in smaller sizes, make joints butting the inside of the bell with a cement mortar before joining. The inside joint shall be wiped clean of excess mortar by brush or a squeegee drawn through the pipe as the laying operations progress. In the lager diameters, which permit the entry of a man, annular space between pipe sections shall be completely filled with mortar and finished off smooth with the inside surface of the pipe.
3. PVC fittings shall be attached to the pipe by solvent welding according to the manufacturer's recommendations.

3.4 INSTALLATION – MANHOLES, CATCH BASINS AND INLETS

A. Drainage structures shall be constructed in accordance with details shown on Drawings and in accordance with Section 33 05 00 as applicable.

B. Precast Sections:
1. Precast section with bases shall be installed in accordance with Section 02300 and 02536 or as shown on drawings.
2. Pipe openings shall be aligned to that of the pipe entering and leaving the manhole, etc. Pipe shall be properly aligned with connections to manholes, etc. as shown on the drawings.

C. Invert channels shall be smooth and accurately shaped to a semicircular bottom conforming to the inside of the adjacent sewer section. Invert channels and structure bottoms shall be shaped with cement mortar. Changes in size and grade of invert shall be made gradually and evenly. Changes in direction of the sewer entering branch or branches shall have a true curve of as large a radius as the manhole will permit.

D. Frames and Covers:
1. Frames and covers shall be set to the proper elevation. The frames shall be firmly embedded in mortar approximately 1 inch thick and aligned to fit the top section of the structure.
2. Bricks set in mortar used to adjust the frame to finished grade shall be limited to no more than four courses.
3. Adjustment rings used to make adjustments in grade shall be made with the initial ring embedded in mortar and the exterior of the rings parged with mortar not less than 1/2 inch thick. No adjustment made in this manner shall exceed 8 inches.

E. Concrete cradles shall be constructed as shown on the drawings and as needed when crossing over and under sewer pipe or utility lines. Concrete shall be 3,000 psi mix with a minimum thickness of 6 inches.

3.5 SUBDRAINS

A. Sub-drains and/or under-drains shall be installed in accordance with the details and at the locations shown on the drawings

3.6 INSTALLATION OF IDENTIFICATION

A. Install continuous plastic underground warning tape during back filling of trench for underground storm sewer piping. Locate 6 to 8 inches below finished grade, directly over piping.

3.7 INSPECTION AND TESTING

A. General:
   1. Strom sewer systems and culverts, upon completion or at such time as directed, shall be cleaned, inspected and tested. The system or culvert shall have a true grade and line. Actual elevations shall be within 0.08 feet of the elevations given on the drawings.
   2. After completion of the Work, or any part thereof, the job shall be tested to determine that it has been installed in accordance with the drawings and specifications. In general, the Work shall prove to be in good condition, installed in accordance with the drawings and specifications and ready for use.

B. Cleaning and Testing: Visibly inspect and remove all debris and obstructions from storm pipe. Test for infiltration and exfiltration by hydrostatic testing per ASTM C969. Manholes and pipe shall conform to ASTM C969 leakage criteria.

C. Alignment Test: After backfill has been placed and compacted to a depth not less than one foot above top of pipe, a visual inspection shall be made by flashing a light between manholes. Any displacement or misalignment of invert shall be corrected.

3.8 FINAL ACCEPTANCE

A. Secure inspection of agency having jurisdiction, and make appropriate corrective measures as required to obtain final acceptance.

END OF SECTION 334000